Operative Dictations in Plastic and Reconstructive Surgery

Tuan Anh Tran
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Jamal J. Hoballah
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I would like to dedicate my efforts to all of my mentors at the University of Miami and UC Davis for training and inspiring me. My parents, Thong Tran and Dung Cao, and brother, Tu Tran for their sacrifices and steadfast support.

Tuan Anh Tran

I would like to dedicate my efforts to my parents, Nergish and Jal Panthaki for their love, support and encouragement. I try to instill the same values they taught me into my children and hope to live up to their example.

Zubin J. Panthaki

To Dr. Wehby A. Shuaib for his caring guidance and mentorship.

Jamal J. Hoballah

To my wife who has always been there for me. I appreciate everything she is and continues to be.

Seth R. Thaller

Foreword

A significant responsibility of plastic surgery educators is to teach and share their experience in the operating room. Achieving the maximum benefit for residents and young plastic surgeons should be a planned approach. Preoperative preparation by residents provides a significant foundation for the development of the clinical and technical skills necessary to becoming an independent plastic surgeon. This book can serve to lay the groundwork for an exceptional instructive opportunity by providing the road maps for the upcoming surgical procedure and provide a venue for self-directed learning and a dress rehearsal so the resident is enabled to enter the operating room better equipped to concentrate on enthusiastically participating in the actual surgical procedure. This book will also provide the framework for plastic surgery trainees and those early in their career on a template for documentation of their surgery. To accomplish this task, the authors have included the most commonly performed plastic, aesthetic, and reconstructive procedures. Consistent with the foundations of our specialty, the authors do not plan to institute a homogeneous methodology and interfere with what makes plastic surgery so satisfying: innovation and the constant motivation for perfection.

Miami, FL, USA — Thomas J. Baker

Preface

The goal of our book is to function as an educational resource especially for residents in training, fellows, and those just entering or early in their plastic surgery practice. It can also serve as a study guide to prepare for upcoming operative procedures or as an essential aspect for specialty examinations. We have attempted to include a majority of the most commonly performed plastic surgery operative procedures. This encompasses the extensive variety of cosmetic, hand, and basic reconstructive surgical procedures and techniques. We have also included the most currently emerging and innovative procedures that are becoming more commonplace in our specialty: migraine surgery, lymphedema, transgender reassignment, urogenital aesthetic surgery, and robotics. In addition, operative dictations encompass such fundamental procedures encountered in craniofacial, oculoplastic, burn, breast, upper extremity, facial aesthetics, body contouring, and reconstructive microsurgery. Completion of this book has allowed us to renew many old friends and colleagues who collaborated with us from a variety of specialties, including otolaryngology, ophthalmology, dermatology, oral and maxillofacial surgery, and orthopedics. In addition, to enhance the experience for our readers, we have reached across the globe and secured the expertise of authors from Europe, Middle East, and Asia. The editors extend our heartfelt gratitude to each of our colleagues who assisted in making this a unique resource by sharing their knowledge with our readers.

Miami, FL — Seth R. Thaller
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Part IV Craniofacial

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Part I

Aesthetics

Closed Rhinoplasty

1

Donald Wood-Smith, John N. Curran, and Wrood Kassira

Introduction

Closed or endonasal rhinoplasty has been practiced since the dawn of the modern rhinoplasty era, see Roe's description in 1887 [1]. In recent years there has been a growing enthusiasm for both teaching and practice of the open approach to rhinoplasty; this technique is both easier to teach and for the student to learn; however, there are small but significant prices to pay for this choice. The most significant is the presence of an external scar on the columella, which proponents of the technique claim to be near invisible but which a significant population of patients find unsightly. Also, despite the clear visibility of both cartilage and bone in the open technique, there is frequent irregularity of contour and of symmetry, especially in inexperienced hands.

The authors prefer the closed technique for its precision, rapid recovery, and lack of external scarring. We also find the technique sympathetic to the frequent frustrations of the less experienced surgeon attempting the technique. For that reason we teach it to our fellows as a "beginner's" technique until sufficient experience has been gained to graduate to the more technically demanding open procedure.

Indications [2–5]

Functional

Nasal airway pathology
- Septal deviation
- Septal perforation
- Internal nasal valve collapse
- External nasal valve collapse
- Turbinate hypertrophy

Aesthetic

Nasal deformity:
- Radix abnormality (too high; too low)
- Dorsal abnormality (hump; excessive width; asymmetry; twist; "pollybeak" deformity; saddle nose deformity)
- Tip abnormality (boxy; trapezoidal; amorphous; bifid; bulbous; twisted; ptotic; rotated)

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Alar base and columella abnormality (shape; width; asymmetry; nostril size; columella deformity)
Projection abnormality (under; over)
Alar rim deformity (asymmetry; notching)

Essential Steps

Patient Preparation

History and physical examination are thoroughly performed and documented with an emphasis on clotting status, and inquiry with respect to the use of any medications which may affect clotting function. We recommend a 2-week period of abstinence from such standard medications such as Aspirin. We also recommend avoidance of nonprescription medications such as Bromelain, Ginkgo, and Vitamin E in addition to Garlic and any other products which may inhibit platelet function [6].

Preoperative Photographic Record

The preoperative record should include the following views: full face, (smiling and unsmiling), "worm's eye" view, oblique and true lateral views from left and right. Use of software packages such as Photoshop (Adobe Systems Incorporated) can be helpful for enhancement of images to illustrate proposed changes and to finalize a surgical plan with the patient. Such records should be taken to the operating room for reference intraoperatively as required.

Antibiotic Prophylaxis [7–9]

Although post-rhinoplasty infection is rare, there is weak evidence to support the use of antibiotic prophylaxis. A single perioperative dose is used with satisfactory results by many of our colleagues.

Skin Prep

Standard Povidone Iodine solutions can be used for cleansing of the head and neck region.

Alcohol-based solutions should not be used on mucous membranes.

Draping

Standard sterile draping of the head and neck region.

Anesthesia [10]

Anesthesia may be "straight local," "monitored local with intravenous sedation" administered either by the surgeon or preferably by the anesthesiologist, or for the very apprehensive patient or one with medically indicated needs, endotracheal general anesthesia may be utilized but does have the penalty of increased risk of bruising. Our preferred method is to operate in patient under "monitored anesthesia care."

In all instances topical anesthesia including a vasoconstrictor is used prior to preparation of the patient. Our preference is for 4 mL of 4 % cocaine mixed with an equal volume of 1:1000 Epinephrine, applied intranasally with a DeVilbiss, or similar atomizer. Oxymetazoline 0.05 % can be used as an alternative.

This is followed by application of the same solution with three pledgets for each side along the intranasal course of the external nasal valve and towards the region of the sphenopalatine ganglion.

Injection of local anesthesia solution is delayed until immediately prior to beginning surgery. Our preference is for the use of 1 % Lidocaine with 1:100,000 Epinephrine. This timing assures peak vasoconstriction during the surgery.

Our routine is as follows:

1. Blocking the infraorbital nerve by percutaneous or intraoral injection with 2.0–2.5 mL of 1 % Lidocaine with 1:100,000 Epinephrine.
2. Blocking the anterior superior dental nerve by percutaneous or intraoral injection of 0.5 mL of 1 % Lidocaine with 1:100,000 Epinephrine.
3. Blocking the external and internal nasal branches of the anterior ethmoidal nerve by

intranasal injection in a deep subcutaneous plane along the nasal dorsum with 4.0 mL of 1 % Lidocaine with 1:100,000 Epinephrine.

4. Injection of the lateral osteotomy sites is delayed until immediately prior to the osteotomies are performed.

Incisions [2]

For closed rhinoplasty incisions are nearly always intercartilaginous or transcartilaginous.

Marginal incisions may be employed less frequently.

These are usually combined with a partial or complete transfixion incision.

Access to the bony and cartilaginous septum can also be provided via a Killian incision at least 5 mm cephalad from the caudal border of the cartilaginous septum.

Maneuvers [2, 5, 11–13]

1. Augmentation
   (a) Injectables
      (i) Hyaluronic acid products
2. Autograft
   (a) Septal, rib, or conchal cartilage graft
   (b) Superficial temporal fascia
   (c) Bone graft
3. Allograft
   (a) Plastic
   (b) Silicone
   (c) Polydioxanone
   (d) High-density porous polyethylene
   (e) Polytetrafluoroethylene
4. Homograft
   (a) Cadaveric cartilage
   (b) Acellular dermal matrices
5. Xenograft
   (a) Bovine cartilage graft
6. Dorsal Hump Reduction
   (a) Rasping
   (b) Osteotome
7. Osteotomies
   (a) Use osteotome with mallet or saw
   (b) Lateral osteotomies are the main element although medial and intermediate are possible
   (c) Lateral osteotomies are via a percutaneous approach or internal via piriform aperture
   (d) Osteotomies can be low-to-low or low-to-high
   (e) Osteotomies can also be continuous or perforated
8. Tip Refinement
   (a) Volume reduction
      (i) Cephalic reduction/trim/resection of lateral crus of lower lateral cartilage
      (ii) Soft tissue debulking
   (b) Cartilage reorientation
      (i) Dome and tip defining suture techniques
   (c) Augmentation
      (i) Columellar strut grafts
      (ii) Shield grafts
      (ii) Cap grafts
9. Nasal Base Adjustment
   (a) Excision at nostril sill
   (b) Alar wedge excision
   (c) Turbinate Reduction
      (i) Resection
      (ii) In-fracture
      (iii) Radio-frequency ablation

Closure, Taping, and Splinting [13, 14]

Closing the mucosa can prevent adverse scar formation (which could have unpredictable effects on the aesthetic outcome), prolonged healing, uncomfortable crusting, and inconvenient bleeding of the mucosa. On the other hand, closing the mucosa can allow collection of blood resulting in hematoma formation. When incisions are closed 5-0 or 6-0 fast absorbing sutures should be used on the nasal mucosa. We do not routinely suture the mucosal incisions.

Postoperative taping with thin adhesive strips is a key maneuver in preventing and controlling postoperative swelling and edema.

Internal nasal packing is controversial. It was originally believed to help with healing, prevent adhesion formation, and prevent hematoma formation. Some believe however that packing can cause other complications such as septal perforation or problems with discomfort or patient distress on removal. We do not pack routinely.

Placement of a nasal splint is also open to interpretation. Plaster of Paris, thermoplastic, or metallic splints can be placed to protect the nose from external trauma and allow unhindered bony healing after osteotomies.

Postoperative Orders

Ice compresses to the eyes for the first 12–24 h. Apply ice for 15 min intervals with at least 30 min between applications.

Bed rest with bathroom privileges for the first 12–24 h.

Elevation of the head of the bed to 30° for the first week after surgery.

Humidification of the patient's bedroom during sleep times increases comfort and nasal breathing ability.

Nasal toilet is absolutely forbidden for 2 weeks after surgery.

Speaking should be kept to a minimum for 72 h after surgery.

Diet should be soft for 72 h after surgery.

Interestingly, fresh pineapple appears to be useful in reducing edema and ecchymosis and is recommended in our practice two or three times per day for the first 2 weeks after surgery.

No dental brushing or other oral hygiene should be practiced for 1 week to reduce mobilization of the nasal tip, columella, and upper lip.

Analgesia medication should be limited to Acetaminophen with 30 mg Codeine taken at regular intervals. The patient should be counseled to switch to Acetaminophen without Codeine as soon as tolerated.

Antibiotics can be prescribed in accordance with guidelines if the surgeon chooses to do so or if there is an indication.

Oral steroids and any form of nasal spray should be avoided.

Exercise should be restricted to easy walking for the first 2–3 weeks.

Direct sun exposure should be avoided for 2–3 weeks.

Operative Dictation

Diagnosis: Cosmetic nasal deformity
Procedure: Closed rhinoplasty
Anesthesia: MAC/local
Complications: none

Indication

This is a __ year old woman who is dissatisfied with the appearance of her nose and desires surgical improvement. After extensive discussion with the patient, the risks, benefits, and alternatives are reviewed and the patient consents for rhinoplasty to address the nasal dorsum and tip. She understands the risks, although not limited to, bleeding, infection, scarring, hematoma, poor cosmesis, asymmetry, pain, numbness, injury to adjacent structures, unsatisfactory result, need for additional surgery, anesthetic complications, airway changes, among other risks.

Procedure in detail: The patient was placed supine on the operating room table. Patient received sedation anesthesia. Time-out was taken. Four milliliter of 4 % cocaine mixed with an equal volume of 1:1000 Epinephrine was applied intranasally followed by soaked pledgets intranasally. The face was prepped with Betadine and draped in the standard surgical sterile fashion. The patient received IV Ancef. Then using a 25 gauge needle, 1 % Lidocaine with 1:100,000 Epinephrine was infiltrated intranasally and intraorally to block the infraorbital, superior dental, and anterior ethmoidal nerves. Using a 15 blade, an intercartilaginous incision was made

bilaterally combined with a transfixion incision. Using an osteotome, composite reduction of the cartilaginous and bony dorsum was performed. Further refinement was performed with a rasp to correct the dorsal hump. Lateral osteotomies were then performed in a low to high fashion via an internal approach via the piriform apertures. Cephalic trim was also performed. Taping with steri-strips was performed along the dorsum and tip. No complications were noted. Patient was extubated successfully (if general anesthesia was used) and taken to post-anesthesia care unit in satisfactory condition.

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Cosmetic Open Rhinoplasty

2

William Lao, Hamid Abdollahi, and Nicolas Tabbal

Indications

1. Large dorsum hump
2. Bulbous tip
3. Lack of tip support
4. Wide nasal base or mid vault

Essential Steps

Preoperative Markings

1. Mark a flat V-shaped incision at the base of the columella in the natural skin crease

Intraoperative Details

1. Place the patient in supine position with the head in a doughnut. The superior edge of the head should reside at or slightly off the superior edge of the table. Raise the upper half of the table and lower the head rest in order to extend the neck and gain easy access inside the nose.
2. General anesthesia with LMA.
3. Place 4 % cocaine-soaked packing strips at the floor of the nasal cavity. Infiltrate the dorsum, bases of bony pyramid, and columellar skin flap with local anesthetic with epinephrine (Mixture: 20 mL 2 % lidocaine + 0.2 mL 1:1000 epinephrine) in a 5 cc syringe and a long 27-gauge needle. A total of 4 mL are generally injected.
4. Skin/Subcutaneous nasal flap elevated in the supra-perichondrial plane up to mid vault, dorsal flap dissected with a Joseph elevator.
5. Dorsum hump reduction with a 7–8 mm pull rasp.
6. Excess septum and bilateral upper lateral cartilages trimmed with Fomon scissors under direct vision.
7. Cephalic trim of superior edge of lower lateral cartilage.
8. Septal cartilage harvest for columellar strut to be placed between the medial crura.
9. Lateral osteotomy and infracture.
10. Hemi-transdomal suture.
11. Single interdomal suture.
12. Skin closure with 6-0 nylon and 5-0 chromic.
13. Mastisol (Eloquest healthcare, Ferndale Michigan), brown paper tape, and Aquaplast splint applied.

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Postoperative Care

1. Control blood pressure, nausea/vomiting, and pain.
2. Cold compresses are used on bilateral eyes to decrease swelling and ecchymosis.
3. Keep head of bed elevated to decrease swelling.
4. Splint and nylon sutures are removed on POD #6.
5. Avoid nasal blowing for 3 weeks.
6. May travel 10 days after surgery.

Possible Complications

1. Contour irregularities
2. Septal hematoma
3. Internal/external valve collapse
4. Infection

Operative Dictation

Diagnosis: Cosmetic concern of the nose
Procedure: Primary rhinoplasty

Indication

This is a __ year-old female with a prominent dorsal hump and a bulbous tip. She has been teased about the look of her nose since elementary school and often feels embarrassed and is afraid to take pictures with others. The patient and her mother understand the risks, benefits, and alternatives including not operating, and wish to proceed. The incision placement is discussed and shown to the patient.

Description of the Procedure

The patient was placed supine on the operating room table. Her head was positioned at the superior edge of the table. The head of the table was slightly tilted upward. Proper time-out was carried out to reconfirm patient's identity, site of procedure, and all personnel involved in the surgery. A V-shaped incision was marked at the base of the columella in the natural skin crease. Lidocaine with epinephrine was then infiltrated into the dorsum, bases of sidewalls, columella, and also tip of the nose. The face then was prepped and draped under the usual sterile fashion. An incision was made along the marking at the base of the columella. Then, a vertical incision was carried bilaterally along the posterior skin edges of the columella. Tip scissors were then used to dissect the skin/subcutaneous columella flap off the underlying medial crura of the lower lateral cartilage in the supra-perichondrium plane. A double prong skin hook was used to aid in dissection of the skin flap off the lower lateral cartilages. The columellar incisions were then slowly extended hugging the inferior border of the lower lateral cartilages, making sure not to violate the soft triangles. A Joseph elevator was used to complete the dorsal dissection subperichondrially and sub-periosteally to the radix while creating enough space for rasping. An 8 mm pull rasp was used to take down the bony dorsum. Under direct vision, an 11 blade was used to score longitudinally the dorsal septum at the site of the intended resection. Right-angled Fomon scissors were then used to complete the resection en bloc. Cephalic trim was performed on each side of the cephalic edge of lateral crura of the lower lateral cartilages under direct vision with a 15 blade and dissected off its underlying soft tissue with tip scissors.

At this time nasal packing was removed and local anesthetic with epinephrine was used to infiltrate each side of nasal septum. With retraction, two medial crura were separated with tip scissors. Caudal septal angle was palpated digitally to locate its edge. Mucoperichondrium and mucoperiosteum were dissected off each side of the septum as needed. Septal cartilage graft was harvested en bloc using a combination of 15 blade and a swivel knife. Then septal sutures were placed using 4-0 plain gut on a Keith needle to close the dead space. A small soft tissue pocket in the anterior aspect between the medial crura of the lower lateral cartilages was created using tip scissors spreading in a vertical direction. A longitudinal

piece of cartilage was cut from the septal graft then placed in this pocket as a strut. Then with the fixation of a 27-gauge hypodermal needle, 4-0 plain gut sutures were used to secure the strut to bilateral medial crura in a horizontal mattress fashion. Three sutures were placed in such fashion. Packing was again replaced back into the floors of the nostrils. A stab incision was made with a 3 mm straight osteotome lateral to piriform aperture inside the nostril. Through this incision, a low-to-high lateral osteotomy was made and curved up to the level of medial canthus. With digital pressure infracture of both nasal bones was done. The stab incisions were closed with single interrupted 4-0 chromic sutures.

A 6-0 PDS was used to place a hemi-transdomal suture on the superior edge of each lower lateral cartilage to define the dome. Then a simple 6-0 PDS interrupted interdomal suture was placed to bring two domes together. The resected piece of lower lateral cartilages was morselized using a cartilage crushing box and placed as an onlay tip/infralobule graft to further increase tip projection. The columella base incision then was closed with 6-0 interrupted nylon and 5-0 chromic was used to close the lateral columella incisions. The dorsum of the nose then was dressed with Mastisol, brown paper tape, and an Aquaplast splint.

The patient tolerated the procedure well and was transferred to recovery room in excellent condition. All needle, instrument, and sponge counts were correct at the end of procedure.

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Extended SMAS Rhytidectomy

3

Ari S. Hoschander and James M. Stuzin

Indications

1. Facial aging
2. Deep nasolabial folds
3. Jowl prominence
4. Oblique cervical contour
5. Facial fat descent
6. Radial expansion of the facial fat away from the skeleton
7. Desire for a more youthful appearance

Possible Complications

1. Facial nerve injury
2. Scarring
3. Asymmetry
4. Tragus or lobule malposition

Essential Steps

Preoperative Markings

1. Mark a line from within the scalp of the temporal region extending inferiorly, toward the superior–anterior aspect of the helix, then anterior to the helix, curving posteriorly toward the tragus, then posterior to the tragus and anteriorly again into the crease that separates the ear from the cheek, then inferiorly toward and around the lobule. This line is then carried superiorly in the conchal-mastoid groove. This line is then curved posteroinferiorly into the occipital hair-bearing scalp.
2. Another line can be drawn from the lateral canthus toward the body of the mandible, paralleling the anterior border of the masseter. This line will serve as the medial aspect of the subcutaneous dissection.

Intraoperative Details

1. Supine position
2. IV sedation
3. Local infiltration
4. Subcutaneous dissection
5. Superficial musculoaponeurotic system (SMAS) flap elevation

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6. SMAS repositioning in a vertical direction
7. Neck contouring with platysmal plication and back-cuts
8. Excision of excess skin
9. Repositioning of skin in a horizontal plane
10. Hemostasis
11. Drains
12. Closure

Postoperative Care

1. Admit the patient to the observation unit for 24 h if there are confounding medical comorbidities.
2. Control systolic blood pressure < 120 and diastolic blood pressure < 85.
3. See the patient on a daily basis for drain care, wound evaluation, and assessment of skin integrity.

Operative Dictation

Diagnosis: Facial aging and aging of jaw line and neck.

Procedure: Extended Superficial Musculo-Aponeurosis System (SMAS) Rhytidectomy

Indication

This is a ___ year-old female with facial aging, volume deflation, radial expansion, deepened nasolabial folds, and prominent jowls who desires a more youthful look. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After positive identification of the patient in the holding area, the patient was marked in the sitting position. She was taken to the operating room and placed upon the operating table in supine position. The patient received preoperative antibiotics. Sequential compression devices were placed on bilateral lower extremities. Intravenous sedation was provided by the anesthesia team. Arms were abducted and properly padded to arm boards to less than 90°. Foley catheter was placed under sterile conditions. A Bair hugger warming blanket was also placed. The bed was turned 180°, and the face and neck were prepped and draped in the standard surgical sterile fashion with Betadine prep. Ophthalmic lubricant was placed within the eyes. A sterile head drape was placed around the head and final time-out was taken and confirmed by the anesthesiology staff, nursing staff, and surgical staff. At this point, attention was turned to the right face using tumescent solution consisting of 250 mL of saline, 20 mL of 1% lidocaine plain, and 1 ampule of epinephrine. This was infiltrated with a 21-gauge needle to the right cheek and postauricular area taking care not to inject intravascularly along the cheek and postauricular area. Once the tumescent had taken effect for hemostasis, a #15 scalpel was used to make an incision just anterior to the hair line, above the ear and follow the natural crease down to the anterior superior helix. This was then continued as an intra-tragal incision followed around ear lobe and into the postauricular area. Elevation proceeded using a #15 scalpel for approximately 3 cm in the subcutaneous plane. This was followed by using facelift scissors to elevate the skin flap under direct vision, in the subcutaneous plane, preserving the underlying SMAS. This was done carefully and meticulously with the use of transillumination, which helped to delineate the interface between the subcutaneous fat and the SMAS. Extreme care was taken so as not to disrupt the SMAS during this dissection. Minor bleeding points were controlled by bipolar electrocautery. Next, the dissection in the temporal region was performed by first identifying the parietal branch of the superficial temporal artery and ligating this branch at its takeoff. The temporal dissection was then performed in the plane just superficial to the deep temporal fascia. The skin flap dissection in

the cheek region then proceeded to the level of the inferior lateral orbicularis oculi and on the lateral cheek, a few centimeters lateral to the nasolabial fold.

Dissection then proceeded along the lateral platysma, lateral neck, and in the postauricular area. In this region, care was taken not to injure the great auricular nerve which lies superficial to the sternocleidomastoid muscle at its mid-belly. Hemostasis was achieved with bipolar electrocautery.

Next attention was turned to the SMAS elevation. This began by first marking a horizontal line 1 cm caudal to the zygomatic arch. The horizontal line was continued medially past the point where the zygomatic arch met the body of the zygoma. The malar extent of this incision was angled superiorly toward the lateral canthus and then turns 90° toward the superior aspect of the nasolabial fold. A vertical line was drawn at the lateral-most aspect of the SMAS that paralleled the skin incision. The vertical line was continued to a point 5 cm below the border of the mandible. Next, the plane deep to the SMAS was infiltrated with a solution of 0.5% Lidocaine with Epinephrine. SMAS elevation began by first incising the pre-drawn lines with a #10 scalpel and dissecting beneath the SMAS with both sharp and electrocautery dissection. This dissection was carried medially until the zygomaticus major was identified. Care was taken to remain superficial to the parotid capsule. A facelift scissors was then inserted into the plane between the malar fat pad and the elevators of the lip. Blunt dissection was used in this location directed toward the nasal ala. This dissection was farther medial than the skin flap dissection. After ensuring hemostasis, the SMAS was then redraped superiorly with a vertical trajectory. The excess SMAS that now overlapped the earlobe was incised allowing the lower portion of SMAS to redrape postero-vertically behind the ear. Excess SMAS that now overlapped the zygomatic arch was folded under itself to augment the malar region. This was now sutured in place with multiple 3-0 Vicryl sutures in figure-of-eight fashion. The remaining lower portion of SMAS was secured posterior to the ear in a similar fashion. This allowed for correction of the jowl and improvement in the jaw line for rejuvenation. Attention then was turned to the left side of the face where the same incision and dissection was performed.

After raising both skin and SMAS flaps in the cheek region, the neck was addressed with a small incision just posterior to the submental crease. Skin and subcutaneous fat was then dissected carefully off of the platysma with electrocautery. This plane was dissected to a point distal to the hyoid. Next, the platysma was plicated in the midline. After plication, the platysma was incised bilaterally in a horizontal plane at a point distal to the hyoid. This allowed the platysma to redrape more effectively. All surgical fields were irrigated. The flaps were noted to have good viability and the SMAS plication allowed for correction of the facial cosmetic deformity. Hemostasis was achieved with bipolar electrocautery. At this point, skin closure proceeded by pulling the skin flaps superolaterally. These were trimmed without tension on the closure and then properly inset with a series of 4-0 Vicryl and 6-0 nylon sutures with a combination of simple interrupted and running fashion. Of note, inferior to the earlobe, inset was performed with deep 3-0 Vicryl sutures securing the flap to the underlying mastoid fascia, and earlobe to prevent pulling down of the earlobe. Further sutures were placed in postauricular area in similar fashion. This was done bilaterally. Prior to closure, 10 French round Blake drains were placed underneath the skin flaps in the cheek and affixed to the postauricular area with 3-0 nylon sutures. Bilaterally the excess skin was trimmed, and the drains were placed in bulb suction. The face was assessed for symmetry. There was very good symmetry, shape, and form in the jaw, face, and neck. Incisions were cleansed and dried and bacitracin was placed along the incisions. The head was wrapped with a combination of dry gauze, cling, and ace wrap. The patient was awaken from anesthesia and brought to the recovery room in stable condition.

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Short Scar Face-Lift

4

William Lao, Hamid Abdollahi,
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Indications

1. Facial rejuvenation.
2. Desire to minimize bilateral facial jowlings, marionette lines, and diffuse skin laxity of the cheek and neck.
3. Reposition ptotic malar tissues.
4. Enhance jawline definition, soften platysmal bands, and remove excess fat in the neck.

Essential Steps

Preoperative Markings

1. Mark a 3–4 cm horizontal line caudal to the submental crease.
2. Mark a short scar face-lift incision: it begins with a sideburn cut to the root of helix along the preauricular (*or post-tragal*) crease downward in the natural skin crease to wrap around the lobule and stop at the first horizontal crease of the posterior ear (Seen in an ear bent position).

Intraoperative Details

1. Patient placed in supine position with the head in a doughnut. The hair is placed in a ponytail.
2. Spontaneous ventilation general anesthesia.
3. Infiltrate the entire neck and bilateral face with local anesthetic (100 mL 1% lidocaine + 200 mL Normal Saline + 1 mL 1:1000 epinephrine) with a 20 cm^3 syringe and a 20 gauge spinal needle.
4. Betadine-soaked cotton pledgets are placed in the ear after patient is prepped. Liposuction of the neck from the midline and diagonally from each ear incision is done as needed using multiple cannulas.
5. Excise redundant platysma along the medial borders and transect the muscle at the level of the cacoid carntage. Deep fat is melted with the ball tip cautery as indicated under direct vision. The medial borders of the platysma are plicated interrupted with 3-0 Mersilene.
6. Elevate bilateral skin/subcutaneous facial flaps, connecting inferior dissection with midline neck undermining.

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7. Inverted L-shaped SMAS and platysma plication are achieved with 3-0 PDO Quill (Surgical Specialties Corporation, Reading, Pennsylvania) suture.
8. Elevate, advance, and redrape skin flap under minimal tension and trim off excess.
9. Tisseel fibrin sealant (Baxter, Westlake Village, California) is used prior to closure, no drains placed. Antibiotic ointment is applied to all suture lines.
10. Head wrap dressing (three layers of open 4×8 gauzes) to provide compression over undermined areas of the face and neck and cover with a Surg-o-flex surginet (Dermapac, Shelton, Connecticut).

Postoperative Care

1. Control blood pressure, nausea/vomiting, and pain. Private duty nurses care for patients.
2. Patient is seen in 24 h to check the wound and remove the dressing. Cold compresses are used on the exposed area on the face to decrease swelling and ecchymosis.
3. Shower at 48 h with a gentle shampoo and minimal motion.
4. Remove permanent running sutures on POD# 7 in the office and staples on POD# 10.

Possible Complications (portal)

1. Hematoma/seroma
2. Neuropraxia or permanent facial nerve injuries
3. Hyperesthesia/hypoesthesia
4. Skin sloughing/ischemia
5. Recurrent platysmal bands
6. Pigment changes
7. Infection
8. DVT/PE
9. Contour irregularities

Operative Dictation

Diagnosis: facial laxity

Procedure: short scar face-lift with submentalplasty

Indication

This is a _____ with jowling, nasolabial creases, and skin laxity of the face and neck who desires a more youthful appearance. He/she also presents with platysmal bands of the neck at rest. The patient understands the risks, benefits, and alternatives of the proposed procedure, and wishes to proceed. The incisions are discussed with and shown to the patient.

Description of the Procedure

The patient was brought to the operating room and placed in the supine position; preauricular and submental markings were reconfirmed. After the patient was intubated, local anesthetic solution with epinephrine was injected into the entire neck and bilateral face. The entire face and neck were then prepped and draped in the usual sterile fashion. The procedure started with the horizontal submental incision. A 2.4 mm Mercedes liposuction cannula was used to liposuction the anterior neck. One small incision around each lobule was made and further neck liposuction was carried out from the diagonal direction bilaterally. A 1.8 mm Mercedes cannula was used to liposuction jowls or any facial area. Final liposuction was done with a spatula cannula. A Thimble hook with assistant providing counter traction on the skin was used to develop a subcutaneous neck skin flap. The medial borders of the platysma were identified and excessive bands in the midline were removed en bloc with face-lift scissors. Midline subplatysmal fat was excised and melted with electrocautery as indicated. A wedge of platysma was excised at the level of the cacoid carntage on each side. Plication of the medial platysma edges was done using 3-0 Mersilene sutures. The first sutures at the top of the platysma incorporated the deep cervical fascia. Ball tip cautery was used to melt any fatty contour irregularities.

Attention was then directed to right side of the face. The incision was delineated and was made along the marked preauricular crease, around the lobule, and then ending at the first horizontal skin crease posteriorly. Skin/subcutaneous flap under-

mining was begun sharply and precisely under direct vision with the aid of fiber-optic retractors. Nasolabial fold was undermined to efface its deepened appearance as needed. Inferior undermining was connected with the skin flap raised from submental incision. The lateral platysma was elevated with a skin hook, and undermined. A 2–4 cm back cut was made. An inverted L-shaped plication of the SMAS–platysma was planned. A 3-0 Quill PDO barbed suture was anchored to the SMAS at the malar arch just anterior to the helical root. One arm of the barbed sutures proceeded anteriorly to provide horizontal plication (vertical lifting) of the cheek SMAS, while the other arm travelled inferiorly to plicate the lateral SMAS/platysmal edge to the mastoid fascia. This provided both vertical lift of the cheek SMAS and refined neck/jawline definition by anchoring the platysma laterally. Ball tip cautery was used to smooth any fatty irregularities in the face and neck areas. Hemostasis was again checked at this time. Irrigation with local anesthetic with epinephrine was done to the entire undermined surface. Final hemostasis was then obtained. The skin flap was pulled up under minimal tension and inset into place. The first anchoring stitch was placed at the junction of the horizontal sideburn incision and the vertical preauricular incision using one 3-0 plain gut interrupted suture. Then, a second 5-0 nylon interrupted suture was placed at the point just superior to tragus. Excess skin was trimmed both horizontally below the sideburn and vertically in front of the ear. Fibrin sealant was sprayed across the entire undermined area within 1 min and gentle pressure over the skin flap was held for 3 min. Care was taken to ensure no skin bunching resulted from the inset at the anterior edge of sideburn. Attention was also paid to ensure no skin excess around the visible lobule. Some pleating was expected, which settled out at the posterior ear surface. The skin was closed with staples at the posterior ear location. A running 5-0 nylon was used to close the anterior ear incision. In a similar fashion, the same procedure was then again performed on the left side of the face. The submental incision was inspected and hemostasis again obtained, fibrin sealant was sprayed. The submental incision then was closed with running subcuticular 5-0 Prolene with interrupted 5-0 running nylon over it. Antibiotic ointment was placed on top of all incision sites. The entire face then was dressed with three strips of 4×8 gauzes and a Surginet. No drains were used.

The patient tolerated the procedure well and was transferred to recovery room in excellent condition. All needle, instrument, and sponge counts were correct at the end of procedure.

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Coronal Brow Lift

5

Tuan Anh Tran and Seth R. Thaller

Indications

1. Desire to minimize the frown lines and prominent forehead creases to achieve a more youthful look
2. Reposition of brow ptosis, minimize forehead and glabellar rhytides
3. Reconstruction of significant facial paralysis involving brows and forehead

Possible Complications

1. Scalp numbness
2. Permanent and long scar associated with alopecia
3. Elevation of anterior hairline
4. Alopecia

Essential Steps

Preoperative Markings

1. Mark the anterior hairline, transverse furrows, glabellar frown lines, supratarsal crease, and nasal root rhytides with the patient in the upright position.
2. Identify and mark supraorbital nerves, and supratrochlear nerves.
3. Mark the coronal incision 5 cm behind the receding line or at the hairline with a sawtooth incision.

Intraoperative Details

1. Place in supine position.
2. General anesthesia or Monitored Anesthesia Care.
3. Neurosurgical Mayfield horseshoe head rest maybe used to support the head.

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4. Cleanse the hair, braid, and shave the hair to expose the proposed incisions.
5. Infiltrate the brow area with local anesthetic plus 1:100,000 Epinephrine.
6. Incise the skin and subcutaneous tissue down to pericranium.
7. Raise a subgaleal flap down to superior orbital rims.
8. Release galeal attachments along central and lateral orbital rims.
9. Release superolateral temporal fixation zone.
10. Identify and preserve supraorbital neurovascular bundles.
11. Resect frontalis, corrugator, depressor supercilii, and procerus muscles.
12. Reposition the flap superolaterally and excise a strip of scalp.
13. Fixate the flap under no tension.

Postoperative Care

1. Control blood pressure, and pain.
2. Patient is seen in 24 h to check the wound and change the dressing.
3. Patient can take down the dressing and shower at 48 h with a gentle shampoo and apply a wide hairband as directed by the doctor to cover the wound.
4. Remove permanent running sutures on POD# 7 in the office or staples at 10 days if used.

Operative Dictation

Diagnosis: brow ptosis with severe forehead wrinkles

Procedure: Coronal Brow Lift

Indication

This was a _____ with significant forehead wrinkles with associated brow ptosis, who desired a more youthful and pleasant look. Patient understood the benefits, risks, and alternatives associated with the procedure, and wished to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time-out among operating room staffs was completed. Sequential compression devices were applied to bilateral lower extremities. Monitored Anesthesia Care was instituted. Preoperative antibiotics were given. Neurosurgical Mayfield horseshoe head rest was used to support the head. Hair was cleansed, and braided and shaved to expose the proposed incisions. Incision line, forehead, and brow area were infiltrated with 1 % lidocaine plus 1:100,000 epinephrine. The patient was prepped and draped in standard sterile surgical fashion.

Skin was incised in a sawtooth pattern through the subcutaneous tissue down to the pericranium using a beveled Number 15 scalpel. The incision was carried laterally to the root of both ears to facilitate scalp and flap mobilization. Running hemostatic stitch with 3-0 Prolene sutures were applied to the edge of the flap to achieve scalp hemostasis. Next, the flap was elevated and dissected in the subgaleal plane to a point 4 cm above the superior orbital rim. At this point, the plane was changed from subgaleal to subperiosteal. The periosteum was incised from one lateral aspect of one superior orbital ridge to the other. Periosteum was raised to just beyond the ridge and onto the nose just beyond the radix using periosteal elevator. The supraorbital neurovascular bundles were identified and preserved. Laterally, the temporal fixations at the temporal crests were bluntly dissected off and released using periosteal elevator. Once the flap was freely mobilized from temporal line to contralateral temporal line, attention was shifted back toward the midline frown muscles. Three to four thin strips of galea and a portion of the frontalis muscle were excised. Care was taken to avoid excessive resection of frontalis muscle to avoid unsightly depressions and postoperative deformities. Next, the glabellar frown lines were marked. The origins of the corrugator muscles from the superomedial orbital rim were identified. Approximately 2 cm of corrugator muscles were resected to prevent reattachment. The procerus

muscle was disrupted in the similar fashion as the corrugator to remove nasal root wrinkles. Care was taken to avoid over-resection of either the corrugator muscles or the procerus muscle to prevent contour irregularities. Hemostasis was meticulously achieved. The scalp was flipped back into its anatomic position. Using three clamps, the scalp edges are grasped and pulled in the superolateral direction. The brows were over-corrected over the desired brow position by 1–1.5 cm. The scalp edges were tailor tacked and the overlapping scalp edge was resected. The galea was closed with interrupted 3-0 Vicryl sutures. The skin edges were closed with running 4-0 Prolene with attention paid to everting the edges. The surgical wound was dressed with non-occlusive dressing and topical antibiotics were applied to wound edges to preclude dressing from sticking to the hair.

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Endoscopic Forehead Lift

6

Tuan Anh Tran and James M. Stuzin

Indications

1. Desire to minimize the frown lines and prominent forehead creases to achieve a youthful look.
2. Reposition of brow ptosis.
3. Reconstruction of significant facial paralysis involving brows and forehead.
4. Receding hairline, low eye brows, and/or frontal bossing where it can be difficult to visualize supraorbital rim via the open approach.

Possible Complications

1. Inadequate lift.
2. Unpredictable maintenance of fixation.
3. Tactile sensation of the Endotine device.
4. Wound complications, numbness, and alopecia at the port sites.
5. Injury to the frontal (temporal) branch of the facial nerve.

Essential Steps

Preoperative Markings

1. Mark the midline; the central paramedian access incisions with the trajectory directly over the peak of each eye brow, and approximately 2 cm behind the hairline. Do this symmetrically for both sides with equal distances to the midline.
2. Palpate the temporalis muscle and the temporal crest; mark temporal access incisions (2–4 cm in length) behind the temporal hairline. Do this symmetrically for both sides.
3. Identify and mark the zygomaticotemporal veins (sentinel veins), and the supraorbital neurovascular bundles on both sides.
4. Mark the upper limb of the upper blepharoplasty incision in the upper lid crease; mark the lower limb at least 8 mm from the upper lash line; connect these lines medially and laterally ensuring the width of the skin area to be resected is at most 5 mm for conservative resection.

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Intraoperative Details

1. Ensure that all the endoscopic equipment is functional prior to the patient entering the operating room.
2. Place the patient in supine position; prep and drape in usual surgical fashion.
3. Infiltrate the upper blepharoplasty areas in the subcutaneous plane, the brow area in the subperiosteal plane, and the four access incisions in the scalp with 1:200,000 epinephrine.
4. Perform conservative skin only upper blepharoplasty.
5. Create an optical cavity in the frontal and temporal region by splitting the lateral orbicularis oculi muscle above the zygomaticofrontal suture through the Retro-Orbicularis Oculi Fat to the periosteum, incise the periosteum, then elevate a subperiosteal plane using an Obwegeser periosteal elevator.
6. Detach the dense attachment (brow ligaments) over the supraorbital rim from lateral to medial with the Obwegeser.
7. From the lateral upper blepharoplasty incision, dissect just superficial to the deep temporal fascia as laterally toward the temporal fusion line as possible.
8. Make an anterior-posterior incision through the paramedian vertex skin marking down to bone and dissect circumferentially in the subperiosteal plane. Repeat this on the other side.
9. Make a vertical incision over the proposed temporal marking down to deep temporal fascia and create an optical cavity by elevating the loose areolar tissue above the deep fascia. Repeat on the contralateral side.
10. Insert an endoscope through the paramedian vertex incision to visualize the temporal crests in a subgaleal plane.
11. Use the periosteal elevator to dissect the flap from one temporal line of fusion to the other. Stay just above the deep temporal fascia to avoid injury to the temporal branch of the facial nerve. Disrupt the attachments to the temporal crests along the line of fusion.
12. Identify and preserve the sentinel vein (medial zygomaticotemporal vein).
13. Divide the septa and adhesions around sentinel vein, and extend the dissection toward the upper eyelids.
14. Continue to elevate the periosteum over the glabella; identify and preserve supraorbital neurovascular bundles; and visualize the procerus, depressor supercilii, and corrugator supercilii muscles.
15. These muscles can be transected with endoscopic scissors.
16. Achieve hemostasis with meticulous cauterization and epinephrine-soaked pledgets.
17. Fixate the brow in the temporal areas by anchoring the anterior superficial temporal fascia to the deep temporal fascia closer to the vertex.
18. Fixate the scalp in the paramedian incisions between the sagittal sinus and the temporal fusion line where the calvarium is thickest with the Endotine device.
19. Close the scalp incisions and upper blepharoplasty incisions, bilaterally.

Postoperative Care

1. Admit the patient to the observation unit for 24 h if there are confounding medical comorbidities.
2. Elevate the head of bed at 30° and place ice packs over the eyes/brows.
3. Control systolic blood pressure < 120 and diastolic blood pressure < 85.

Operative Dictation

Diagnosis: brow ptosis with severe forehead wrinkles

Procedure: Endoscopic forehead lift

Indication

This is a _____ with significant forehead wrinkles with associated brow ptosis, who desires a more youthful and pleasant look. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time-out among operating room staffs was completed. Monitored Anesthesia Care was instituted. Preoperative antibiotics were given. Hair was cleansed, braided, and shaved to expose four proposed incisions. Incision lines in the upper eyelids, scalp, brows, and forehead were infiltrated with 1 % Lidocaine with 1:200,000 epinephrine. The patient was prepped and draped in the standard sterile surgical fashion.

Incisions were carried out along the marked upper blepharoplasty line down to the subcutaneous tissues. Conservative skin only blepharoplasty resection was carried out from lateral to medial. Care was taken to preserve the orbicularis oculi muscles and levator aponeurosis. At the lateral extend of the blepharoplasty incision above the zygomaticofrontal suture, the orbicularis oculi muscle was split. Dissection was carried through the retro-orbicularis oculi fat (ROOF) and through the periosteum using the electrocautery. The optical cavity was formed just medial to the temporal line of fusion. Periosteal elevator was inserted. Brow ligaments over the supraorbital rim were encountered in the first 2 cm of the dissection. These adhesions (brow ligaments) were taken down by blunt dissection with the Obwegeser periosteal elevator. Subperiosteal flap was then elevated from lateral to medial using the Obwegeser from this optical cavity. Care was taken to avoid injuring the supraorbital neurovascular bundle. Next, the lower aspect of the temporal dissection was done through the lateral upper blepharoplasty incision making sure that the plane of dissection was immediately superficial to the deep temporal fascia. Dissection along this plane was carried out as laterally as possible. These steps were repeated on the contralateral side.

Attention was shifted toward the vertex of the scalp. Incisions were made through both paramedian vertex skin markings. This dissection was made until the outer calvarial cortex was reached. Both optical cavities were made by clearing the periosteum around these incisions using the Obwegeser elevator. The Obwegeser was directed toward the temporal markings. The scalp was elevated and incisions were made over the temporal markings. The tissues were deepened until the deep temporal fascia overlying the temporalis muscle was reached. A straight 30° 5 mm endoscope was inserted in the paramedian vertex port to visualize the temporal crests and temporal lines of fusion. An Obwegeser inserted via the temporal incision was used to take down the adhesions over the temporal crests. This was repeated on the contralateral side. Next, the subperiosteal flap was raised from one temporal line of fusion to the other connecting both optical cavities. As the dissection was carried toward the supraorbital rim, the sentinel veins (medial zygomaticotemporal veins) were identified and preserved. The septa and adhesions around the sentinel veins were divided. Dissection was extended toward the upper eyelid, deep to the orbicularis oculi muscle, and retro-orbicularis oculi fat connecting with the optical cavities created from the lateral upper blepharoplasty incisions. Medially, this dissection was carried toward the glabella until the level approximately 2 cm above the supraorbital rim is reached. The procerus, depressor supercilii, and corrugator supercilii were visualized and transected by using endoscopic grasper teasing and resecting the muscles. Next, the forehead was pulled upward to test that all the attachments have been released, and the lateral brows were mobile. Once adequate mobility was obtained, meticulous hemostasis was achieved using electrocautery and epinephrine-soaked pledgets.

Brows were adjusted and set in place, symmetrically. Temporal incisions were closed by anchoring the superficial temporal fascia and galea down to the deep temporal fascia with 3-0 PDS sutures such that the lateral aspects of the eyebrows were suspended at the appropriate height. Peaks of the eyebrows (between the middle and lateral 1/3 of the brow) were fixated at the paramedian incisions by the Endotine devices. An Endotine drill with a 4.5 mm drill bit was used to slowly drill the outer cortex, which was lateral to the sagittal sinus and medial to the

temporal fusion line where the calvarium was the thickest. Drilling continued until the superficial diploic space was entered. (If any bleeding from calvarium occurred, bone wax was used to control the bleeding.) The Endotine post was inserted into the drilled hole such that the tines were pointing toward the vertex. The scalp was pulled backward and elevated to reach the desired brow lift height. Forehead symmetry was checked. The stretched scalp was placed over the Endotine device and manual pressure was applied to ensure penetration of the tissue by the device. The galea was closed with interrupted 3-0 Vicryl sutures. The four port sites in the scalp were closed with interrupted 5-0 Nylon suture. Upper blepharoplasty incisions were closed with interrupted 5-0 Nylon sutures. Bacitracin was placed over these incisions.

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Upper Blepharoplasty

7

Sarah A. Eidelson and Seth R. Thaller

Indications

1. Cosmetic concern including:
   (a) Dermatochalasis (excess skin)
   (b) Fat herniation
   (c) Brow ptosis
   (d) Blepharoptosis [1]
2. Visual field defects
3. Entropion

Essential Steps

Patients taking anticoagulants should ideally be held for 7 days pre-procedure.

Preoperative Markings

1. Identifying the area of desired lid crease that is individualized to patient's anatomy. For the inferior margin of incision, Caucasian women should be marked approximately 8–10 mm above upper eyelid margin (lash line) at the mid-pupillary axis [2]. Men should be marked at 8–10 mm. Asian patients should be marked at 4–6 mm.
2. Lateral edge of marking should not extend beyond the level of lateral canthus. If significant redundant tissue is present, the lateral incision can be extended up to 5 mm but patient must be made aware of potential result on scar position.
3. Medial marking should be roughly 5 mm lateral to the medial canthus. It should not reach the level of the medial canthus. Connect these inferior markings along a curvilinear pattern running in line to the natural eyelid crease to form an ellipse.
4. For the superior incision, mark 20 mm above the upper eyelid margin at the mid-pupillary axis. Create a similar curvilinear marking that mirrors the inferior incision.
5. Connect these lines. Ensure adequate tissue remains to allow eye closure without tension [1]. This is determined by having the patient close and open eyes while area of planned excision should be grasped with a smooth forceps. Plastic surgeon's goal is to leave patient without resulting lagophthalmos. Lateral corners should connect at roughly 30–40° [3].
6. Repeat above steps in contralateral eye and check for symmetry of markings before incision.

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Intraoperative Details

1. Establish the sterile field with ophthalmic strength Povidone-Iodine solution.
2. Slowly inject 4–5 cc of 1 % Lidocaine with 1/100,000 epinephrine to subcutaneous tissue with 25-gauge needle to form wheal within area of excision of upper lid similar to hydro-dissection for harvesting a full thickness skin graft. Wait 10–12 min to form adequate analgesia and vasoconstriction.
3. Using a #15C blade make a medial to lateral skin incision along the line of inferior marking while holding gentle digital retraction.
4. Follow by making an incision along the superior marking.
5. Using handheld pointed tip electrocautery, dissect through skin to the level of orbicularis oculi muscle starting at the superficial incision. Care should be taken not to violate level of levator aponeurosis.
6. Fat resection is generally discouraged unless central or medial fat pads are significantly herniated upon gentle pressure of the globe. If present, conservative resection using electrocautery can then be performed.
7. Using curved iris scissors, remove upper lid skin en bloc with tips facing upwards. May send for pathology for gross evaluation only.
8. Irrigate gently with 10 cc of normal saline and ensure adequate hemostasis with handheld electrocautery before placing sutures.
9. Begin closure by placing 6-0 or 5-0 nonabsorbable suture from the superior preseptal orbicularis to the inferior orbicularis and levator aponeurosis at the mid-pupillary axis. Orbital septum or tarsus should never be sutured. Place 4–6 fixation sutures, as the orbital septum does not need to be completely closed [4].
10. Once eyelid crease is recreated, a running 6-0 plain gut or prolene suture may be used to close incision medially to laterally.
11. Gently push down and ensure that eyelid comes down easily.
12. Place Steri-strips across incision.
13. Gross visual acuity and extraocular movements should be evaluated at the end of procedure.

Postoperative Care

1. Keep head of bed elevated at least 30° to decrease swelling.
2. Twenty minutes cold compress, as needed, to wound post-op day 1.
3. Can shower within 48 h postoperatively.
4. Apply ophthalmic antibiotic ointment twice daily once Steri-strips fall off.
5. Avoid makeup products for at least 2 weeks.
6. Exercise and contacts can be resumed 2 weeks postoperatively.
7. Avoid direct sun exposure for 4–6 weeks postoperatively.

Possible Complications

1. Asymmetry
2. Retrobulbar hematoma causing visual disturbances (any acute worsening of eye pain postoperatively should be evaluated immediately)
3. Dry eyes
4. Eyelash loss
5. Ectropion
6. Corneal abrasions
7. Lagophthalmos
8. Ptosis
9. Swelling and/or bruising for 2–3 weeks
10. Chemosis

Operative Dictation

Diagnosis: Bilateral cosmetic dermatochalasis/ possible visual field defect

Procedure: Upper blepharoplasty

Indication

This is a __/__ (Age/gender) with a history of dermatochalasis resulting in bilateral visual field defects. This has been confirmed both by preoperative visual field studies and visual improvement upon taping of her lids. She is now admitted for upper lid blepharoplasty. The proposed procedure, surgical options, limitations, incision locations, risk, benefits, and alternatives are explained to the patient in detail and he/she understands and agrees to the procedure outlines.

Description of the Procedure

The patient was brought into the operating room in satisfactory condition and placed in supine position. Patient's periorbital area was prepped and draped in standard sterile fashion using ophthalmic strength povidone-iodine. A final time-out was performed verifying patient's name, medical record number, procedure, and operative site. This was confirmed with surgical staff. Markings were made with calipers at 8 mm above lash line at the mid-pupillary axis. Lateral marking was made at the level of the lateral canthus in the plane of patient's natural eyelid crease. Medial most marking was made 5 mm lateral to medial canthus also in line with patient's natural eyelid crease. These three markings were connected to form curvilinear pattern. For the superior marking of excision, a mark 20 mm above lash line in mid-pupillary axis was made and connected to form elliptical pattern of excision. Zone of excision was gently grasped with a smooth forceps to ensure patient was left without significant resulting lagophthalmos. We repeated same steps for contralateral eye and ensured symmetry between our preoperative markings that were confined in calipers. We then slowly injected 1 % Lidocaine with 1/100,000 epinephrine to subcutaneous tissue with 25-gauge needle to form wheal within area of excision of upper lid and allowed adequate time for analgesia and vasoconstriction to right eye. While using gentle digital retraction, we used a #15C blade to make a medial to lateral incision over our preoperative markings down to the level of the orbicularis oculi muscle. We then repeated this maneuver to the superior marking. We removed the full thickness skin en bloc with curved iris scissors and sent specimen for gross pathology only. We irrigated area gently with 10 cc normal saline and ensured adequate hemostasis with handheld Bovie electrocautery. Once hemostasis was ensured, we began to re-approximate preseptal orbicularis oculi using four 5-0 nonabsorbable fixation sutures. Once we recreated eyelid crease, we ran 6-0 Prolene running subcuticular sutures medially to laterally. We then performed the above procedure on the left side. We ensured both eyelids opened and closed easily without significant lagophthalmos at the end of procedure. We placed Steri-strips across incision. Gross visual acuity and extraocular movements were assessed and determined to be intact at the end of procedure. Sponges and instrumentations were counted and correct. Patient was taken to recovery unit in stable condition without complications.

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Lower Blepharoplasty

8

Urmen Desai and Richard Ellenbogen

Indications

1. Surgically address pseudoherniation of fat, excess infraorbital fat, redundant lower eyelid skin and muscle, as well as lower eyelid malposition
2. Reestablish youthful fullness after age-related changes
3. Enhance overall patient self-image and self-confidence
4. Utilize an effective and long-lasting technique for lower eyelid rejuvenation
5. Ideal for the medically unstable patient unable to undergo general anesthesia

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Essential Steps

Transconjunctival Approach

Preoperative Markings and Preparation

1. Obtain a detailed preoperative History & Physical and American Society of Plastic Surgeons (ASPS) consent titled "Blepharoplasty."
2. Examine the patient with careful documentation of visual acuity, dermatochalasis, blepharochalasis, skin elasticity with a pinch test, snapback test, festoons, pseudoherniation of fat from the lower three compartments, Schirmer's test, degree of scleral show, presence of tear trough deformity, and the presence of a positive or negative vector.
3. Start preoperative antibiotics.
4. Hang preoperative photographs in clear view in operating room.
5. Discuss strict blood pressure control with anesthesia colleague.
6. Make sure Sequential Compression Devices (SCDs) are placed on patient and power turned on prior to induction.
7. Place Bair Hugger over the patient.
8. Rotate bed 90° or 180° from the anesthesia machine.
9. Once the patient is prepped and draped, a fine-tipped marking pen is used to make

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surgical markings on the conjunctival surface of the lower lid 4 mm inferior to the lower border of the tarsal plate to preserve the orbital septum.
10. The medial extent of the markings should be in line with the inferior punctum.
11. The lateral extent of the markings should be 4–5 mm medial to the lateral canthus.

Intraoperative Details

1. Two drops of 0.5 % tetracaine hydrochloride are instilled into each inferior fornix.
2. Corneal eye shields are placed bilaterally.
3. Lower lid conjunctiva is injected with 1 cc of 1 % lidocaine with 1:100,000 epinephrine using a 30-gauge needle.
4. A needle-tip electrocautery is used to make a transconjunctival incision as previously marked, keeping the orbital septum intact.
5. A 5-0 nylon suture is placed through the conjunctiva closest to the fornix to retract the posterior lamella over the cornea with a mosquito hemostat held on to the patient's headwrap to hold the suture under tension.
6. Simultaneous eversion of the lower eyelid using a Desmarres retractor and gentle pressure on the globe will produce a bulge of orbital fat which helps guide the dissection.
7. Blunt dissection with the assistance of a cotton-tip applicator is performed until the medial, central, and lateral fat pads are identified.
8. A fine forceps is used to carefully tease out the excess fat with care to remove only the excess herniated fat to prevent a hollowed-out appearance.
9. A mosquito hemostat is used to clamp the fat pad at its stalk. Then it is transected with a needle-tip electrocautery.
10. After resection of fat, the surgical field is examined until meticulous hemostasis is achieved.
11. A comparison of volume of fat removed from the medial, middle, and lateral compartments on the left and right lower eyelids can be performed to confirm symmetry.
12. Finally, fat repositioning may be performed to fill in more inferior orbital hollowing by redraping the fat over the arcus marginalis and to fill nasojugal deficiencies after releasing the orbitomalar ligament.
13. The conjunctival incision can then be reapproximated with or without suture closure.
14. Additional facial fat grafting to the nasojugal groove or tear trough can also be performed as an adjunctive procedure.
15. Adjunctive procedures to treat excess skin can now be performed, including fillers, neurotoxin, chemical peel, laser resurfacing, microdermabrasion, or skin-pinch excision.

Subciliary Skin-Muscle Flap

Preoperative Markings and Preparation

1. Once the patient is prepped and draped, a fine-tipped marking pen is used to mark a subciliary incision 2 mm beneath the eyelid margin.
2. The medial extent of the marking lies 1 mm lateral to the inferior punctum to avoid potential injury to the interior canaliculus.
3. The lateral extent of the marking lies 8–10 mm lateral to the lateral canthus, curving inferolaterally and blending into a natural periorbital rhytid.

Intraoperative Details

1. Two drops of 0.5 % tetracaine hydrochloride are instilled into each inferior fornix.
2. Corneal eye shields are placed bilaterally.
3. 1 cc of 1 % lidocaine with 1:100,000 epinephrine is injected along the surgical markings down to the infraorbital rim.
4. A #15 scalpel is used to make a skin incision to the lateral canthus. Lateral to this point, a skin and muscle incision is made.
5. A small blunt-tip dissection scissor is used to dissect in a submuscular plane from lateral to medial.
6. A 5-0 nylon suture is then placed through the gray line lateral to the limbus above the incision for counter-retraction and to protect the globe (Frost retention suture).
7. Blunt dissection is then performed using a combination of a cotton-tip applicator and a small blunt-tip dissection scissor until a

skin-muscle flap is developed down to the level of the infraorbital rim.
8. Simultaneous eversion of the lower eyelid with a Desmarres retractor and gentle pressure on the globe produces a bulge of orbital fat which helps to guide the dissection.
9. Blunt dissection through the orbital septum is performed with the assistance of a cotton-tip applicator and the small blunt-tip dissection scissors until the medial, central, and lateral fat pads are identified and penetrated through the orbital septum.
10. A fine forceps is used to carefully tease out the excess fat with care to remove only the excess herniated fat to prevent a hollowed-out appearance.
11. A mosquito hemostat is used to clamp the fat pads at their stalk and are then transected with a needle-tip electrocautery.
12. After resection of fat, the surgical field is examined until meticulous hemostasis is achieved.
13. A comparison of volume of fat removed from the medial, middle, and lateral compartments on the left and right lower eyelids can be performed to confirm symmetry.
14. Finally, fat repositioning may be performed to fill in more inferior orbital hollowing by redraping the fat over the arcus marginalis and to fill nasojugal deficiencies after releasing the orbitomalar ligament.
15. A lateral canthoplasty, canthopexy, or tarsal strip procedure can then be performed at this point to restore eyelid position.
16. The inferior skin-muscle flap is then redraped over the subciliary incision, and the redundant skin-muscle overlap is marked and conservatively resected.
17. A 6-0 fast-absorbing gut suture is then used to reapproximate the skin incision in a running fashion.
18. Additional facial fat grafting to the nasojugal groove or tear trough can also be performed as an adjunctive procedure.
19. Adjunctive procedures to treat excess skin can now be performed, including fillers, neurotoxin, chemical peel, laser resurfacing, microdermabrasion, or skin-pinch excision.
20. Antibiotic ointment is then applied to the subciliary skin incision.

Subciliary Skin-Only Flap

Preoperative Markings and Preparation

1. Once the patient is prepped and draped, a fine-tipped marking pen is used to mark a subciliary incision 2 mm beneath the eyelid margin.
2. The medial extent of the marking lies 1 mm lateral to the inferior punctum to avoid potential injury to the interior canaliculus.
3. The lateral extent of the marking lies 8–10 mm lateral to the lateral canthus, curving inferolaterally and blending into a natural periorbital rhytid.

Intraoperative Details

1. Two drops of 0.5 % tetracaine hydrochloride are instilled into each inferior fornix.
2. Corneal eye shields are placed bilaterally.
3. 1 cc of 1 % lidocaine with 1:100,000 epinephrine is injected along the surgical markings down to the infraorbital rim using a 30-gauge needle.
4. A #15 scalpel is used to make a skin-only incision.
5. A 5-0 nylon suture is then placed through the gray line lateral to the limbus above the incision for counter-retraction and to protect the globe (Frost retention suture).
6. Careful blunt dissection is then performed using a combination of a cotton-tip applicator and a small blunt-tip dissection scissor to develop a skin flap down to the level of the infraorbital rim.
7. Simultaneous eversion of the lower eyelid with a Desmarres retractor and gentle pressure on the globe produces a bulge of orbital fat which helps to guide the dissection.
8. Blunt dissection through the orbital septum is performed with the assistance of a cotton-tip applicator and a small blunt-tip dissection scissor until the medial, central, and lateral fat pads are identified and penetrated through the orbital septum.
9. A fine forceps is used to carefully tease out the excess fat with care to remove only the excess herniated fat to prevent a hollowed-out appearance.
10. A mosquito hemostat is used to clamp the fat pads at their stalk, and are subsequently transected with needle-tip electrocautery.

11. After resection of fat, the surgical field is examined until meticulous hemostasis is achieved.
12. A comparison of volume of fat removed from the medial, middle, and lateral compartments on the left and right lower eyelids can be performed to confirm symmetry.
13. Finally, fat repositioning may be performed to fill more inferior orbital hollowing by redraping the fat over the arcus marginalis and to fill nasojugal deficiencies after releasing the orbitomalar ligament.
14. A lateral canthoplasty, canthopexy, or tarsal strip procedure can then be performed at this point to restore eyelid position.
15. The inferior skin flap is then redraped over the subciliary incision, and the redundant skin overlap is marked and conservatively resected.
16. A 6-0 fast-absorbing gut suture is then used to reapproximate the skin incision in a running fashion.
17. Additional facial fat grafting to the nasojugal groove or tear trough can also be performed as an adjunctive procedure.
18. Adjunctive procedures to treat excess skin can now be performed, including fillers, botox, chemical peel, laser resurfacing, microdermabrasion, or skin-pinch excision.
19. Antibiotic ointment is then applied to the subciliary skin incision.

Postoperative Care

1. Strict blood pressure control
2. Head of bed at 45°
3. Cold compresses to reduce immediate postoperative edema for 24–48 h.
4. Close observation in a dimly lit room for any indication of retrobulbar hematoma for at least 1–2 h postoperatively and discharge only after a thorough visual examination is performed
5. Ocular lubrication with artificial tears and nighttime lubrication with ophthalmic bacitracin ointment
6. Strict instructions to limit physical activity for 2 weeks postoperatively
7. Close monitoring on follow-up examination for any signs of development of ectropion, scleral show, chemosis, or any changes in lid contour or position

Key Points

1. Choose the right patient for the operation and the right operation for the patient.
2. Consider complementary nonsurgical adjuvant therapies such as botox, fillers, chemical peels, laser resurfacing, and microdermabrasion to the lower eyelids to synergistically achieve an ideal result.
3. Additional facial fat grafting to the nasojugal groove or tear trough can also be performed as an adjunctive procedure.
4. Age-related changes to periorbital skin and fat content are among the first to occur in the face. Even minor corrections of these entities can lead to significant rejuvenation and restoration of a more youthful appearance.
5. A thorough preoperative evaluation is essential in determining the candidacy and surgical approach that is ideal for correcting periorbital aesthetic imperfections.
6. Ophthalmic conditions need to be evaluated by an ophthalmologist prior to any operative intervention.
7. A conservative skin-muscle or skin-only flap resection is recommended to prevent complications.
8. Meticulous hemostasis is crucial for reducing the chance of developing a postoperative retrobulbar hematoma.

Possible Complications

1. *Retrobulbar Hematoma*: Vascular injury during surgery with retraction of the vessel into the retrobulbar space can lead to this potentially catastrophic complication. This frequently presents with pain, proptosis, and chemosis that becomes progressively worse. Loss of visual acuity can be indicative of optic nerve ischemia. This complication typically occurs within the first 4–6 h

postoperatively. It requires prompt opening of incisions, saline compresses, and intravenous treatment with mannitol, diamox, and decadron. Additionally, hypertension and any coagulopathies should be controlled. An emergency canthotomy and ophthalmologic consultation are necessary.
2. *Ectropion and Lid Malposition*: Postoperative scleral show can be due to edema or weakness of the orbicularis oculi muscle and resolves with edema resolution and muscle reinnervation.
3. *Corneal Injury*: Lubrication is the best measure to prevent this.
4. *Chemosis*: Disruption of ocular and eyelid lymphatic drainage leads to edema of the cornea.
5. *Dry eyes*: Injury to the lacrimal gland, excessive skin resection, and postoperative edema can lead to this.
6. *Epiphora*: This is common postoperatively during the first 48 h due to edema or a temporary decrease in muscle tone.
7. *Extraocular Muscle Injury*: The inferior oblique muscle is vulnerable to injury during dissection of fat compartments in the lower lid. Injury to this muscle would present as diplopia on upward and lateral gaze.

Operative Dictation

Brief History and Indications for Procedure

This was a woman who presented in consultation for aging changes to her face. She complained of others commenting on her tired look, despite getting much rest. She had concerns with lower eyelid dermatochalasis and discoloration. She was seeking surgical intervention to meet this objective. After extensive consultation she was deemed an appropriate candidate for surgery. Risks, benefits, and alternatives to the procedure were discussed, including but not limited to bleeding, infection, contour irregularities, seroma, changes in lacrimation, dry eye, asymmetry, chemosis, corneal injury, injury to extraocular muscles, vision changes, ectropion, entropion, lid malposition, scarring, retrobulbar hematoma, and blindness. The patient was allowed to ask questions throughout this discussion and these were answered to the patient's satisfaction. She was an active participant regarding the choice of procedure, including the planned incision.

Description of the Procedure

The patient was seen in preoperative holding and the medical records, lab values, preoperative photographs, American Society of Plastic Surgeons (ASPS) consent, and patient expectations were reviewed. The procedure, risks as listed above, and benefits were again discussed in detail. Preoperative markings were made with patient awake in the standing position. These markings were discussed and demonstrated to the patient in a mirror. Planned incision, location, and approximate size were again confirmed with the patient who understood and agreed with the operative plan.

The patient was then taken to the operating room and placed in the supine position on the operating room table. All bony prominences were appropriately padded and protected. Arms were then tucked. SCDs were applied to both lower extremities and a Bair Hugger was also placed over the patient. A time-out was then performed, confirming the patient and the surgical procedures to be performed. Uneventful general anesthesia was then established. (*This procedure can be routinely performed under MAC anesthesia*.) Surgical prepping and draping was then done using half-strength betadine solution in the usual sterile fashion after which a final time-out was taken to confirm the patient and procedure.

A fine-tipped marking pen was initially used to mark a planned incision on the conjunctival surface of the lower eyelid 4 mm inferior to the lower border of the tarsal plate to preserve the orbital septum. The medial extent of the marking was in line with the inferior punctum while the lateral extent of the marking was 5 mm medial to the lateral canthus. Next, two drops of 0.5 %

tetracaine hydrochloride were instilled into the inferior fornix, bilaterally. Corneal eye shields were then carefully placed, bilaterally. The lower lid conjunctiva was then injected with 1 cc of 1 % lidocaine with 1:100,000 epinephrine using a 30-gauge needle. Several minutes were allowed for vasoconstrictive and anesthetic properties to take effect.

A needle-tip electrocautery was used to make a transconjunctival incision as previously marked, while taking caution to keep the orbital septum intact. Next, a 5-0 nylon suture was placed through the conjunctiva closest to the fornix to retract the posterior lamella over the cornea with a mosquito hemostat held on to the patient's head-wrap to hold the suture under tension, acting as a retention suture. A Desmarres retractor was used to perform simultaneous eversion of the lower eyelid. Gentle pressure on the globe then produced a bulge of orbital fat, helping to guide the dissection in a retro-septal plane. Blunt dissection was then performed with the assistance of a cotton-tip applicator until the medial, central, and lateral fat pads were clearly isolated and identified. A fine forceps was used to carefully tease out the excess fat which was easily delivered. Caution was used to remove only the excess herniated fat in order to prevent a hollowed-out appearance. A mosquito hemostat was then used to clamp the fat pad at its stalk, and was then transected with a needle-tip electrocautery.

After resection of fat, the surgical field was examined until meticulous hemostasis was achieved. A comparison of the medial, middle, and lateral fat removed from the left and right lower eyelids was performed for symmetry. Next, the orbitomalar ligament was released with a small blunt dissection scissor. Fat repositioning was performed to fill in the inferior orbital hollowing and nasojugal deficiency, as fat was redraped over the arcus marginalis. This fat was secured to periosteum with a 5-0 monocryl suture. Meticulous hemostasis was then achieved. Finally, the conjunctival incision was left open without suture closure.

The patient was awakened uneventfully from anesthesia. The patient was then transferred to a stretcher and transported to the recovery room awake and in stable condition. The patient tolerated the procedure well and there were no complications. Confirmation was made that all sponge and needle counts were correct.

Suggested Reading

American Society of Plastic Surgery .Top five cosmetic surgical procedures. http://www.plasticsurgery.org/news/plastic-surgery-statistics

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Structural Fat Grafting to the Face

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Urmen Desai and Richard Ellenbogen

Indications

1. Reestablish youthful fullness after age-related changes
2. Apply a minimally invasive approach to address facial deflation
3. Utilize an effective and long-lasting material to restore loss of volume and facial hollowing
4. Ideal for the medically unstable patient unable to undergo general anesthesia for a more aggressive surgical procedure
5. Rapid postoperative recovery
6. Enhance overall patient self-image and self-confidence

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Essential Steps

Preoperative Markings and Preparation

1. Obtain a detailed preoperative History & Physical and American Society of Plastic Surgeons (ASPS) consent titled "Fat Graft Procedures"
2. Examine the patient with careful documentation of malar depression or flattening, hollowing of the supraorbital rim, pseudoherniation of fat from the lower eyelids, temporal hollowing, presence of tear trough deformity, deep nasolabial folds, and jowling of the jaw line
3. With the patient standing in the upright position, use a fine-tipped marking pen to mark areas of facial atrophy and volume deflation
4. Continue preoperative marking of fat donor area based on patient preference to enhance contour at donor site and ease of fat harvest
5. Start preoperative antibiotics
6. Hang preoperative photographs in clear view in the operating room
7. Discuss strict blood pressure control with anesthesia colleague
8. Rotate bed 90° or 180° from the anesthesia machine

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9. Make sure Sequential Compression Devices (SCDs) are placed on patient and power turned on prior to induction
10. Secure Bair Hugger over patient

Intraoperative Details

Fat Harvest

1. Prep the face of the patient with half-strength betadine and drape patient in supine position
2. Use an #11 scalpel to make a 4 mm incision in a concealed location in the area of donor fat harvest
3. Inject donor area with 0.2% lidocaine with 1:400,000 epinephrine in a super-wet technique (1 cc tumescence : 1 cc fat aspirated)
4. Use a blunt tip 3 mm diameter (17-gauge lumen) fat harvesting cannula connected to a 10 cc Luer-Lok syringe under constant negative pressure to begin fat harvest, allowing harvesting of intact fatty tissue parcels that are large enough to survive, but small enough to pass through the standard 17-gauge infiltration cannula
5. Perform aspiration in a wide, evenly distributed, crosshatched, and fanning pattern from multiple directions
6. Harvest approximately 200–300 cc of fat, and place red Luer-Lok plug on syringe
7. Close donor site incisions with 3-0 Nylon suture

Fat Processing by Centrifugation

(*The authors prefer fat processing by centrifugation, however alternative fat processing can also be performed by strictly washing of harvest fat or by fat sedimentation*)

1. Remove plunger from syringe
2. Centrifuge harvested fat at 1286 g for 2 min so that separation can occur without lipolysis
3. After completion of centrifugation, decant upper (oil) layer or wick away with absorbent Telfa pad
4. Drain lower (blood) layer from syringe by removing the red Luer-Lok plug until all of the blood products have drained out, leaving the middle (fat) layer in the syringe
5. Transfer only the bottom 1–2 cc of the purest concentrated fat ("gold fat") from each 10 cc syringe into 1 cc syringes using an open barrel connector piece

Fat Injection

1. Inject proposed areas of fat grafting with 0.5% lidocaine with 1:200,000 epinephrine for vasoconstriction of host vessels to prevent intravascular embolization of fat and reduce bruising
2. Use an #11 scalpel to make 1 mm incisions in concealed locations in the area of fat recipient site
3. Begin microparticle fat injection by using a blunt 7 cm long 17-gauge lumen cannula attached to a 1 cc Luer-Lok syringe
4. Inject fat globules in less than 0.1 cc aliquots upon withdrawal of 1 cc syringe in a widespread, crosshatched, fanning pattern from multiple directions
5. Fat can be injected at various depths depending on surgeon preference and patient goals; inject immediately beneath the dermis to improve quality of skin and to decrease wrinkles; inject just superficial to periosteum to alter the shape of the bony skeleton
6. Massage areas to correct for irregularities, however do not attempt to mold the injected fat
7. Close stab incisions with 6-0 Prolene suture

Postoperative Care

1. Strict blood pressure control
2. Head of bed at 45°
3. Consider compression garment in area of donor fat harvest for 3 months
4. Strict instructions to limit physical activity for 2 weeks postoperatively

Key Points

1. Harvest fat based on patient preference to enhance contour at donor site as there has been no conclusive evidence of enhanced fat viability from one harvest site to another

2. Consider atraumatic fat harvest and handling under a low-pressure system using a large-bore cannula for long-term fat viability
3. Perform aspiration in a widespread, cross-hatched, and fanning pattern from multiple directions
4. Only use blunt injection cannulas to prevent an intravascular embolization
5. Perform microparticle fat injection with small aliquots less than 0.1 cc per pass in multiple passes so that each parcel of fat is surrounded by native host tissue
6. Preoperative counseling the patient of initial fat resorption as well as the potential need for multiple procedures

Possible Complications

1. Ecchymosis
2. Resorption of Fat
3. Contour Deformity
4. Hematoma
5. Fat Necrosis
6. Calcification
7. Fat Embolus

Operative Dictation

Brief History and Indications for Procedure

The patient is a pleasant middle-aged woman interested in aesthetic improvement for upper eyelids, lower eyelids, lower face, and jaw line. She complains of others commenting on her tired look, despite getting much rest. She demonstrated evidence of deflation of the malar region and mid-cheek, hollowing of the supraorbital rims, prominent tear through, depressed nasolabial fold, atrophic upper and lower lips, and jowling along the jaw line. She is seeking surgical intervention to meet this objective. After extensive consultation she was deemed an appropriate candidate for surgery. Risks, benefits, and alternatives to the procedure were discussed, including but not limited to: bleeding, hematoma, infection, ecchymosis, contour irregularities, fat necrosis, seroma, scarring, resorption of fat, need to repeat procedure, fat embolus, and blindness. The patient was allowed to ask questions throughout this discussion and these were answered to the patient's satisfaction. She was an active participant regarding the choice of procedure, including the planned incisions, donor harvest, and recipient site injections.

Description of the Procedure

The patient was seen in preoperative holding and the medical records, lab values, preoperative photographs, American Society of Plastic Surgeons (ASPS) consent, and patient expectations were reviewed. The procedure, risks as listed above, and benefits were again discussed in detail. Preoperative markings were made with patient awake in the standing position. A fine-tipped marking pen was used to mark out the areas of facial atrophy and volume deflation including the bilateral malar region, supraorbital rim, infraorbital area, nasolabial folds, upper and lower lips, and pre-jowl sulcus. Additionally, excess lipodystrophy in the lower abdomen was marked out for donor fat harvest. These markings were discussed and demonstrated to the patient in a mirror. The planned incisions, location, and approximate size were again confirmed with the patient who understood and agreed with the operative plan.

The patient was then taken to the operating room and placed in the supine position on the operating room table. All bony prominences were appropriately padded and protected. The arms were then tucked. SCDs were applied to both lower extremities and a bair hugger was also placed over the patient. A time-out was then performed, confirming the patient and the surgical procedures to be performed. Uneventful general anesthesia was then established. (*This procedure can be routinely performed under MAC anesthesia*.) Surgical prepping of the face was done using half-strength betadine solution, and full-strength betadine was used to prep the anterior lower abdomen. The patient was draped in the

usual sterile fashion after which a final time-out was performed to confirm the patient and procedure.

First, an #11 scalpel was used to make a 4 mm incision in the lateral groin region 18 cm from midline bilaterally in preparation for donor fat harvest. Next, 200 cc of 0.2% lidocaine with 1:400,000 epinephrine was injected into the subcutaneous and deep tissue plane in the area of the entire lower abdomen. This was injected in a super-wet technique. After allowing 15 min for the infiltration to take effect, a 3 mm diameter (17-gauge lumen) fat harvesting cannula was connected to a 10 cc Luer-Lok syringe under constant negative pressure to begin fat harvest. Aspiration was performed in a wide, evenly distributed, crosshatched, and fanning pattern from multiple directions. A total of 200 cc of fat was aspirated and contained in 10 cc syringes. Red Luer-Lok plugs were placed on each syringe. Bilateral groin incisions were closed with 3-0 Nylon suture.

Next, the fat was processed. Plunger from each syringe was removed, and each syringe was placed in the centrifuge with sterile technique. The fat was centrifuged at 1286 g for 2 min. After the completion of centrifugation, the fat was sterilely prepared as the upper oil layer of each syringe was wicked away with an absorbent Telfa pad. The lower blood layer was drained out of each syringe by removing the red Luer-Lok plug until all of the blood products had drained out. This left a residual middle fat layer in each syringe. The harvested fat was further purified by transferring only the bottom 1–2 cc of the purest concentrated fat ("gold fat") from each 10 cc syringe into 1 cc syringes using an open barrel connector piece.

Attention was made to the areas of the face for revolumization. The proposed areas of fat grafting were injected with 0.5% lidocaine with 1:200,000 epinephrine for vasoconstriction. An #11 scalpel was used to make 2 mm incisions in the lateral malar area, medial and lateral supraorbital rims, apex and base of the nasolabial fold, lateral commissures, and just proximal to the pre-jowl sulcus. Microparticle fat injection was initiated using a blunt 7 cm long 17-gauge lumen cannula attached to the 1 cc Luer-Lok syringe containing the purified fat. Fat globules were injected in less than 0.1 cc aliquots upon withdrawal of 1 cc syringe in a widespread, crosshatched, fanning pattern from multiple incision entry points. In both a supra-periosteal plane and subcutaneous plane, 4 cc of fat was injected into the bilateral malar areas, 3 cc of fat was injected into each supraorbital rim, 2 cc of fat was injected into both tear troughs, 2 cc of fat was injected into each nasolabial fold, 2 cc of fat was injected into the upper lip, 1 cc of fat was injected into the lower lip, and 4 cc of fat was injected into the pre-jowl sulcus bilaterally. Minimal light massage of the fat was performed to correct for irregularities. The stab incisions were closed with a 6-0 Prolene suture.

The patient was awakened uneventfully from anesthesia. She was subsequently placed into an abdominal compression garment. The patient was then transferred to a stretcher and transported to the recovery room awake and in stable condition. The patient tolerated the procedure well and there were no complications. Confirmation was made that all sponge and needle counts were correct.

Suggested Reading

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Cosmetic Neurotoxin Injection

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Indications (FDA Approved)

1. Minimize glabellar rhytids in order to achieve a more youthful look (2002).
2. Minimize lateral canthal lines (a.k.a. "crow's feet") in order to achieve a more youthful look (2013).

Indications (Off-Label Uses)

1. Depressor anguli oris (DAO)
2. Bunny lines
3. Forehead
4. Upper lip
5. Platysmal bands
6. Masseters

Possible Complications

1. Temporary asymmetry in the injected areas, which will eventually dissipate
2. Temporary bruising, possible short-term bleeding
3. Numbness
4. Headaches
5. Temporal asymmetry of the face
6. Blurred or double vision
7. Lid lag caused by paralysis of muscle groups around the eyes

Essential Steps

Glabellar Rhytides

Preoperative Preparation

1. Cosmetic neurotoxin of choice (e.g., Botox) must first be reconstituted with sterile, non-preserved normal saline (NS), injected into the manufacturer-prepared vial of vacuum-dried crystalline material to result in the desired dilution (e.g., usually 2 mL NS, which when added to the 100 unit vial results in a dose of 5 units per 0.1 mL).

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2. The vial is then rotated gently.
3. Date and time of reconstitution are recorded on the vial's label. Administration should be within 24 h from the time the neurotoxin (e.g., Botox) is reconstituted, and the reconstituted neurotoxin should be kept refrigerated (between 2 and 8 °C) if not immediately administered upon reconstitution.

Intraoperative Details

1. Patient positioning varies depending on the doctor's preference, but some prefer the patient to be either sitting comfortably or slightly reclined.
2. Injection sites are prepared with topical cleansing agent of choice (e.g., Betadine).
3. Application of topical anesthetic (*optional*).
4. Target muscles (corrugator supercilii, orbicularis oculi, and procerus muscles) are first palpated while the patient frowns/scowls.
5. Insert the 30-gauge needle into the medial aspect of the corrugator supercilii muscle, slightly superior to the medial canthus, taking care to avoid superficial vessels. Advance the needle superolaterally within the muscle body up to a point 1 cm above the orbital rim and to the lateral aspect of the medial 1/3 of the eyebrow width. Care should also be taken to assure the injection syringe is inserted to desired depth during this positioning and advancement (intramuscular and supraperiosteal).
6. Inject desired volume of neurotoxin (usually 4–6 units) into the corrugator supercilii muscle belly while withdrawing the needle. Repeat on contralateral side.
7. Using the same technique (injection while withdrawing from the muscle), inject desired volume of neurotoxin into the medial orbital portion of the orbicularis oculi muscles bilaterally, with the needle penetrating the muscle body 1 cm superior to the superomedial aspect of the supraorbital ridge and advancing slightly superiorly within the muscle.
8. Using the same technique, inject desired volume of neurotoxin into procerus muscle medially, at a point slightly superior to the horizontal line connecting the patient's medial canthi.
9. In men, using the same technique, inject desired volume of neurotoxin into point along the mid-pupillary line bilaterally, 1 cm superior to the supraorbital rim.
10. Direct gentle pressure and massage are applied to injection sites.

Lateral Canthal Lines (Crow's Feet)

1. Using the same technique described above, inject 3–4 doses of neurotoxin each side (with each dose containing desired volume of neurotoxin) into the lateral portion of the orbicularis oculi muscles. These injections are spaced 0.5–1 cm apart from each other in a vertical line configuration, located 1 cm lateral to the lateral orbital rim. Each dose should contain no more than 2–3 units. Take special care not to place injections too medial.
2. Direct gentle pressure and massage are applied to injection sites.
3. Application of ice pack as needed for patient's comfort.

Postoperative Care

1. The patient lays supine for 2–5 min after the injections.
2. Ice may be placed gently on injected areas to reduce swelling.
3. The patient should avoid lying down for the 2–4 h immediately post-op.
4. The patient should avoid strenuous activity for the few hours immediately post-op to minimize the risk of bruising.
5. The patient should avoid aspirin or NSAIDs after the procedure, if possible, to minimize the risk of bruising.
6. Results of the procedure become evident within the next 1–2 weeks and fade after a few months, so regular follow-up procedures are necessary to maintain same post-procedure appearance.

Operative Dictation

Diagnosis: glabellar rhytids and crow's feet.
Procedure: Botulinum neurotoxin injection to the glabella and lateral canthal regions.

Indication

This is a _____ with wrinkles of the glabella and bilateral canthal areas, who requires botulinum neurotoxin injection. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

The patient had a consultation regarding the use of botulinum toxin Botox, Dysport, or Xeomin. The risks and benefits of the toxin were discussed. We discussed the potential uses for the toxin in this patient either associated with the FDA-approved cosmetic indication for frown lines in the glabellar area or for off-label indications in areas of the face and neck other than the glabella.

The patient was told that botulinum toxin (Botox/Dysport/Xeomin) works by causing temporary weakness of brows and the muscles of the area which are injected and most often is also used off label for non-FDA-approved indications specifically for areas of the face and neck other than the glabella. Effects of the purified botulinum toxin Botox/Dysport/Xeomin begin to appear as early as 24 h but often take up to 7 days or more to be fully effective. The patient was told they can expect some slight swelling and occasional bruising in areas where the injection has been given. The patient was also told that botulinum toxin generally lasted between 3 and 4 months but may have shorter or longer effect of life depending upon an individual's physiology. We discussed the choice of the three different FDA-approved toxins Botox, Dysport, and Xeomin and the fact that these toxins worked in similar ways but were not interchangeable. We discussed that there were differences in effects of the toxin; individuals who have received Botox in the past may not have exactly the same effects with Dysport or Xeomin. The patient was told that after injection they may have some temporary asymmetry in the areas in which they are injected and this will eventually dissipate. The patient also understood the risks and benefits of botulinum toxin treatment which include temporary bruising, possible short-term bleeding, numbness, headaches, temporal asymmetry of the face, possible blurred or double vision, and lid lag caused by paralysis of muscle groups around the eyes. The patient was also told that we cannot guarantee the results nor the duration of action of the botulinum toxin. The patient was told that they need to understand all the risks and benefits before having the procedure. The patient read and signed the consent for treatment and was offered the patient medication guide as required by the FDA. Topical anesthesia may be used for the procedure. The patient was treated with either Botox, Dysport, or Xeomin as outlined in the flow sheet in the chart.

After the informed consent was verified, the patient was seated comfortably. Injection sites were prepped with antiseptic cleansing solution, and topical anesthetic agent was applied.

Attention was first directed at treating the glabellar rhytids. Palpating the target muscles (corrugator supercilii, orbicularis oculi, and procerus muscles) was confirmed by asking the patient to frown, a syringe was preloaded with the prepared dilution of Botox, and a sterile 30 g needle was inserted into the medial aspect of the corrugator supercilii muscle, slightly superior to the medial canthus, taking care to avoid superficial vessels. The needle was advanced superolaterally within the muscle body to a point 1 cm above the orbital rim and to the lateral aspect of the medial one third of the eyebrow width, taking care to keep the needle intramuscular and supraperiosteal. Four to six units of Botox were injected into the corrugator supercilii muscle belly while withdrawing the needle. This was repeated on the contralateral side.

Using the same technique (injection while withdrawing from the muscle), 4–6 units of Botox were then injected into the procerus

muscle medially, at a point slightly superior to the horizontal line connecting the patient's medial canthi.

Attention was addressed to the bilateral crow's feet. Using the same technique described above, 3–4 doses per side of 2–3 units each of Botox were injected into the lateral portion of the orbicularis oculi muscles. The injections were spaced 0.5–1.0 cm apart from each other in a vertical line, 1.0 cm lateral to the lateral orbital rim. Direct gentle pressure and massage was then applied to all injection sites. Ice packs were also applied as needed for patient's comfort.

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Dermal Fillers

11

Ajani G. Nugent, Mark S. Nestor,
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Indications

1. Nasolabial folds
2. Tear troughs
3. Upper lip augmentation and enhancement
4. Temples
5. Midface
6. Marionette lines
7. Prejowl Sulcus
8. Jawline
9. Glabellar lines

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Essential Steps

Preoperative Markings

No markings were made in this case. Physician may want to identify injection sites with nonpermanent marker while patient is fully upright to ensure effects of gravity are taken into account. However, this is not necessary.

Intraoperative Details

1. Patient is seated upright.
2. Method of anesthesia should be discussed, but is not necessary. Topical anesthetic may be applied in the specified area of injection. A cooling device may also be used immediately prior to injection to reduce risk of bruising. When necessary, patient may opt to receive local anesthetic injections, which can also be done intraorally.
3. Filler material of choice injected into appropriate plane as indicated to efface appropriate rhytids.

Postoperative Care

Immediately place ice onto injected areas to reduce swelling.

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Possible Complications

1. Swelling.
2. Bruising and pinpoint bleeding.
3. Skin irregularity and unevenness of the filler, which may last for numerous weeks or months.
4. Infection.
5. Numbness, irritation, and tenderness in the area of the injection.
6. Filler can either compress or fill a blood vessel leading to sloughing of the skin in a specific area. In extremely rare cases, this can lead to blindness.
7. Inflammatory and as granulomatous nodules.

Operative Dictation

Diagnosis: Facial deflation
Procedure: Filler injection to nasolabial folds, tear troughs, and lips

Indication

This is a _____ with deepened nasolabial folds, tear trough deformity, and lip deflation, who requires volume replacement with filler injection. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

The patient had a consultation regarding folds, lines, wrinkles, volume replacement, or enhancements of areas such as lips. Multiple treatment options were outlined to the patient including the use of lasers both ablative and non-ablative, the use of Botox in certain areas, as well as the use of filler substances. The patient was counseled that a number of filler substances are FDA approved including Perlane, Juvederm, Restylane, Restylane Silk, Voluma, and Belotero. Perlane, Juvederm, Restylane, and Belotero are hyaluronic acid substances, which are produced from bacteria. Depending on the needs of the patient, the use of a specific filler or combination of fillers was recommended. The patient understood that the duration of improvement can range from 2 to 3 months up to over 1 year depending upon the filler substance, location of injection, as well as their reaction to them. The patient understood the risks and benefits including allergic reaction, swelling, bruising, pinpoint bleeding, and some unevenness of any of the filler substances. These substances required no skin testing although there is a small chance that a reaction can develop. With all filler substances in addition to allergic reaction, the patient was told the complications include swelling, bruising, pinpoint bleeding, as well as skin irregularity and unevenness of the filler, which may last for numerous weeks or months. There was a low but possible incidence of infection which could cause long-term chronic abscess formation. There was a possibility of numbness, irritation, and tenderness in the area of the injection. There was a very rare occurrence whereby the filler can either compress or fill a blood vessel leading to sloughing of the skin in a specific area and in extremely rare cases can lead to blindness. Finally, there were rare and unusual reactions and risks associated with the use of filler substances which included skin infection and inflammatory as well as granulomatous nodules.

The patient understood that satisfactory correction of wrinkles or deficits in volume may not be achieved and that whatever correction they had was not permanent and would diminish over time and required additional treatment. She understood that I have made no representations as to the final outcome of the procedure and could not guarantee their satisfaction with the procedure. The patient understood all of this, signed a full consent regarding the treatment of these filler substances. Topical anesthesia and/or cooling were used for the procedure. The actual amount and type of filler as well as the injection location was outlined on the flow sheet.

After the informed consent was verified, the patient was seated upright. Topical anesthetic ointment was applied to the lip and nasolabial folds, avoiding the tear trough area. Three 1.0 mL sterile syringe preparations of Radiesse© were

set aside for facial injection with 26-gauge, 1¼ in. needle for nasolabial folds. Two 1.0 mL sterile syringe 20 mg/mL Restylane© preparations were set aside for lip and lower eyelid injections with a 30-gauge, ½ in. needle.

The left nasolabial fold was injected first. Radiesse© was deposited in the subdermal plane for optimal structural support. Injection began at the lowest point of the fold, using a linear threading and fanning technique in a V-shaped manner up the nasolabial fold. *Cross-hatching with transverse threads may help flatten the skin of the upper part of the fold*. The same was done in symmetric fashion on the right side. A total of 1.0 mL of calcium hydroxyapatite was deposited on each side.

The tear trough injections were then performed using the hyaluronic acid serial puncture technique. On the left side, Restylane© was injected perpendicular to the skin just under the orbital rim deep to the orbicularis oculi muscle, in a medial to lateral serial fashion. Depth of injection was calibrated by hitting the bone first, then the needle was withdrawn slowly as hyaluronic acid was deposited in retrograde fashion. The first injection was administered 0.5 cm below the medial canthus, the second in line with the pupil, and the third 0.6 cm medial of the lateral canthus all in plane of rim. Injected area was immediately massaged. *May inject 3–5 times to create the column-shaped deposits along the rim*. 0.1–0.2 mL of hyaluronic acid was injected with each pass for a total of about 0.6 mL per eye. The right tear trough was then injected in a symmetric fashion and massaged. *Some physicians may opt to use a parallel thread approach or a fanning technique to treat tear troughs*.

After careful evaluation of the patient's natural lip contour, it was decided that injection be done along the vermilion border using a linear threading antegrade injection technique. Using a 1.0 mL sterile syringe preparation, the hyaluronic acid was injected into the middle dermis as a continuous, linear deposit, while the needle followed the intended path. Filler injection stopped right before the needle was removed from the skin. The left side was done first beginning on the lateral end and moving medial, followed by the right side. Care was taken not to overcorrect, and a total volume of 0.8 mL was used. Judicious use of lip massage immediately followed injection. *Other technique options include retrograde linear threading and serial puncture techniques. Combinations of techniques and location variations may be used depending on physician's assessment of patient*.

Note These Variations

A number of filler substances are FDA approved including Perlane, *Juvederm*, *Restylane*, *Restylane Silk*, *Voluma*, *Radiesse*, *and Belotero. Perlane*, *Juvederm*, *Restylane*, *and Belotero are hyaluronic acid substances. Most of the fillers come premixed with lidocaine. Approximately 0.05 mL of 2 % lidocaine can be added to those that are not premixed by using a fluid-dispensing connector*.

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Chemical Peel with Croton Oil

12

Fadl Chahine and Salim C. Saba

Introduction

Chemical peels for skin rejuvenation preceded laser skin resurfacing. Various kinds of chemical peels are available. They reach various levels of skin depth from the epidermis to reticular dermis. The Baker-Gordon phenol peel, the gold standard since the early 1960s, provided the deepest and most extensive treatments with dramatic results [1]. A "waxy" appearance and hypopigmentation after chemical peel may render these side effects "undesirable." Fractional CO_2 laser resurfacing has now become, in our opinion, the new standard of care for skin resurfacing. However, the cost of the laser delivery unit makes it financially burdensome on small cosmetic practices. Laser resurfacing is also associated with problems such as prolonged recovery from erythema and problematic long-term hypopigmentation.

Hetter's thoughtful analysis of the Baker-Gordon peel convincingly demonstrated that it was the croton oil that was the effective peeling ingredient [2, 3]. By changing its concentration, Hetter showed that the peel depth could be controlled depending on skin thickness. In the old Baker-Gordon formula, 2.1 % croton oil was used, and it resulted in dramatic results. Nevertheless, it was also associated with hypopigmentation. Reducing the concentration to 0.1 %, for instance, allowed for predictable peeling of the eyelids without the resultant ectropion that would result from the older, higher concentration, formulation.

As a cost-effective alternative to laser modalities, croton oil peel has given the plastic surgeon a safe, predictable, and reproducible treatment of skin dyschromia and mild-moderate rhytids. Chemical peeling should be performed under the technical control and responsibility of a physician with an understanding of the structure and physiology of the skin and wound healing. With the availability of other formulations that result in a relatively lower degree of peeling, the ultimate judgment regarding the appropriateness of any specific treatment must be made by the physician in light of all standard therapeutic protocols which are appropriate for the individual patient (Table 12.1).

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Table 12.1 Various peels according to depth of skin penetration

	Superficial peels	Medium-depth peels	Deep peels
Effective treatment depth	Epidermis	Papillary dermis to upper reticular dermis	Mid-reticular dermis
Peels	Alpha-hydroxy acids, Jessner's solution, salicylic acid	Trichloroacetic acid	Phenol-croton oil (Baker-Gordon, Hetter's formula), trichloroacetic acid (>40 %)

Indications

1. Facial rejuvenation
2. Photoaging of the skin and dyschromia
3. Mild to moderate rhytids (wrinkles)
4. Post-rhytidectomy homogenization of skin texture
5. Acne vulgaris

Contraindications

1. Noncompliant patients, especially with regard to sun exposure
2. Pregnancy/breastfeeding
3. A history of hypertrophic scars or keloid
4. Inflammatory dermatoses (e.g., psoriasis, pemphigus, atopic dermatitis, etc.)
5. Isotretinoin use within 12 months of peeling (prolongs epithelialization and increases risk of scarring)
6. Kidney or liver dysfunction
7. Active bacterial, fungal, viral, or herpetic infection

Possible Complications

1. Scarring
2. Infections
   (a) Bacterial
   (b) Viral (e.g., herpes simplex)
   (c) Fungal
3. Allergic reactions
4. Pigmentary changes
   (a) Hyperpigmentation usually resolves
   (b) Hypopigmentation can be permanent
5. Prolonged erythema

Essential Steps

Preoperative [4]

1. Standardized pre- and post-peel facial photographs are crucial.
2. Patient education is the key.
   (a) Effectiveness of treatment depends on skin type.
   (b) Post-peel effects may be alarming if patient is not informed.
   (c) Consider allowing patients interested in peeling to speak with a patient who has already undergone a comparable treatment successfully.
   (d) Post-peel sun avoidance to avoid prolonged erythema and hyperpigmentation.
3. Pre-peel skin preparation is crucial to ensure evenness of penetration and minimize erythema and post-peel hyperpigmentation.
   (a) Treatment commences in a 4–6-week pre-peel facial regimen of tretinoin 0.1 %, hydroquinone 4 %, and glycolic acid.
   (b) Tretinoin, applied daily, allows rapid skin turnover, thus reducing time to reepithelialization post-peel.
   (c) Hydroquinone, placed twice daily, suppresses melanocytes, thus minimizing post-peel hyperpigmentation.
   (d) Eight percent glycolic (or 2 % phytic) acid provides exfoliation which results in better overall depth penetration by the peeling agent.
4. The pre-peel skin preparation is stopped about 1 week prior to peeling to avoid prolonged post-peel erythema.
5. Administer valacyclovir 500 mg twice daily starting 3 days prior to and continuing for 1 week after treatment in patients at risk.

Intraoperative Details

1. Hetter's phenol-croton oil solution is used and can be easily prepared to vary the concentration of the croton oil (see below).
2. Weaker concentrations of croton oil (i.e., 0.1 and 0.05 %) can be prepared by diluting a standard 0.4 and 0.2 % with water and phenol stock solution, respectively.
3. The solution may be caustic so IV sedation or general anesthesia is necessary.
4. Standard nerve blocks to the face.
5. Intraoperative administration of intramuscular ketorolac tromethamine.
6. Extreme care is exercised around the eyes.
7. Cardiac monitoring is mandatory (phenol toxicity may result in dysrhythmia and pulmonary edema).
8. IV hydration.
9. Meticulous degreasing of the skin is performed using oil-free acetone-soaked gauze sponges.
10. A solution-dampened gauze is used to apply solution over the face. A cotton tip may be used to apply solution on the lower eyelids.
11. The number of coats applied is additive, and the dampness of the gauze is directly related to depth of peel.
12. End point depends on the desired depth:
    (a) Thin white frost with pinkish background denotes peeling to the level of the papillary dermis.
    (b) Uniform white frost denotes peeling to the superficial to mid-reticular dermis.
    (c) Reddish-brown hue of the skin denotes peeling to the level of the mid-reticular dermis.
13. Epidermal sliding denotes peeling just beyond the epidermis.
14. Croton oil concentration varies depending on thickness of the region treated. Some general guidelines are as follows:
    (a) Perioral region—0.8 %
    (b) Forehead and temples—0.2–0.4 %
    (c) Cheeks—0.2–0.4 %
    (d) Eyelids—0.1 % (0.05 % for upper eyelids)
    (e) Neck—0.1 % (done mainly for blending)
    (f) Deep rhytids in any region—0.4–0.8 % (Table 12.2)

Postoperative Care

1. Wait for frosting to subside and then apply a mixture of Polysporin (Pfizer, New York, NY) and lidocaine jelly.
2. Post-peel discomfort is ameliorated with a regimen of ibuprofen 800 mg three times daily, Medrol Dosepak (Mova Pharmaceutical, Manati, PR) started the day after, and a sleep aid.
3. Polysporin-lidocaine gel is continued until epithelialization is complete (7–14 days).
4. Peeling and serous oozing from the face are to be expected. The patient is cautioned to avoid picking crusts lest scarring takes place.
5. Postoperative erythema may last several months and can be mitigated with topical steroids.

Table 12.2 Standard Hetter's solution formulations based on composition

Croton oil concentrations					
	0.2 %	0.4 %	0.8 %	1.2 %	1.6 %
Water	5.5 mL	5.5 mL	5.5 mL	5.5 mL	5.5 mL
Septisol	0.5 mL	0.5 mL	0.5 mL	0.5 mL	0.5 mL
USP phenol 88 %	3.5 mL	3.0 mL	2.0 mL	1.0 mL	0.0 mL
Phenol-croton oil stock solution[a]	0.5 mL	1.0 mL	2.0 mL	3.0 mL	4.0 mL
Total volume (mL)	10	10	10	10	10

[a]Stock solution—24 mL phenol and 1 mL croton oil, i.e., 4 % croton oil

Operative Dictation

Diagnosis: Photoaging and moderate facial rhytids
Procedure: Chemical peel with croton oil

Indication

This is a _____ with photo-damaged skin, who requires chemical facial peeling. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. IV hydration was initiated along with cardiac monitoring. Time-out among operating room staff was taken. Monitored anesthetic care was instituted. Supraorbital, infraorbital, and mental nerve blocks were given using a mixture of lidocaine-bupivacaine solution.

Meticulous degreasing of the skin was performed using oil-free acetone-soaked gauze sponges. Using Hetter's solution-moistened gauze, region-specific concentrations of croton oil were applied appropriately to the various regions of the face until a solid white frost was seen. Notable exceptions included the upper and lower eyelids and the neck, where a pinkish white frost was the end point. Deep rhytids in the lip, perioral, and glabellar regions were specifically treated with a more concentrated solution utilizing a cotton tip. Upon clearance of the frost, an amalgam of Polysporin-lidocaine jelly was applied to the face. Patient tolerated the procedure with no complications.

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Microdermabrasion

13

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Introduction

Microdermabrasion (MDA) is a safe, effective, and noninvasive skin rejuvenation tool that acts by mechanical exfoliation of the stratum corneum [1–4]. Regeneration of this layer results in a more evenly textured skin surface [1–4]. The basic unit is a dual-channel handpiece that blows micro-sized, sharp crystals (e.g., aluminum oxide, magnesium oxide, sodium chloride, etc.) onto the skin surface for superficial abrasion. In this closed-loop system, a second channel suctions the crystal particles along with skin debris [3]. Several histological and molecular studies have confirmed a net overall thickening of the epidermal and dermal layers with increased alignment of collagen fibers in the latter attributed to the suction [1, 2, 4].

Two types of microdermabrasion systems exist: crystal MDA and crystal-free MDA (diamond or bristle tip). Each possesses its advantages and limitations. Crystal MDA has higher efficacy due to its ability for deeper penetration into the epidermis, higher sterility, and bactericidal effect of the aluminum oxide crystals. Crystal-free MDAs that often utilize a diamond brush demonstrate shorter procedure times, lower maintenance cost, and less pain. They are often utilized in thin and sensitive type of skin [4].

MDA is recommended for use in the face, neck, décolleté, shoulders, back, hands, knees, and elbows. Indications for MDA include, but are not limited to, treatment of fine rhytids, acne scars, stretch marks, enlarged pores, and dyschromia [1–4]. Although safe, great care must be taken in patients who have used retinoid within 6 months of the procedure as irritation and redness posttreatment is a risk [4].

Indications

1. Skin texture irregularities of the face, i.e., fine rhytids, acne scars, and enlarged pores
2. Dyschromia and photoaging
3. Adjunctive prior to chemical peels to enhance trans-epidermal absorption

Contraindications

1. Active herpetic lesions
2. Use of retinoid within 6 months of treatment

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3. Patients with lupus erythematosus or other autoimmune diseases
4. Patients with active acne
5. Oral anticoagulants or antiplatelet therapy
6. Vitiligo

Possible Complications

1. Mild pain and erythema are the most common.
2. Pressure-induced urticaria is a common minor side effect.
3. Minor abrasion or bleeding if excessive pressure is applied with the handpiece or if the suction setting is greater than 50 mmHg.
4. Corneal irritation/abrasion is a major, but uncommon complication (especially in crystal-based systems).
5. Transient petechiae in patients with thin, photodamaged skin, or those taking antiplatelet agents.
6. Reactivation of latent herpes simplex virus.
7. Post-inflammatory hyperpigmentation.

Essential Steps

Preoperative Markings

1. Mark the areas to be treated with the patient in the upright position.
2. Identify and mark the areas of thin skin (i.e., eyelids and lips) where decreased suction and crystal outflow pressures are required.

Intraoperative Details

1. Although anesthesia is not required, mild sedation or regional block may be used.
2. The patient is placed in supine position.
3. In males, facial hair should be shaved.
4. Cleanse areas to be treated with a sterilizing agent.
5. Moist gauze pads or corneal protectors are applied for eye protection.
6. Suction level and crystal pressure settings are determined by testing outside the treatment zone, i.e., forearm or abdomen skin.
7. Grasp the handpiece in the dominant hand and flatten the target area with the free hand.
8. Apply the handpiece on the skin, performing multiple (usually between five and seven) passes until reaching clinical endpoint—appearance of mild erythema. Note that suction pulls the skin into the handpiece. It is not necessary to apply pressure.
9. Maximize crystal outflow pressures up to 60 mmHg to reach areas with thicker skin (i.e., back, knees, elbows, etc.) for better results. Likewise, suction or crystal outflow is reduced over delicate areas of the face (i.e., eyelids and lips).
10. Upon completion of the procedure, wipe away residual crystals with soap and warm water followed by cold gauze.

Postoperative Care

1. Pain control.
2. Daily application of skin moisturizers and sunscreen to the treated areas in between treatment sessions.
3. Avoidance of alpha-hydroxy acids and benzoyl peroxides for at least 3 days post procedure.
4. Avoidance of sun exposure for 2 weeks post procedure.
5. Administration of oral HSV1 prophylaxis for 3 days post procedure.
6. Treatment sessions may be repeated weekly for 2 months or until clinically satisfactory improvement is seen. On average, people require 4–12 treatments to notice improvement. Monthly treatments may be continued indefinitely to maintain results.

Operative Note

Diagnosis: Fine rhytids, acne scars, striae distensae, enlarged pores, and/or dyschromia

Procedure: Microdermabrasion

Indication

This is _____ with significant (facial fine rhytids, acne scars, striae distensae, enlarged pores, and/or dyschromia) who desires an improvement of his/her facial skin condition. Microdermabrasion will be performed. Patient understands the benefits and risks associated with the procedure and wishes to proceed.

Description of the Procedure

Following a proper time out to identify patient and procedure, the patient was placed in the supine position. Nerve block/local anesthesia was instituted for selective oversensitive/anxious patients. Preoperative markings were made with the patient in the upright position. Prepping of the area of treatment was done with a sterilizing agent. The patient was draped in standard sterile fashion. Moist gauzes were applied over the eyes to prevent injury. Determination of crystal outflow pressure and vacuum level was done by testing on the forearm. The handpiece was grasped with the dominant hand, and the area to be treated was stretched in order to avoid excessive suction, abrasion, or bleeding. The handpiece was then applied on the treated skin. Multiple passes were performed according to the operator's preference in a grid-like fashion. Five to seven passes were made until a clinical endpoint of mild erythema was reached. Where the face was subject to microdermabrasion, it was approached in aesthetic subunits. Passes were performed sequentially addressing the same subunit on each side of the face before addressing a different subunit. Where skin was thicker or where textural irregularity was increased, higher crystal outflow pressures (60 mmHg) to reach the papillary dermis were used. Likewise, pressure was reduced over areas of thin skin such as the lips or the eyelids. Upon completion, residual crystals were wiped away from the eyes using moist gauze soaked with soap and warm water. Gauze soaked in cold saline was applied as needed to areas with erythema and/or pain.

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Fractional CO_2 Laser Skin Resurfacing

14

Fadl Chahine and Salim C. Saba

Introduction

Within the last couple of decades, we have witnessed a growing interest in self-improvement and healthier lifestyles. While society's demand for plastic surgery is at an all-time high, nonsurgical rejuvenation procedures (e.g., botulinum toxin and laser skin rejuvenation) have eclipsed surgery in terms of absolute numbers over the last decade.

From the first ruby laser introduced in 1960 to the continuous-wave carbon dioxide (CO_2) laser in 1964, lasers have continued to evolve in the last five decades to include a variety of delivery systems, each with their distinctive energy characteristics and clinical indications [1].

Most commonly used laser systems for skin rejuvenation include CO_2 (10,600 nm), erbium/yttrium-aluminum-garnet (Er:YAG, 2940 nm), fractional (Fraxel™ with CO_2 [10,600 nm], erbium [1550 nm], or thulium [1927 nm]), and combined Er:YAG/CO_2. All these lasers target water as their chromophore and operate on the principle of selective photothermolysis to minimize collateral tissue damage.

Continuous-wave ablative CO_2 laser has been traditionally used for skin rejuvenation. With its ability for tissue ablation and dermal coagulation, it provides for excellent resurfacing. However, posttreatment drawbacks from erythema, edema, scarring, and hyperpigmentation are also more prevalent. New non-ablative lasers such as the Er:YAG have been associated with less scarring and shorter recovery periods. However, they are less potent at treating deep rhytids [2].

One of the most effective and commonly used modalities is ablative fractional resurfacing (AFR), i.e., Fraxel™, with CO_2. For each square centimeter of a treated area, AFR using the Fraxel Repair laser (Solta Medical, Hayward, California) delivers hundreds of microthermal zones (MTZs) with a diameter of 135 μm and penetration depths of up to 1.6 mm, interspersed with untreated zones. This combines the potency of ablative treatments with the safety profile of the non-ablative lasers. It allows for quicker re-epithelialization and recovery times. It also stimulates an increase in collagen and elastin production in the dermis with regenerative skin effects that can be seen for up to 3 months following treatment. In this chapter, we will discuss skin resurfacing using the Fraxel Repair laser system.

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Indications

1. Photoaging
   (a) Facial rhytids
   (b) Mild skin laxity
   (c) Dyschromia (use pigmented handpiece with larger spot size [600 μm] and lower energy fluence)
2. Scarring
   (a) Atrophic acne scars
   (b) Hypertrophic scars
3. Rhinophyma
4. Actinic keratosis

Contraindications

1. Absolute
   (a) Active infection in the area (bacterial, viral, fungal).
   (b) Oral isotretinoin used within the past 6 months may result in delayed healing.
2. Relative
   (a) Collagen vascular diseases
   (b) Previous scarring after cutaneous laser resurfacing
   (c) Immunosuppression
   (d) History of keloid or hypertrophic scar formation
   (e) Previous radiation therapy
   (f) Other autoimmune cutaneous diseases (vitiligo, psoriasis)
   (g) Gold therapy

Possible Complications

1. Erythema (expected side effect in almost all patients)
2. Edema
3. Milia (occlusive posttreatment ointments)
4. Permanent hypopigmentation (occurring in up to 57 % of patients [3] and resulting from decreased melanogenesis; not reported in the Fraxel Repair system)
5. Posttreatment herpetic infection
6. Bacterial folliculitis superinfection

Essential Steps

Preoperative

1. Note the patient's Fitzpatrick skin type (lighter skin types associated with prolonged posttreatment erythema; for darker skin types, consider non-ablative laser modalities to reduce long-term hypopigmentation).
2. Prophylactic antibiotic (cephalosporin) and antiviral therapy 24 h prior to start of treatment and continue for 7 days posttreatment.
3. May be done under local (topical and/or nerve blocks), local with sedation, or general anesthesia depending on patient and physician preference.
4. Topical anesthesia (EMLA or compound mixture of 7 % lidocaine and 7 % tetracaine) applied to treatment area for 1 h prior to initiation.
5. Protective metallic eye shields coated with antibiotic ophthalmic ointment for the patient; protective eyewear for the operator and assistant(s) to avoid retinal injury.
6. Energy fluence of 20–70 mJ may be used (note: consider reducing fluence by 50 % around the chest, neck, and lower eyelids, especially if there is history of previous blepharoplasty as temporary ectropion may occur).
7. Coverage densities of 30–50 % (note: may be increased to 60–70 % in areas of excessive laxity).

Intraoperative Details

1. Protective eye gear for patient and operator/staff.
2. Treat cosmetic units of the face sequentially, i.e., cheeks, nose, lips, chin, temples, forehead, and eyelids.
3. Reduce energy fluence and spot size around the lips and lower eyelids.
4. Deliver treatment in linear parallel rows and avoid overlapping.
5. A second pass can be performed with linear rows perpendicular to the first pass and delivered in the same fashion (avoid up-and-down pattern when laying down adjacent rows as it can result in bulk heating and potential scarring posttreatment).

6. Treatments in excess of three passes may apply to conditions such as rhinophyma with the end point being the papillary dermis (marked by dense punctate bleeding).

Postoperative Care

1. Apply gauze soaked in ice-cold water to the treated area immediately upon completion of treatment.
2. Apply Aquaphor ointment to treated area followed by a sterile protective mask which may be removed when the patient reaches home.
3. Soak treated area with water four times daily and maintain moisture with Aquaphor ointment until all crusting had resolved (usually occurs with complete re-epithelialization at 3–6 days).
4. May switch to non-greasy moisturizer when crusting is resolved so as not to cause miliary eruption.
5. Crusting is followed by erythema which may persist for up to 3–4 weeks and can be concealed by makeup.
6. Sun avoidance for at least 3 weeks to minimize the risk of posttreatment hyperpigmentation.
7. Follow up at 2 days, 1 week, and 1 month posttreatment.
8. Treatment may be repeated at 6–12 weeks as needed until desired results are seen.

Operative Dictation

Diagnosis: Facial photoaging and skin laxity
Procedure: Skin resurfacing with fractional CO_2 laser

Indication

This is _____ with photo-damaged skin, who is amenable to AFR and rejuvenation with a fractional CO_2 laser. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

Care was taken to label all the entrances to the operating room with appropriate signage warning potential incomers of laser usage. Protective eyewear was worn by all staff present in the room. After informed consent was verified, the patient was placed in supine position, and monitored anesthetic care consisting of a local supraorbital, infraorbital, and mental nerve blocks along with administration of an intravenous sedative was administered. Metallic eye shields coated with antibiotic ophthalmic ointment were placed in the patient's eyes for corneal protection. Time out among operating room staff was taken.

Fraxel Repair laser with CO_2 was set at a fluency of 40 mJ and a coverage density of 40 %. Treatment began in zones starting with the cheeks and running the handpiece in horizontal, parallel, non-overlapping rows until the entire cosmetic unit was covered. This was then followed by a second pass with rows oriented perpendicularly and in the same fashion to the previously applied rows. The handpiece was designed to modify the rate at which MTZs were produced on the skin depending on the operator's hand speed. Toward the marginal zones of the face, the handpiece was allowed to pass more quickly to allow for fewer MTZs and blending between treatment and nontreatment zones. Over the eyelids, the setting was reduced to 20 mJ with a coverage density of 30 %. Perpendicularly oriented rows were applied in the same fashion as described for the other cosmetic units. Note that forced cold air was applied in tandem over the treated areas for increased patient comfort.

Upon completion, the eye shields were removed, and gauze soaked in ice-cold water were applied to the face. Pressure was applied over areas of punctate bleeding until satisfactory hemostasis was achieved. Aquaphor was applied to the face after cleaning, followed by a sterile face mask.

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Alloplastic Augmentation of the Chin

15

Arij El Khatib and Salim C. Saba

Indications

1. Desire to provide greater projection to the mentum in patients with otherwise normal occlusion.
2. Complementary to rhinoplasty in patients with under-protruded chins.

Contraindications

1. Micrognathia associated with occlusal abnormalities
2. Body dysmorphic disorder

Possible Complications

1. Infection
2. Implant extrusion
3. Damage to the mental nerves if intraoral technique is used
4. Implant malposition
5. Implant migration

Essential Steps

Preoperative Markings

With the patient in a sitting position looking straight ahead, chin implants of various sizes are used to assess the optimal size. This is based partly on anthropometric data of Farkas and partly on the patient's preference [1]. As a rule of thumb, in an otherwise anthropometrically balanced male, the mentum should protrude approximately 1–2 mm beyond the border of the upper lip. In females, the mentum should be set back 1–2 mm in relation to the upper lip [2].

Intraoperative Details

1. The patient is positioned supine with a shoulder bump to allow for slight hyperextension of the neck.
2. May be done under local anesthesia with IV sedation or general anesthesia. General anesthesia with nasotracheal intubation is preferable as it allows for an unobstructed and unaltered view of the surgical field.

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3. Infiltration of the operative field with a 1:200,000 epinephrine solution helps with hemostasis.
4. A throat pack is placed.
5. When additional augmentation of the mandibular body and/or ramus is needed, an intraoral mucosal incision is made on the labial side about 1 cm away from the sulcus for exposure.
6. A submental incision is made to expose the anterior border of the mandible (chin), and subperiosteal dissection is carried on the inferior and posterior surfaces of the mandible.
7. Mental nerves are visualized and protected.
8. Often associated with deficient mandibles, vertical chin height deficiency is addressed first with a horizontal chin osteotomy. Downward positioning is adjusted so that the distance from the mouth opening to the inferior-most edge of the chin is about twice that of the distance from the mouth opening to the base of the nose [1].
9. Patients with mandibular deficiency associated with a long face require vertical shortening of the chin. Up to 7 mm of shortening can be done with a burr. Exceeding 7 mm risks detaching the anterior belly of the digastric which then results in submental fullness. In cases where vertical shortening in excess of 7 mm is required, a horizontal segment is removed above the inferior edge of the mandible [3].
10. Most alloplastic implants of the chin are made of silicone rubber or porous polyethylene. Choice should be based on surgeon comfort and familiarity with a specific implant material.
11. Rigid screw fixation of the implant to the underlying bone is crucial to prevent migration or infection associated with movement.

Postoperative Care

1. Pain control
2. Same-day discharge in most stable patients
3. Patient given instructions on signs and symptoms of wound complications/infection
4. Soft diet and regular mouth washing when intraoral technique is utilized

Operative Dictation

Diagnosis: Microgenia or under-projected chin
Procedure: Alloplastic augmentation of the chin

Indication

This is a male/female patient with under projection of the mentum, who desires augmentation for aesthetic considerations. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time out among operating room staffs was completed. The patient was placed under general anesthesia, and the face was prepped and draped in the usual standard surgical manner.

Submental Technique

A 15 blade was used to make a 3–4 cm submental incision through the skin and subcutaneous tissue exposing the periosteum of the mentum. An incision in the periosteum was created with the 15 blade. A periosteal elevator was used to elevate the periosteum from the mentum, creating a subperiosteal pocket matching the dimensions of the implant. Irrigation and hemostasis were performed. Appropriate-sized implant was then inserted into the pocket and fixed with titanium screws. Deep dermal sutures using 4-0 Monocryl were taken. The skin was closed using 5-0 Monocryl sutures. Steri-strip was applied to the submental incision.

Intraoral Technique

One percent lidocaine with epinephrine (1:100,000) was infiltrated into the lower gingiva, about 0.5–1 cm proximal to the buccal sulcus in the midline. A 2 cm transverse incision was then made in the oral mucosa. Dissection continued caudally taking care not to injure the mental nerves which emerged from the mental foramina locating midway along the lower mandibular height between the two premolars. The mentalis muscle was exposed and dissected along its fibers without stripping it off the mandibular bone, to provide exposure of the mentum. Incision was made in the periosteum, and a subperiosteal pocket was dissected along the inferior border of the mandible and extending toward the ramus. The implant was placed and fixed using titanium screws to allow for precise abutment to the underlying bone. Hemostasis and irrigation were performed. The mentalis muscle was repaired along the dissection plane using 3-0 Vicryl sutures, and the buccal mucosa was sutured using 4-0 Vicryl sutures.

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Hair Restoration Surgery: Follicular Unit Grafting

16

Joe Baroud and Salim C. Saba

Introduction

For adults, a full head of hair, at any age, confers a picture of health, vigor, and vitality. Therefore, alopecia in both men and women may have profound effects on self-esteem and overall well-being. Male pattern androgenic alopecia (MAGA) as well as female pattern hair loss (FPHL) is polygenic. While the latter is less understood, the former is usually the result of testosterone-dependent structural miniaturization of the hair follicle secondary to a reduction in the volume of dermal papillae [1, 2]. This is the end result of prolongation of the telogen-anagen phase ratio of the hair growth cycle.

The male scalp consists of several sections: frontal, mid-scalp, vertex, and temporal. Medical treatment with minoxidil (Rogaine; McNeil-PPC, Inc., Morris Plains, New Jersey) and 5-α-reductase type 2 inhibitors such as finasteride (Propecia; Merck & Co., Inc., Whitehouse Station, New Jersey) is far more commonly used by younger men in the early stages of hair loss [3, 4]. For older men and those with more profound hair loss as characterized by Norwood, follicular unit hair transplantation (FUT) offers very good results. Female pattern hair loss, normally characterized by maintenance of the frontal hairline with central thinning, is characterized by Ludwig [5]. Exceptions to these patterns exist for both men and women.

Recent advances in microvascular surgical instrumentation have resulted in greatly improved outcomes in the treatment of MAGA and FPHL. The ability to extract single follicular units (FUs), containing between one and four hairs, either via follicular unit extraction (FUE) or strip excision (SE), has allowed for more seamless transition points between areas of hair loss and unaffected areas. While FUE is gaining in popularity, many surgeons are still utilizing SE which will be discussed in more detail in this chapter [6].

The art of hair restoration is dependent on several other variables that include recipient site creation, graft size, packing density, and medical hair loss treatment. The future of hair restoration surgery is ever evolving and is moving toward minimal incision surgery and cell-based therapies. Discussion of these developments however is beyond the scope of this chapter.

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Indications

1. Male pattern androgenic alopecia (MAGA)
2. Scars from previous surgery
3. Burn reconstruction
4. Radiation injury
5. Congenital deformities

Contraindications

1. Diffuse or female pattern hair loss (FPHL) (relative contraindication)
2. Hair loss due to hormonal or metabolic imbalance
3. Conditions that mimic FPHL, e.g., frontal fibrosing alopecia, telogen effluvium (acute and chronic), alopecia areata, etc.

Possible Complications

Medical or surgical complications from hair transplant procedures are rare. The extensive vascular supply of the scalp results in rapid wound healing and low infection risk:

1. Excessive swelling (~5 %).
2. Postoperative bleeding (<0.5 %).
3. Folliculitis, temporary headache, temporary pruritus, and numbness of the scalp.
4. Permanent numbness in the donor or recipient sites, abnormal scarring around the grafts, and poor growth of hair grafts.
5. Hypertrophic or wide donor site scar if under tension.
6. Setting a low anterior hairline.
7. Hair grafts may appear unnatural in a frontal line if very coarse.
8. Transplanting the vertex area may eventually result in a "halo head" pattern if the posterior and lateral border hair continues to thin out.
9. A low frontal hairline may overtime turn into a "monk's head" look if the patient has only one procedure or runs out of donor hair prematurely.
10. Multi-bladed knives may cause significant follicular injury and decrease survival.

Essential Steps

Preoperative

1. Need for thorough patient education during the preoperative consultation to appropriately manage expectations:
   (a) Hair loss is progressive in the majority of men.
   (b) Quality of donor hair, i.e., hair shaft thickness (better results with shaft >80 μm), curl, color, texture, greater follicular unit (FU) density (three to five hairs per FU), and in situ telogen-anagen ratio.
2. Meticulous standardized pre- and postoperative photography are crucial for objective measurement of treatment success.
3. Differential diagnosis important for males with non-MAGA hair loss.
4. Consider work-up for hormonal imbalances for women with male pattern hair loss.
5. Consider work-up for iron deficiency and thyroid dysfunction in women with typical FPHL.
6. Graft site selection in those with MAGA should begin by targeting the forelock region in the frontal area as it provides the most natural result and may be performed in one large session.
7. Future graft sites, if the patient chooses further treatment, may target the crown in the vertex region.
8. Determine adequacy of FUs in donor region. Consider the need for 25–40 FU/cm^2 for a good visual result in the frontal region (non-balding male has 52 FU/cm^2 in frontal region).
9. Determine hair shaft thickness and density in donor region. The cross section trichometer measures these parameters. A minimum of 40 FU/cm^2 is required to consider the donor region adequate.
10. The region between the occipital protuberance and 1 cm cephalad to the top of the ears is most ideal for harvest. This zone is about 5 cm in width. Hair outside the zone has a higher tendency to thin out.

11. Consider that individuals with light, fine, and straight hair, even when transplanted with the requisite density of 40 FU/cm^2, will have a more "see-through" result as compared with men who have darker, coarser, and curlier hair
12. Diffuse FPHL is less amenable to follicular unit hair transplantation (FUT).

Intraoperative Details

Graft Harvest

1. Local anesthesia consisting of a mixture of lidocaine 1% and bupivacaine 0.25% with 1:200,000 epinephrine is used for regional block in combination with local infiltration.
2. Local anesthesia may be supplanted with varying levels of sedation.
3. FUs may be obtained either via strip excision with subsequent microsurgical preparation (discussed here) or by follicular unit extraction (FUE).
4. FUE involves manual, power-assisted, or automated micropuncture technique to isolate singe FUs, while the donor site is allowed to heal by secondary intention.
5. Identify an elliptical portion of donor scalp and shave the hairs to approximately 4–5 mm in length.
6. A strip of occipital scalp that is approximately 1 × 15 cm in length should contain well over 1000 FUs.
7. Subcutaneous tumescence with normal saline creates better separation of FUs and facilitates harvest and avoids hair shaft transection.
8. Depth of excision extends to superficial fat layer to avoid injury to the occipital neurovascular bundle.
9. Trichophytic (a.k.a. pretrichial) technique is used to allow for hair growth within and to camouflage donor site scar.
10. Stereomicroscopy and microsurgical instruments are used to divide donor strip into slivers that are 1–2 mm or 1 FU in width.
11. Strips are then divided into individual FUs and placed in chilled normal saline holding solution.

Hairline Design

1. Most important variable to a successful outcome is the creation of a natural anterior hairline (AHL).
2. Usually AHL is located between 7.5 and 9.5 cm above the glabella.
3. AHL should be even with or slightly anterior to the temporal line. Thus, determining potential temporal recession is important.
4. Lateral hump is the superior most extension of the inferiorly oriented hairs in the temporal region. It intersects with the lateral most extension of the forelock. Intersection with the lateral most aspect of the AHL marks the apex of the frontotemporal recession.
5. The leading edge of the AHL is recreated with many, one to two-hair, FUs placed in a nonlinear and irregular fashion. These FUs are procured from the temporal fringe. The next row posteriorly may include two to three-hair FUs consisting of coarser hair for a natural transition [7].
6. The posterior edge of the forelock should likewise be created with small grafts consisting of soft hairs laid in an irregular pattern. Regardless of whether the vertex is grafted, the forelock should extend to at least the level of the mid-scalp.

Recipient Site Creation

1. The main principle centers around matching recipient size to FU length and width.
2. Coarser hairs and those containing 2–3 per FU require a somewhat deeper recipient site than FUs containing finer hair.
3. Eighteen to twenty-three gauge hypodermic needles or the "mindi" knife are used for recipient site creation.
4. Angulation of recipient site should mimic that of existing hair. If no hairs exist in the region being grafted, then angulation proceeds at a 30°–45° anteriorly off the scalp.
5. Regardless of the side being grafted, hair should also have an inclination toward midline.
6. A whorl pattern may be created in the vertex for a more natural appearance.
7. Density for optimal site packing should be approximately 25–40 FU/cm^2.

Graft Planting

1. This step requires gentle handling of well-hydrated grafts.
2. Great care is taken to place the graft at the same angle as the recipient site.
3. Planting takes place in one of two ways with the help of an assistant: Recipient site creation along the area to be grafted first, followed by sticking the grafts sequentially or combining both maneuvers into one step, the "stick and place," whereby the assistant creates the recipient site, followed immediately by placement of the graft before creating another site. Experienced professionals can place 200–300 grafts per hour.

Postoperative Care

1. A typical session utilizing up to four assistants grafting 1500–2500 FUs may take up to 6 h
2. No bandaging is required either at the recipient or donor sites.
3. Head elevation postoperatively.
4. Icing of the forehead and donor region.
5. Analgesics may be given.
6. Application of Aloe ointment and gentle shampooing of the scalp may commence on the second postoperative day.
7. Recipient site eschars will resolve by the tenth postoperative day.
8. Donor site staples or sutures are removed 2 weeks postoperatively
9. Expect the grafted FUs to enter into a telogen phase within the first 3 months before reaching an anagen phase. Final results can be expected at 8–12 months post grafting.

Operative Dictation

Diagnosis: Frontotemporal balding or MAGA
Procedure: Hair restoration surgery, follicular unit grafting

Indication

This _____ year-old male patient is presenting with Norwood type balding in the frontotemporal region. He is bothered by his noticeably receding hairline and desires increased density in the lateral hump, forelock, and temporal triangle regions of his scalp. Risks to be discussed with the patient include, but are not limited to, progressive hair loss resulting in an unnatural appearance of the hairline in the future, poor graft take, visible recipient site scarring, and donor site scarring. The patient understands the risks and agrees to proceed.

Description of the Procedure

Images were taken from different angles after the operative consent and grafting areas were confirmed. The patient was pre-medicated with oral valium until maximal effect was attained. The patient was placed in a seated position in a recliner chair. Monitored anesthesia care was instituted. Preoperative antibiotics were administered. The scalp donor ellipse was marked, bound superiorly by the vertex balding zone, laterally by a vertical line from the external auditory canal and inferiorly 4 cm proximal to the hairline at the nape. The donor site hair was trimmed to leave a 2–3 mm hair shaft. A trimmed 1–2 cm cuff around the donor site allowed for easier dissection and approximation of the wound. The hair was cleansed with chlorhexidine-based soap and dried well. Local anesthesia was infiltrated superficially along the borders of the donor site. A mixture of Xylocaine and epinephrine in normal saline was then injected into the subcutaneous plane of the donor area. The scalp was prepped with chlorhexidine and allowed to dry. A sterile clear plastic baggie was placed over the marked recipient site as a surgical field.

An incision was made through the superficial dermis along the ellipse inferior border using a 15 blade beveled parallel to the hair follicles. The skin along the incision was retracted using single skin hooks. Dissection proceeded down to the subcutaneous layer without violating of deeper scalp layers. The same process was repeated in the superior border of the ellipse. A plane superficial to the occipitofrontal aponeurosis was developed deep to the hair follicles. Electrocautery was avoided as the donor strip was raised using a combination of blunt gauze peanut and blade dissection. Hemostasis was obtained using electrocautery,

and the donor site was closed using 3-0 interrupted Monocryl sutures in a double-layered fashion. The skin was sutured using 4-0 Monocryl in a running subcuticular manner.

The donor strip was cut using Teflon-coated scalpel blades and micro-forceps to 1–3 mm width pieces under loupe or microscope magnification. The resultant strips were slivered into hundreds of micro-follicular grafts consisting of one to five follicles per unit. This process was assisted by two to three technicians to save time. The harvested follicles were immediately placed in cold normal saline holding solution to avoid desiccation. As the harvesting process advanced, one technician stratified the micrografts into 10–50 clusters according to size: one to two hairs, three to four hairs, etc.

As the micrografts were being harvested, the recipient area was anesthetized using a combination of supraorbital/supratrochlear nerve blocks, field blocks, and local infiltration with 1 % lidocaine with epinephrine. The recipient site was prepared using 19 or 20 gauge needles. Spaces were punched randomly at 30°–45° angle with the scalp in an irregular pattern of 20–35 follicular units/cm^2. (*The recipient spaces may be prepared entirely prior to follicular insertion or punched immediately prior to insertion*.)

The follicular micrografts were placed on the radial aspect of the operator's index finger in sets of five to ten. Micrografts were then transferred to the punched holes. Insertion was facilitated by holding the deepest part of the perifollicular tissue and sliding the micrografts deep before releasing the forceps teeth. Follicles must be tailored to a tight fit to prevent perifollicular scarring. The unpredictable phenomenon of "graft popping" was overcome by applying light pressure over a placed graft for 5–15 s with a saline-soaked cotton swab or Q-tip before placing the next graft. Two to three technicians assisted in punching and placing the grafts to diminish operative time.

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Liposuction

17

Georgio Atallah and Salim C. Saba

Indications

Cosmetic Indications

1. Lipodystrophy in body areas resistant to diet and exercise
2. Breast reduction
3. Gynecomastia

Non-cosmetic Indications

1. Chronic lymphedema (nonfibrous type)
2. Thinning of pedicled and free flaps
3. Fat harvesting in reconstructive techniques, e.g., fat grafting to breast

Contraindications

1. Unrealistic patient expectations
2. Liposuction to treat obesity
3. Patients with abdominal wall hernias (relative contraindication)
4. Poor physical health, i.e., cardiac disease
5. Liposuction to treat cellulite

Possible Complications

1. Contour irregularities (superficial fat layer)
2. Ecchymosis
3. Edema
4. Seroma
5. Volume overload
6. Thermal injury (common with ultrasound-assisted technique)
7. Paresthesia
8. Penetration of viscera (preexisting abdominal wall hernia or overly aggressive technique)
9. Venous thromboembolic event

Essential Steps

Preoperative Detail

1. Careful patient selection and evaluation taking into account patient history and physical examination; including whole body, target areas, and skin tone.
2. Evaluate patient in front of a mirror and distinguish between subcutaneous fat versus deep visceral fat that cannot be addressed by liposuction.

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Intraoperative Details

1. May be done under local, sedation, or general anesthesia, although the author prefers the latter as it allows for increased patient comfort and safety.
2. Compression stockings or sequential compression device should be used in any case done under general anesthesia that will exceed 2 h.
3. Up to 75% of body areas can be accessed through the prone position including the arms, back, hips, flanks, medial thighs, and lateral areas. Supine position may be used for the abdomen, chest, anterior thighs, and knees.
4. When prone, ensure adequate padding of bony prominences.
5. Small 3–4 mm incisions can be used for site entry.
6. Various wetting solutions are available, i.e., Klein, Hunstadt, University of Texas Southwestern Medical Center formula, etc., that have as their base ingredients normal saline, lidocaine, and epinephrine.
7. Superwet (1 cc lipo-aspirate for each 1 cc of wetting solution infiltrated) technique is preferred over wet (increased blood loss) or tumescent (high volume shifts) techniques.
8. Aspiration of fat using the dominant hand making even strokes in a systemic fashion and using cross tunneling or radial pattern.
9. Utilize a pinch test to compare sides and optimize symmetry.
10. Avoid superficial liposuction in the torso as it increases the tendency for skin dimpling.
11. Smaller-diameter cannulas (1 mm or less) are used in the neck, while larger-diameter cannulas (greater than 3 mm) may be used in areas with thick layers of deep fat, e.g., abdomen and flanks.
12. Smaller cannulas may also be used elsewhere in the body for liposculpture in the superficial layers—this is to be done only by highly skilled individuals.
13. Cannulas with forked tips may be used in areas where fat is highly septated and fibrous to facilitate lipolysis.
14. Incisions for cannulas larger than 3.0 mm are closed using 5-0 nylon sutures, or incisions are kept open to drain wetting solution.
15. When addressing the abdomen, hips, and thighs, it is important to avoid zones of adherence as liposuction in these areas may cause significant contour deformity.
16. Various modes of lipolysis such as power-assisted, ultrasound, and laser-assisted (SmartLipo™) techniques decrease the work force exerted by the operating surgeon but do not necessarily yield superior results as compared to traditional suction-assisted liposuction.
17. Treatment end point for a specific area includes any of the following—desired contour, desired pinch test, and bloody aspirate.

Postoperative Care

1. Patient is dressed in a compression garment with compression foam for 2 weeks postoperatively—note that garments may also cause excessive pressure on the skin and should be utilized with care.
2. Twenty-four-hour monitoring of urine output and vitals under medical supervision is imperative in any patient undergoing a procedure whereby more than 5 L of lipo-aspirate is removed or patients with a history of cardiac or pulmonary disease.
3. Drains are recommended for gynecomastia and when >2000 mL lipo-aspirate is removed from the abdomen.
4. Expect swelling to persist for up to 6–8 weeks after liposuction.
5. Patient must adhere to a conducive lifestyle that consists of a healthy diet and exercise in order to maintain results.

Operative Dictation

Diagnosis: Lipodystrophy of _____
Procedure: Liposuction

Indication

This is a _____ year-old patient presenting with lipodystrophy of the _____.

Description of the Procedure

The patient was brought to the operating room after being marked in a standing position with a permanent marker bringing to the attention asymmetries, indentations, depressions, zones of adherences, and previous scars.

After performing a time-out, the patient was positioned on the operative table. Sequential compression devices were placed. General anesthesia was administered. The patient was prepped and draped in standard sterile fashion. A Bair hugger was placed on untreated areas and a Foley catheter was inserted (if more that 5 L lipoaspirate was planned).

Small skin incisions were made, and wetting solution was infiltrated systematically and evenly from deeper planes to more superficial until the infiltrated fat was firm with no areas of disproportionate bulges (note for the superwet technique each area on the torso is infiltrated with approximately 200–300 cc). The wetting solution was allowed 7–10 min for maximal vasoconstrictive effects.

Appropriate-sized cannula connected to large bore tubing and suction apparatus was inserted into the intermediate and deep plane. Using even in-and-out strokes with the dominant hand, the cannula was moved back and forth in a radial/fanlike pattern away from the incision. The nondominant hand felt over the treatment areas to provide tactile feedback.

Cross tunneling was performed through a second incision at a right angle of the first incision. The end point of aspiration was determined after the desired contour was achieved, and the pinch test was performed to assess thickness of the underlying subcutaneous tissue. Comparison was made to the preoperative state.

Final contouring was performed after wetting the skin and gliding over it to assess for smaller irregularities. A smaller cannula (2.5 or 3.0 mm) was chosen for the final contouring and feathering. Large cannula incisions (>3.0 mm) were closed using 5-0 nylon sutures, and smaller incisions were kept open for drainage of wetting solution.

The patient was dressed in a compression garment overlying compression foam over the suctioned areas.

Postoperative Management

The patient may experience some serosanguinous drainage from the incision sites for the first 24–48 h.

Showering was permissible 1–2 days postoperatively. Compression garments were encouraged to be worn for 23 h daily (except for when showering) for the next 2–4 weeks postoperatively.

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Autologous Fat Transfer to Buttocks

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Introduction

This chapter describes in detail the surgical steps involved in performing the Brazilian butt lift or autologous fat transfer to the buttocks. Buttock augmentation has been gaining increasing popularity, particularly in certain ethnic groups [1]. Buttock augmentation can be achieved with either implants or autologous fat. The advantage of autologous fat is that there is minimal risk of infection and no risks of implant malposition, rotation, or extrusion [2]. Another advantage of autologous fat transfer is that fat is removed from less desirable areas such as the abdomen, flanks, back, and/or thighs [3]. There is risk of fat necrosis or fat absorption (failed take) [4]. The key area to suction is the lumbosacral triangle (the "V" zone). This alone gives the visual illusion of a prominent buttock. This fat is harvested using standard tumescent liposuction techniques and then separated by gravity or centrifuge [2]. This "pure fat" is devoid of oil, blood, and tumescent fluid. There are four basic buttock shapes: the "A" shape, "V" shape, "round" shape, and "square" shape [5]. The "A" shape is considered the most attractive, and the goal of this surgery is to convert the other buttock shapes to an "A" shape.

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Indications

1. Buttock ptosis
2. Flat buttock
3. Enhance buttock both volume wise and contour wise

Essential Steps

Preoperative Markings

1. Mark upper contour of the buttock. Push upward on each buttock to see where this natural curve lies.
2. Mark lower contour of the buttock.
3. Mark sacrolumbar triangle area ("V").
4. Mark areas to be liposuctioned above and below "ideal V" buttock shape.
5. Mark midline abdomen including linea alba.

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6. Mark semilunaris lines on either side of the abdomen.
7. Mark the iliac crest to create iliac crest indentation lines.

Intraoperative Details

1. Patient may be placed initially in the supine position for liposuction of the abdomen and flanks.
2. Sterile preparation of patient's abdomen and flanks.
3. General anesthesia via endotracheal tube.
4. Infiltrate the abdomen and flanks with tumescence (30 mL 1% lidocaine + 1000 mL normal saline + 1 mL 1:1000 epinephrine). Typically a total of six bags are used to stay below the toxic limit so two to four bags are used for the front. If additional bags are necessary, leave out the lidocaine.
5. Make a total of four incisions. One at the superior umbilicus and three in the lower abdomen crease along linea alba and semilunaris lines.
6. Perform power-assisted liposuction of the deep layer abdomen and flanks using a #5 Mercedes cannula.
7. If abdominal etching is desired, then use power-assisted liposuction to create linea alba, semilunaris, and iliac crest lines by bringing cannula superficially to the dermis. This is a controlled contour abnormality to "etch" a defined abdomen.
8. Harvest aspirate into a sterile container.
9. Pour into 60 cc syringes so that gravity can allow separation of oil (top layer), emulsified fat (middle layer), and blood/tumescent fluid (bottom).
10. Leave incisions open (typically 1–1.5 cm) to allow for drainage and prevention of seroma/hematoma.
11. Place gauze/Opsite dressing over incisions.
12. Undrape patient and reposition to prone. Pad all bony prominences and use sponge face protector.
13. Re-prep in prone position.
14. Redraw/reinforce buttock lines.
15. Create incisions right above the gluteal cleft midline and midthoracic spine midline.
16. Use power-assisted liposuction to suction back and flank fat but preserve buttock area.
17. Aggressively liposuction lumbosacral area to create a "V" depression and visual illusion of a buttock shelf.
18. Suction above the ideal "A" frame buttock to create aesthetic contour.
19. Again harvest fat into sterile container and separate into 60 cc syringes.
20. Pour off top layer oil and squeeze out tumescent fluid to preserve only fat in the 60 cc syringes.
21. Make two incisions in the gluteal crease inferiorly.
22. Inject harvested fat into the upper third buttock to create desired contour and volume utilizing the gluteal cleft and gluteal crease incisions.
23. Inject fat approximately 2/3 superficial to the gluteal muscles and approximately 1/3 into the gluteal muscles (be aware of the sciatic nerve).
24. Close gluteal crease incisions with 4-0 Monocryl subdermally.
25. Loose closure of midline incisions in the midthoracic spine and gluteal cleft to allow for some drainage.
26. Flip patient back into supine position.
27. Cut topifoam to size to cover etched areas. These should be only about 1–2 cm in width.
28. Place large topifoams over the abdomen and flank and over the smaller-sized etched topifoams.
29. Apply abdominal binder over the abdomen, but no compression over buttocks.
30. In post-op recovery, alternate logrolls to patient's sides to avoid direct compression over the buttocks as much as possible.

Postoperative Care

1. Encourage ambulation on the same day of surgery and drink plenty of fluids.
2. Avoid lying straight supine. Have patient sleep on sides or prone.
3. For 2 weeks have patient wear abdominal/buttock garment that compresses all areas except the buttocks (specialized order beforehand).

4. For 2 weeks have patient sit on pubic rami (i.e., have patient sit forward) to reduce pressure on the buttock and maximize fat take.

Possible Complications

1. Hematoma/seroma
2. Hypertrophic scarring (counsel patients that incisions left open can always be revised, but this rarely occurs)
3. DVT/PE
4. Contour irregularities
5. Fat absorption (failed take)

Operative Dictation

Diagnosis:

1. Lipodystrophy of the abdomen, flanks, and back
2. Buttock ptosis, decreased buttock projection, or dystrophic/atrophic buttock

Procedure:

1. Power-assisted liposuction of the abdomen, flanks, and back
2. Autologous fat transfer to the buttocks (Brazilian butt lift)

Indication

This patient has excess fat in the abdominal, flank, and back areas with decreased buttock projection. She consented for the procedures listed above. Risks, benefits, and/or alternatives were discussed with the patient. Informed consent was obtained.

Description of the Procedure

The patient was identified in the preoperative holding area. She was asked to stand up with a female chaperone present. Preoperative markings were made including her midline abdomen consisting of linea alba and both semilunaris lines. Excess fat on the flanks and back were circled. The lower end and upper end of her buttocks were marked to delineate areas of fat transfer. She was then brought to the operating room and positioned supine initially. Sequential compression devices were placed on bilateral lower extremities. General endotracheal anesthesia was induced. Preoperative antibiotics were administered. She was prepped and draped in sterile fashion. A time-out was performed.

A total of four incisions, three in her lower abdominal crease and one in the superior umbilicus, were made. A hemostat was used to spread from the incisional opening through underlying soft tissues. Next a total of 4000 mL was tumesced into the abdomen and flanks. The tumescence consisted of 30 mL of 1 % plain lidocaine and one ampule of 1:1000 epinephrine per 1 L normal saline bag. After the tumescence had taken effect, power-assisted liposuction was carried out with a #5 Mercedes cannula. A total of 3600 mL was aspirated from the abdomen and flanks in the deep layer. The cannula was brought up superficially to the dermis to etch out her linea alba and semilunaris lines. All fat was suctioned into a sterile container, which would later be used for fat transfer. Upon completion of liposuction, the incisions were left open and covered with gauze and Opsite dressings.

The patient was then placed back onto her gurney and flipped into the prone position. All bony prominences were padded and her face was also supported. She was re-prepped and draped in sterile fashion. I created two incisions in the midline, one just above her gluteal cleft and one in the midthoracic spine. Two additional incisions were made in the gluteal creases, bilaterally. A hemostat was used to spread through the subcutaneous tissues. The back, flanks, and lumbosacral triangle area were tumesced with a total of 2000 mL of solution. Next, power-assisted liposuction was used to suction fat from the back, flanks, and lumbosacral triangle area. A total of 2700 mL of aspirate was harvested into a sterile container. After suction of the lumbosacral triangle area, a nice buttock shelf was created. All fat from the sterile containers were divided into 60 cc syringes.

Only the fat was preserved. Oil and tumescent fluid was drained out of the syringes.

Next a total of 500 mL of fat was injected into each buttock for a total fat transfer of 1000 mL. Most of this fat was concentrated in the upper third buttock to create a nice rounded contour. Approximately 2/3 was injected superficial to the gluteal muscles, and approximately 1/3 was injected into the muscle itself with care to avoid the sciatic nerve. An "A"-type buttock was achieved. On lateral view a natural sloping superiorly and inferiorly was made with a nice rounded effect on AP view. Incision sites were closed loosely with 4-0 Monocryl subdermally to allow some drainage. A sterile dressing was applied consisting of Xeroform, gauze, and ABD pads. The patient was returned back to the supine position, and topifoam was cut to the size of the etched areas over the abdomen. Larger topifoam pads were then placed on top of these over the abdomen, flanks, and back. An abdominal binder was placed over the abdomen. No compression was applied over fat-grafted areas. She was extubated and awakened without difficulty. She was transferred to recovery in the lateral decubitus position.

The patient tolerated the procedure well and was transferred to recovery room in excellent condition. All needle, instrument, and sponge counts were correct at the end of procedure.

Postoperative Plan

No direct pressure over the buttocks for 2 weeks. Full-time compression of liposuctioned areas for 2 weeks is followed by nighttime compression for 2 weeks.

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Panniculectomy

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Indications

1. Excess skin and soft tissues (pannus) located mainly but not restricted to the lower abdominal area
2. Intertrigo
3. Recurrent infections between excess skinfolds
4. Panniculitis adiposus
5. Back pain resulting from heavy pannus
6. Demonstration of a commitment to a long-term lifestyle changes including healthy diet and exercise

Contraindications

1. Unrealistic patient expectations (scarring, postoperative results)
2. Poor physical health
3. Still active weight loss post-bariatric surgery
4. Morbid obesity
5. Concurrent ventral herniation necessitating additional abdominal wall reconstruction (relative)

Possible Complications

1. Wound dehiscence
2. Surgical site infection
3. Seroma (common)
4. Venous thromboembolism
5. Atrophic scarring

Essential Steps

Preoperative

1. Careful patient selection and evaluation (patient's history and physical examination of whole body and target areas as well as skin laxity and dermal quality, including patient postoperative expectations and lifestyle).
2. Informed consent, including photographic consent if pictures are to be taken.
3. Consider number and location of fat rolls in the abdomen (i.e., presence of supraumbilical in addition to infraumbilical rolls).
4. Supraumbilical rolls or skin redundancy may necessitate the addition of a vertical component to the excision.

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5. The presence of scars in post-bariatric or other surgical patients, e.g., vertical midline scars, makes resection of redundant supra-umbilical skin and the resulting inverted T-scar less onerous.
6. Administration of systemic antibiotic or antifungal therapy in patients with panniculitis or severe fungal intertrigo.
7. Markings are drawn in the standing position.
8. Markings include the borders of the pannus and/or redundant skin to allow for removal of the excess tissue while still permitting primary closure.
9. Umbilical salvage may be difficult in the morbid and super obese patients, and the possibility of sacrificing the umbilicus should be discussed.
10. Consider type and cross as potential high-volume blood loss.

Intraoperative Details

1. Patient placed in supine position.
2. General anesthesia.
3. A single prophylactic dose of antibiotics is administered 30 min prior to incision.
4. Intraoperative foley catheter for monitoring of urine output.
5. For morbidly obese or super obese patients, they need to obtain a wide "big boy" surgical table.
6. A large pannus may be suspended in the air with the use of large skin hooks to facilitate retraction and minimize the work of the assistant.
7. A transverse elliptical incision is made to remove the lower abdominal pannus. Care is taken to remain approximately 7 cm above the mons pubis centrally. Laterally the incision is carried out just above the inguinal ligament.
8. Superiorly the incision may incorporate the redundancy borderline.
9. Dissection is carried to the level of the muscular fascia except for the inguinal region, where more superficial dissection restricted to the subcutaneous layer is maintained in order to avoid injury to the lymphatics of the femoral triangle.
10. Vertical skin redundancy may be addressed with a vertical elliptical excision.
11. Minimal undermining of residual abdominal flaps is done.
12. Additional horizontal rolls above the umbilicus may be addressed with liposuction or staged resection at a later date.
13. Consider delaying closure in cases where residual tissue contains a thick fatty layer as these tend to carry a higher risk of postoperative wound dehiscence.
14. Subcutaneous drains are placed under the skin flaps in cases of primary closure.

Postoperative Care

1. May remove urinary catheter at the completion of the procedure or on postoperative day 1.
2. Incentive spirometry is crucial, especially in those with concomitant obstructive pulmonary disease.
3. Ensure respiratory support with CPAP or BiPAP devices for those with concomitant obstructive sleep apnea.
4. Chemoprophylaxis against thromboembolic events, i.e., subcutaneous heparin or Lovenox.
5. Ambulate patient as soon as possible postoperatively.
6. For staged panniculectomy, delayed closure may take place when the wound demonstrates a preliminary degree of granulation tissue.

Operative Dictation

Diagnosis: severe lipodystrophy (excess skin and soft tissues in a certain anatomic region mainly representing the lower abdomen) with associated suprapubic intertrigo and back pain

Procedure: panniculectomy

Indication

This is a _____ year-old obese patient presenting with a lower abdominal, overhanging pannus. Associated medical symptoms include intertriginous skin rashes recalcitrant to drying agents, severe back pain, inability to exercise, and lymphedema in the dependent portions of the pannus. All the benefits and potential risks of the procedure are explained to the patient who agrees to proceed.

Description of the Procedure

After performing a time-out procedure among all operating room staff, the patient was placed in the supine position. Induction and endotracheal intubation were carried out. The patient's abdominal wall was scrubbed and prepped with Betadine solution using standard technique. The pannus was then grasped with a sharp clamp from its lateral edges and suspended from fixed hooks projecting from the ceiling, with the help of an assistant.

Using a ten-blade scalpel, an incision was made along the inferior border of the pannus starting above the mons pubis centrally and extending laterally a few centimeters above the inguinal ligament. Dissection was performed with electrocautery down to the level of the deep fascia. Undermining of the pannus superiorly was carried out at the level of the deep fascia to the level of the umbilicus. The superior portion of the transverse ellipse was then incised above the umbilicus and corresponding to the border of the pannus. In similar fashion, undermining was carried inferiorly until the entire pannus, along with the excised umbilicus, was removed and delivered to the back table. Meticulous hemostatic technique was exercised to minimize blood loss.

Only minimal undermining of the inferior and superior residual flaps was done to allow for tension-free closure. Two 19-French Blake drains were placed on the deep fascia and exteriorized through the skin of the pubic region. The skin flaps were approximated and sutured together in several layers: interrupted 2-0 Vicryl for the superficial fascia, interrupted 3-0 Monocryl for the deep dermis, and 4-0 Monocryl running subcuticular for the skin.

The patient was reversed, extubated, and taken back to the recovery unit in good medical condition.

Abdominoplasty

20

Renee J. Gasgarth and Seth R. Thaller

Indications

1. Desire for an improved abdominal contour: removal of excess abdominal skin and subcutaneous tissue, treatment of abdominal wall laxity, and correction of rectus diastasis
2. Desire for body recontouring after massive weight loss in a patient who is not a candidate for belt lipectomy

Essential Steps

Preoperative Markings

1. Patient is placed in upright position for the initial markings. For women, it is particularly helpful if they bring bikini bottoms/undergarments of their choice to design a well-hidden incision.
2. Asymmetries are noted and pointed out to the patient during the marking procedure. This includes umbilicus deviation from midline, scoliosis, lower limb asymmetries, and asymmetric distribution of subcutaneous fat. Striae that will not be excised are also noted.
3. Midline is marked from the xiphoid to the pubic symphysis.
4. Inferior incision is marked first: the pubic skin is placed on stretch and marked 6–8 cm from the vulvar commissure. Previously placed incisions are excised, if possible.
5. End of the pannus skin creases are then marked, and a line that gently tapers from the site 6–8 cm from the vulvar commissure to the lateral pannus edge is drawn.
6. Tissue from the umbilicus to the pubis is gently grasped to determine site of the upper incision, and again a gentle ellipse is drawn.
7. Patient is then placed in supine position and the upper border of the incision is verified.

Intraoperative Details

1. Patient is marked in upright position and then placed in supine position to verify the amount of tissue that can be resected.
2. Patient is then taken to the operating suite and placed in supine position. Bilateral sequential devices must be placed. Arms are

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extended on padded arms boards and secured in place with Kerlix rolls and ACE bandages.
3. Perioperative antibiotics (cefazolin or clindamycin) are administered.
4. General anesthesia is induced.
5. A Foley catheter is placed for anticipated cases >3 h.
6. Abdomen is prepped from the xiphoid to the mons and draped in the standard sterile fashion.
7. Traction sutures or single skin hooks are placed in the umbilicus and an 11 blade is used to incise circumferentially around the umbilicus. Sharp dissection is used to bevel away from the umbilical stalk to preserve an adequate vascular pedicle. Umbilicus is then freed down to the level of the fascia.
8. Inferior incision is made using a scalpel blade and then carried down to the fascia with electrocautery.
9. A thin layer of loose areolar tissue over the fascia should be maintained to preserve lymphatics associated with the fascial system. A carpet of fat should be preserved over the anterior iliac spine to the inguinal ligament to avoid damaging the lateral femoral cutaneous nerve.
10. Skin flap is then raised superiorly with careful attention to the preservation of the umbilicus. Flap is raised to the level of the subxiphoid process and costal margins. Laterally, perforators are preserved.
11. Once the flap has been raised, the patient is placed in beach chair position (with the bed flexed gently). Superior aspect of the resected margin is verified.
12. Laterally the subcutaneous fat is "cored out" to minimize the standing cone deformities at the lateral aspect of the incision. Excess abdominal tissue is then excised.
13. Hemostasis is obtained and the abdomen is irrigated with warm normal saline.
14. Next, the rectus diastasis is marked. After returning the patient to supine position, visual inspection and electrocautery are used to identify the rectus muscle edges. A marking pen then marks the diastasis and a diamond or elliptical shape is drawn from the xiphoid to the pubis.
15. Rectus plication is then performed according to surgeon preference. Our preference is to plicate in two layers. Interrupted buried figure of eight sutures with 0 Ethibond composes the first layer. Then a running continuous layer of 0 or 1-0 PDS is placed. (*There are many alternatives*, *including an absorbable monofilament running suture in a single layer*.)
16. For patients who do not have significant rectus diastasis (and therefore do not require midline plication) or for patients with persistent abdominal wall laxity after rectus plication, plication of the external oblique can be performed. For significant lateral laxity, an L-shaped plication with a longer longitudinal component can be designed. For less lateral laxity, an obliquely oriented elliptical-shaped plication can be used.
17. Abdomen is then irrigated again with warm normal saline and examined for hemostasis.
18. Patient is then placed again in flexed/beach chair position for marking of the new umbilical position. A 4-0 Prolene suture is placed in the 12 o'clock position of the umbilical stalk, and a 4-0 Nylon is placed at the 6 o'clock position. Midline skin is loosely approximated with suture or staples or a towel clamp.
19. Skin directly over the umbilical stalk is marked: the position should be at the level of the anterior superior iliac spine. A skin incision in the midline of the skin flap is then made according to surgeon preference: we prefer a "heart-shaped" skin incision. Umbilicus is then inset using the Prolene and Nylon sutures for correct orientation and according to surgeon preference: we prefer 4-0 Monocryl deep dermal interrupted sutures and then a running "baseball stitch" 5-0 Fast Gut.
20. Two #19 French round JP drains are then placed; they exit the skin through a separate incision in the mons area and are secured with 3-0 Nylon.
21. Scarpa's fascia is then re-approximated with interrupted 2-0 Vicryl suture.

22. Dermis is then re-approximated with 3-0 Monocryl interrupted deep dermal sutures, and then a running 4-0 Monocryl subcuticular suture is placed.
23. Dermabond is then applied to the incision; xeroform is applied to the umbilicus.
24. JP drains are placed to bulb suction.
25. Patient is placed in an abdominal binder.
26. "Beach chair" position is maintained during transfer of the patient to the hospital bed.

Postoperative Care

1. Patient is typically admitted overnight for observation. However, some surgeons prefer to discharge home with the use of liposomal bupivacaine or balloon-type anesthetic pumps.
2. Chemical and mechanical DVT prophylaxis is indicated if the patient is admitted.
3. Patient should ambulate and sleep in the "beach chair" position for 2 weeks.
4. Abdominal binder should be worn at all times for 6–8 weeks.
5. Routine postoperative JP care: continue to bulb suction until <30 mL/day for 24 h.

Note These Variations

1. Abdominoplasty can be combined with suction-assisted lipectomy of the lateral abdomen and flanks.
2. Abdominoplasty can be safely combined with gynecological procedures, ventral hernia repairs, or breast surgery, although there is a slightly increased risk of thromboembolic events.
3. For patient with excess soft tissue in the vertical direction, as well, a fleur-de-lis abdominoplasty can be performed.
4. Lateral abdominoplasty incision can also be extended toward the posterior axillary line in an "extended" high lateral abdominoplasty to remove excess tissue from the lateral thighs/hips.
5. If patients have more excess upper abdominal tissue, a reverse abdominoplasty can be designed.
6. Some surgeons place quilting sutures between the fascia and Scarpa's layer.
7. Some surgeons do not place drains.

Possible Complications

1. Seroma
2. Wound dehiscence
3. Delayed wound healing
4. Infection
5. Hypertrophic scarring
6. Residual deformity/poor cosmesis
7. Wide umbilical scar/umbilical abnormality requiring reoperation
8. Bleeding/hematoma
9. Umbilical necrosis (including complete loss of umbilicus)
10. Skin loss
11. Fat necrosis
12. Elevation of pubic hair line
13. Painful neuromas
14. Need for second surgery
15. Deep vein thrombosis/pulmonary embolus
16. Fluid overload
17. Pulmonary dysfunction/atelectasis
18. Lymphedema/swelling
19. Cardiac event
20. Death

Operative Dictation

Diagnosis: Abdominal pannus and rectus diastasis; history of bariatric surgery with massive weight loss
Procedure: Abdominoplasty

Indication

The patient is a pleasant __-year-old female who underwent bariatric surgery 3 years ago resulting in massive weight loss. She has had stable weight for over a year, and her nutritional labs were normal. On exam, she had excess infraumbilical tissue with a small amount of excess supraumbilical tissue and a pannus that reached the level of her mons. She also had 3 cm of rectus

diastasis and no appreciable hernias. Risks, benefits, and alternatives to the procedure were discussed. She wishes to proceed with an abdominoplasty. She reviewed the American Society of Plastic Surgery Consent and verbalized her understanding of the risk of seroma, hematoma, changes in skin sensation, contour irregularities, scarring, major or minor wound separation, umbilical malposition or loss, firmness, poor wound healing, visible or palpable sutures, damage to deeper structures, fat necrosis, need for further procedures, asymmetry, persistent swelling or lymphedema, cardiac or pulmonary complications, blood clots, or unsatisfactory results. She understands that in the event of the need for additional surgery, we might waive our professional fees. However, she would be responsible for any anesthesia or facility fees.

Description of the Procedure

After informed consent was obtained and the patient's identification was verified in perioperative holding, she was marked in the standing position. Six centimeters from the vulvar commissure was marked and tapered laterally to the area of the overhanging skin. Using a skin pinch, the upper mark was made and also tapered laterally in an elliptical shape. The patient was then placed in the stretcher and flexed; she was reexamined and it appeared the marks were appropriate. The patient was then taken to the operating suite and placed in supine position. All pressure points were padded, and she had bilateral sequential compression devices in place. She received Ancef 2 g intravenously 20 min prior to the skin incision. Anesthesia was induced with general endotracheal anesthesia uneventfully. Her arms were secured to a padded arm board with Kerlix rolls and ACE wraps abducted at 80°. Her abdomen was then prepped and draped in the standard sterile fashion. A time out verified the patient's name, identity, procedure, and site. We then began by placing single hooks to retract the umbilicus. A #11 scalpel was used to incise the skin and dermis circumferentially around the umbilicus. Then sharp dissection with Metzenbaum scissors was carried down to the level of fascia by carefully beveling the incision outward to preserve the blood supply. We then used a #10 scalpel to complete the lower aspect of our incision, which was then carried down through the subcutaneous tissue to the loose areolar tissue overlying the fascia. Clips were used to ligate the superficial and deep inferior epigastric arteries bilaterally. We kept a thin carpet of tissue above the fascia, thickening the layer laterally over the anterior superior iliac spine and inguinal ligament. We continued to raise skin flap superiorly toward the umbilicus. We were careful to preserve adequate tissue around the umbilicus, and it continued to appear healthy and viable. We then continued our dissection to the level of the xiphoid medially and laterally to the subcostal margins. We identified and preserved lateral perforators along the subcostal margins; medially the large perforators were clipped and divided. Once we had completely elevated our skin flap, we examined the fascia and skin flaps for hemostasis and used electrocautery as necessary. We placed the patient in flexed beach chair position and confirmed our markings of the superior aspect of the incision. We then used a #10 scalpel to incise the superior aspect of the ellipse and carried the dissection down through the subcutaneous tissue. The abdominal pannus was then sent for gross only pathology. We returned the patient to supine position. We then identified the extent of the rectus diastasis and confirmed there were no appreciable hernias. We used a marking pen to mark the medial edge of the rectus sheath. Then a series of buried figure of eight 0 Ethibond sutures were placed to plicate the subxiphoid to suprapubic fascia. We were careful to avoid suturing the umbilicus directly. Next we used 1-0 PDS in a running fashion to reinforce the plication. Again, we were careful to preserve the vascularity of her umbilicus. Her peak airway pressures remained stable throughout the plication. We irrigated with warm normal saline and inspected again for hemostasis. We then placed the patient again in flexed beach chair position. Two #19 French round JP drains were placed and secured to skin with 3-0 Nylon sutures. A marking suture with 4-0 Prolene at the 12 o'clock position of the umbilicus and with 4-0 Nylon at the 6 o'clock position of the umbilicus was then marked. 2-0 Vicryl interrupted sutures were placed in the midline of Scarpa's fascia to

re-approximate the skin, and the skin was temporarily closed with staples. The new position of the umbilicus was marked by palpating the umbilicus; this position was confirmed to be at the level of the anterior superior iliac spine. A V-type excision of skin and subcutaneous tissue was completed. The Prolene and Nylon sutures were then passed through the new umbilicus site. The umbilicus was inset with 4-0 Monocryl in a deep dermal fascia and then with a running 5-0 Fast Gut at the skin level. The abdominal incision was closed with 2-0 Vicryl interrupted sutures in Scarpa's fascia, followed by 3-0 Monocryl deep dermal sutures, and finally a running 4-0 Monocryl subcuticular stitch. Dermabond was applied to the incisions, and the JP drains were placed to bulb suction. The umbilicus was dressed with Xeroform and then dry gauze. ABD pads were then placed on the incisions prior to an abdominal binder being placed. The patient was extubated and transferred to the hospital bed in a flexed beach chair position. She tolerated the procedure well, and there were no immediate intra- or postoperative complications. All instrument, sponge, and needle counts were correct.

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Lower Body Lift

21

Edgar Bedolla, Klara Sputova,
and Imad L. Kaddoura

Indications

1. To remove excess abdominal, outer and lateral thigh, gluteal (or buttocks) skin, and pubis with irreversible laxity after significant weight loss thus restoring definition of the lower trunk
2. To provide a more dramatic improvement in circumferential lower truncal contour than a conventional abdominoplasty or belt lipectomy alone can achieve

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Essential Steps

Preoperative Markings

1. With the patient in standing position, mark both the anterior and posterior vertical midlines.
2. Palpate and mark both anterior superior iliac spines (ASIS).
3. With patient in the standing position and the knees approximately 6–10 in. apart, start by marking high-cut bikini lines to guide final planned line of closure, which should fall within these lines.
4. Planned line of closure begins at midline approximately 7 cm above the vulvar commissure and extends to perineal-thigh crease and runs vertically along lateral mons to lie 2–3 cm above ASIS. Posteriorly, the closure should curve gently toward the top of the gluteal crease.
5. Superior resection margins are marked starting laterally and continued posteriorly in a transverse fashion, by pinching the skin so the resultant line falls 4–5 cm above planned line of closure depending on the amount of tissue redundancy.
6. Next estimate redundant tissue inferior to planned line of closure, which is usually 10–18 cm along the lateral body.
7. Inferior resection margins are then marked anteriorly and extended circumferentially.

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8. Superior resection line is marked across the abdomen anteriorly at level of the umbilicus.
9. Mark the excess medial thigh laxity and taper to perineal-thigh crease. Avoid extending into inferior gluteal fold.
10. Draw multiple vertical reference marks to help maintain symmetry.

Intraoperative Details

1. General anesthesia.
2. Placed in lateral decubitus position with hip flexed at 45° angles and thighs abducted keeping knees 15–18 in. apart.
3. Inject the incision lines 2 min prior to initial incision with tumescent solution consisting of 25 mL 1 % xylocaine with 1:100,000 epinephrine diluted in 1 L normal saline.
4. Incise the skin and subcutaneous tissue at the superior line of resection.
5. Undermine superficial to muscle fascia anterolaterally and extend posteriorly along the same plane over the iliac crest, preserving deep fat posterior to iliac crest.
6. Limit undermining to flap being resected. *Do not* undermine over the buttock except for the trochanteric fibrous superficial fascial system.
7. Ensure adequate undermining of supratrochanteric superficial fascial system and extend to lateral thigh to correct any aesthetic deformity.
8. Excise redundant soft tissue and skin.
9. Place Jackson-Pratt drains and exteriorize over region of mons pubis and flank.
10. Close the thigh and buttock wounds.
11. Perform second thigh/buttock lift on contralateral side as mentioned above.
12. Reposition patient to supine position. Maintain the hips at 40–45° of flexion and thighs widely abducted.
13. Inject the incision lines prior to initial incision with tumescent solution consisting of 25 mL 1 % xylocaine with 1:100,000 epinephrine diluted in 1 L normal saline.
14. Incise the inferior resection line and perineal-thigh crease incisions.
15. In medial thigh, pubis, and perineum, identify and preserve any blood vessels and lymphatics, to minimize postoperative lymphedema.
16. Excise soft tissue and skin over medial thigh and reconstruct perineal superficial fascial system along Colle's fascia. Avoid vulvar distortion.
17. Limit undermining centrally to edges of rectus and extend cephalad to complete rectus diastasis repair if indicated.
18. Plicate the fascia as needed.
19. Drape the upper abdominal flap over the lower line incision to verify and adjust final superior margin of excision.
20. Excise the excess skin and subcutaneous tissue.
21. Place Jackson-Pratt drains and bring drains out through separate stab incision over mons.
22. Close the wound in layers. Apply light dressings.

Postoperative Care

1. Control blood pressure and pain.
2. Patient is seen in 24 h to check the wound and change the dressing.
3. Patient can be discharged home within 24 h if medically stable.
4. Continuous use of the binder and compressive garments is recommended for 3 weeks following the procedure.
5. Nonabsorbable umbilical sutures are removed at the postoperative office visit in approximately one week.
6. Jackson-Pratt drains can be removed once output decreases to less than 30 mL/drain for 3 consecutive days or at 3 weeks postoperatively, whichever is earlier.
7. Patients should be cautioned against heavy lifting or strenuous physical activity for a minimum of 6 weeks following the procedure.

Possible Complications

1. Seroma/hematoma
2. Wound infection
3. Wound separation/dehiscence
4. Tissue necrosis

Operative Dictation

Diagnosis: Abdominal, lateral thigh, gluteal adipose, and skin excess.
Procedure: Lower body lift.

Indication

The patient is a _____ with significant abdominal, lateral thigh, and gluteal adipose and skin excess as a result of massive weight loss. The risks, benefits, and alternatives to surgical intervention were discussed with the patient, who agreed to proceed.

Description of the Procedure

After informed written consent was obtained, the patient was marked preoperatively in the holding area. Patient was taken to the operating room and placed in supine position. Lower extremity sequential compression devices were placed, and preoperative IV antibiotics were administered. General endotracheal anesthesia is induced. An indwelling urinary catheter was inserted, and the patient was repositioned in the lateral decubitus position with hips flexed at 45° and thighs abducted to keep knees 15 in. apart. All pressure points were appropriately padded. The patients flank; abdomen and thighs were prepped and draped in usual sterile surgical fashion. A time-out to verify the patient's name, medical record number, and procedure was performed.

The incision line and surrounding area were infiltrated with 1 % lidocaine plus 1:100,000 epinephrine to ensure hemostasis and provide additional anesthesia. A skin incision was made along the previously marked superior line of resection using a #10 blade scalpel. The incision was then carried through the subcutaneous fat layer using bovie electrocautery down to the level of the muscle fascia. An extended distal mobilization of the lateral thigh was carried out, with assisted liposuction, anterolaterally and extended posteriorly toward the midline back. Past the level of the iliac crest, the deep lower back fat was preserved. Gluteal attachments were preserved except for the trochanteric fibrous superficial fascial system which was obliterated. The supratrochanteric dissection was extensively liposuctioned along the lateral thigh to allow for cephalad transfer of the lateral thigh tissues. The flap was subsequently elevated to the proposed superior excision line. Tailor tack sutures were placed in an interrupted fashion to simulate the final resection border. All excess tissue and skin resulting from the dissection were resected using a #10 scalpel. Hemostasis was ensured. The flap was passed off the field as a specimen. Two 15-French Jackson-Pratt drains were placed along the wound, brought through a separate stab incisions over flank and mons. The superficial fascial system was reconstructed with 0 Vicryl, and the horizontal incision was closed in layers. The deep layers of subcutaneous tissue were closed with interrupted 2-0 PDS. The subcutaneous dermal layer was closed with interrupted 3-0 Monocryl and the skin with a running subcuticular 4-0 Monocryl, leaving the medial margins of incision open. Closure was reinforced using Dermabond. The patient is then repositioned in the contralateral lateral decubitus position, and contralateral thigh/buttock lift is performed in a similar fashion.

After completion of both thigh/buttock lifts, the patient was then placed in the supine position while maintaining the hips at 40–45° angle. The abdomen and inner thighs were prepped and draped in standard sterile fashion. The incision line and surrounding area were infiltrated with 1 % lidocaine plus 1:100,000 epinephrine. Following our preoperative markings, the inferior resection margins and perineal-thigh incisions were created using a #10 scalpel. The incisions were then extended through the subcutaneous fat layer using Bovie electrocautery. The pubis, perineal, and medial thigh dissection ensued, taking care to dissect superficially preserving any lymphatic vessels or blood vessels in the femoral region. The dissection was continued posteriorly ensuring no extension of the dissection past the inferior gluteal fold. The dissected soft tissue and skin were excised, and the medial thigh and perineal superficial fascial system were reconstructed

along Colle's fascia. The abdominal dissection was then continued cephalad. All large subcutaneous vessels were identified, ligated and divided to maintain hemostasis. The dissection was taken down to the level of the anterior rectus sheath. Dissection of the abdominal flap centrally was then continued superiorly to the xiphoid process, taking care to preserve lateral perforators. The medial borders of rectus abdominis muscles were plicated in a double layer consisting of figure-of-eight 2-0 PDS sutures, followed by an imbricating, running 2-0 PDS suture line. Irrigation and hemostasis ensued. The operating table was then flexed at the level of patient's hips, and adequate mobilization of the flap was ensured. The superior border of resection was verified by draping the upper abdominal flap over the lower border of incision to determine the final margin of resection. The preoperative marking for the superior line of excision was adjusted accordingly. The skin and subcutaneous tissues were excised with a combination of scalpel and bovie electrocautery. Once completed, the abdominal flap was passed off the field as a specimen for weight determination. Temporary tacking sutures were placed in the Scarpa's fascia and skin of the midline of the abdominal flap to secure it to the lower flap. Two 15-French Jackson-Pratt drains were placed at the lateral corners of the wound at either side, exiting through the hair-bearing region of the pubis. All drains were externally secured using 3-0 nylon suture. The horizontal incision was closed in layers. Scarpa's fascia was re-approximated with interrupted 2-0 PDS. The subcutaneous dermal layer was closed with interrupted 3-0 Monocryl and the skin with a running subcuticular 4-0 Monocryl. Closure was reinforced using Dermabond + *or* *Steri-Strips*. Standard light abdominal binder was placed over light surgical dressings following the procedure. The legs were wrapped with 4×4 fluffs and Kerlix rolls and secured with compressive dressings. The patient anesthesia was reversed. Patient was extubated, moved to a flexed hospital bed, and transferred to the recovery room.

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Medial Thigh Lift

22

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Indications

Medial thigh soft tissue and skin laxity after massive weight loss.

Possible Complications

1. Recurrent ptosis
2. Deformity of the labia/vulva
3. Scar widening
4. Wound migration
5. Pubic hair migration
6. Lymphorrhea and delayed wound healing

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Essential Steps

Preoperative Markings

1. If only a transverse excision is required (Lockwood's medial thighplasty), a horizontally oriented ellipse is drawn in the standing position. The superior incision consists of a line starting at the ischiocrural line along the labia majora in the perineal crease and proceeds along the groin toward the anterior superior iliac spine.
2. To avoid excessive resection, the point of maximum resection width is better determined with the patient in the standing position by moderately pulling the redundant medial skin excess toward the planned incision in the perineal crease.
3. For circumferential contouring combined with a classical Lockwood's medial thighplasty, an additional ellipse is drawn vertically along the median line of the thigh inner aspect. The resulting scar will therefore have a T or L shape, with an inguinal and an axial component.

Intraoperative Details

1. Placed in supine position with the lower extremities in frog-leg position.
2. General anesthesia is instituted.

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3. The lower extremities are prepped and draped in the usual manner.
4. Kline solution (1 L of normal saline 0.9 % solution mixed with 1 ampule of 1:1000 Epinephrine and 25 mL of 2 % lidocaine) is prepared and injected throughout the medial aspect of each thigh.
5. Liposuction on the medial aspect of each thigh is performed.
6. For Lockwood's medial thighplasty, an incision is made down to the fascia lata laterally, and the anterior medial thigh is undermined only lateral to the femoral triangle.
7. Medially, the incision is carried only to the superficial fascia.
8. The thigh flap is undermined and the redundant skin is excised.
9. The flap is advanced superiorly and firmly anchored to Colles' fascia and ischium using 0 Vicryl.
10. For vertically oriented medial thigh lift, anterior incision is made down to the deep fascia that is subsequently elevated.
11. Fat tissues are preserved and the skin is merely undermined near the groin area.
12. Adjacent edges of the wound are re-approximated.
13. In each thigh, a Blake drain is placed, exteriorized, and fixed with 3-0 nylon sutures.
14. The fascia is approximated using 2-0 Vicryl anchoring sutures.
15. The subdermal layer is closed using 3-0 Monocryl sutures.
16. The skin is closed with 4-0 Monocryl sutures.
17. Dressing applied.

Postoperative Care

1. Monitor vitals, urine output, and drainage.
2. Adequate control of blood pressure and body temperature.
3. Pain control.
4. Antibiotics therapy with beta-lactams for Gram-positive microorganism coverage or clindamycin (in case of allergy to penicillin).
5. Compressive garment.
6. Drains and wound care.

Operative Note

Diagnosis: Medial thigh skin and soft tissue laxity.

Procedure: medial thigh lift.

Indications

This is a _____ presenting with medial thigh skin and soft tissues laxity post massive weight loss. The risks and the benefits of the procedure have been discussed with the patient who agreed with the treatment plan.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating theater and placed in supine position with the lower extremities positioned in frog-leg fashion. Time-out among the operating theater staffs was taken. Preoperative antibiotics were administered. General anesthesia was instituted. Prepping of both lower extremities was done from the level of the anterior superior iliac crests down to the midlegs and allowed to dry completely. The patient was then draped in the standard sterile surgical manner. Kline solution of 1 L of normal saline solution diluted with 1 ampule of 1:1000 epinephrine and 2 % lidocaine was prepared and injected throughout the medial aspect of each thigh.

Liposuction on the medial aspect of each thigh was performed between the markings designed preoperatively for the medial thigh lifting. Liposuction was continued until all the subcutaneous fat was removed. At first, Lockwood's medial thighplasty was performed. The incision, based on the preoperative markings, was made down to the fascia lata laterally, and the anterior medial thigh was undermined only lateral to the femoral triangle. Medially, the incision was carried only to the superficial fascia. Care was taken during dissection at the level of the fascia between the fatty layers to preserve the lymphatic and to prevent the formation of seroma and lymphoceles. By applying lateral traction to

the dissected tissues, Colles' fascia was identified. Following broad undermining of the thigh flap and excision of the redundant skin, the flap was stretched superiorly and anchored securely to Colles' fascia using 2-0 Vicryl sutures. To remove excess vertical skin laxity, the decision was made to add the vertically oriented medial thigh lift to the procedure. Anterior incision was made first down to the deep fascia that was subsequently elevated. Care was taken to avoid the saphenous vein. In an attempt to preserve the lymphatic network, all fat tissues were preserved, and the skin was merely undermined during proximal dissection near the groin area. Following hemostasis, and copious irrigation, the adjacent edges of the wound were tailor-tacked using skin staplers in a sequential and gradual manner. Excess skin was excised. All the staples were removed. Blake drain was placed in each thigh, exteriorized, and suture anchored with 3-0 nylon sutures. The fascia was approximated using 2-0 Vicryl anchoring suture in a water-tight fashion in a sequential manner. The wound was closed using 3-0 Monocryl subdermal sutures in a water-tight fashion, followed by 4-0 Monocryl running subcuticular sutures. Steri-strips were applied along the entire length of the wound, followed by dressings.

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Gluteal Auto-augmentation

23

Nazareth J. Papazian, Bishara Atiyeh, and Amir Ibrahim

Indications

Buttock ptosis, skin laxity, and platypygia (flattening of the buttocks) postmassive weight loss.

Possible Complications

1. Recurrent ptosis
2. Scar widening
3. Asymmetry
4. Insufficient volume to overcome the gluteal flatness
5. Point of maximal projection lying above the transposed level of mons pubis (higher than ideal)
6. Bleeding and/or hematoma
7. Infection
8. Seroma
9. Fat necrosis and/or oil cysts

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Essential Steps

Preoperative Markings

1. Preoperative markings are made with the patient in the standing position.
2. The upper incision line determines the final position of the postoperative scar and is drawn along the patient's wishes while pulling the gluteal skin down so that it can be hidden by a low-cut bathing suite.
3. If the patient agrees to a high position scar, the line is drawn at the level of the waistline parallel to the iliac crest convexity joining in the midline at the upper level of the midline gluteal crease.
4. The amount of skin and subcutaneous tissue that can be safely excised is estimated by pushing the gluteal areas and lateral thighs upward, and a line is drawn at a level where the gluteal skin may reach the upper drawn line.
5. The upper and lower lines thus determine bilateral adipodermal flaps based medially that can be transposed or rotated for auto-augmentation. The extent and type of mobilization of these flaps will depend on existing anatomical laxity and specific patient requirements.
6. All markings are checked intraoperatively with the patient in the prone position and the hips slightly flexed by applying staples to join

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the upper and lower lines before any incisions are made. Only the level of the lower line may be modified accordingly.

Intraoperative Details

1. General anesthesia is instituted.
2. Placed in prone position.
3. The back and the lower extremities are prepped and draped in the usual manner.
4. Kline solution (1 L of normal saline 0.9 % solution mixed with 1 ampule of 1:1000 epinephrine and 25 mL of 2 % lidocaine) is prepared and injected along the incision lines and in areas needing liposuction. No infiltration is made to the tissues that would potentially be used for auto-augmentation.
5. The upper incision is performed first over the lower back and extended laterally to both flanks then followed by the marked lower incision.
6. Incision is carried down to reach Scarpa's subfascial plane. The area between the two incisions is de-epithelialized.
7. The flaps are raised from lateral to medial till reaching the superior gluteal artery perforators around 5–7 cm off the midline of the back.
8. Gluteal undermining is performed bilaterally to create a pocket in each buttock.
9. Both adipofascial flaps are rotated downward, into the pockets, and fixed with 0-Vicryl.
10. The flaps are trimmed as required.
11. A 15-Fr Blake drain is inserted beneath each flap and fixed with 3-0 nylon bilaterally.
12. The gluteal skin is advanced cephalad over the flaps, and the wound is closed by approximating the Scarpa's fascia with 2-0 Vicryl.
13. The deep dermal layer is closed with 3-0 Monocryl.
14. The skin is closed using 4-0 Monocryl.
15. Dressings are applied.

Postoperative Care

1. Monitor vitals, urine output, and drainage.
2. Adequate control of blood pressure and body temperature.
3. Pain control.
4. Antibiotics prophylaxis therapy for two doses postoperatively.
5. Compressive garment.
6. Drains and wound care.

Operative Note

Diagnosis: Gluteal ptosis, skin laxity, and platypygia postmassive weight loss.
Procedure: Gluteal auto-augmentation.

Indications

This is a patient presenting with gluteal ptosis, skin laxity, and platypygia (flattening of buttocks) postmassive weight loss. The risks and the benefits of the procedure have been discussed with the patient who agreed with the plan of care.

Description of the Procedure

After obtaining a detailed informed consent, the patient was taken to the operating theater; a proper time-out among the operating theater staff was done. Preoperative antibiotics were given 30–60 min prior to skin incision. General anesthesia was instituted. The patient was placed in the prone position. Prepping of the back, the buttocks, and both lower extremities was done and allowed to dry completely. The patient was then draped in the standard sterile surgical manner. Kline solution (1 L of normal saline 0.9 % solution mixed with 1 ampule of 1:1000 epinephrine and 25 mL of 2 % lidocaine) was prepared and injected over the back and the buttocks. With a sharp #15 scalpel, an incision was performed over the back reaching laterally to both flanks along the markings designed previously. Dissection was deepened reaching the Scarpa's fascia and going into a plane deep to this fascia. Two flaps were raised on both sides from lateral to medial until reaching the superior gluteal artery perforators around 5–7 cm off the midline of the back. Both flaps were de-epithelialized

using #15 scalpel leaving dermis to preserve the subdermal plexus blood supply.

Undermining using electrocautery was performed to create two pockets in both buttocks bilaterally down to few centimeters above the infragluteal fold. Both adipofascial flaps were rotated downward for inset in the pockets created in the buttocks. Both flaps were fixed with interrupted 0-Vicryl. Some fat resection from both flaps was performed in order to create a natural contouring of the buttocks bilaterally. Two Blake 15-Fr drains were inserted beneath the flaps, exteriorized, and fixed with 3-0 nylon bilaterally. Approximation of Scarpa's fascia was performed with 2-0 Vicryl in a water-tight fashion-interrupted sutures. The skin was closed with 3-0 Monocryl inverted water-tight fashion-interrupted sutures. This was followed by 4-0 Monocryl subcuticular continuous fashion. Dressing was applied.

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Brachioplasty

24

Dennis J. Hurwitz

Indications

1. Excess hanging skin of the arm along with an oversized and/or wrinkled axilla
2. Excess adipose of the upper arm
3. Excess hanging skin of the upper arms restricting physical activity, such as swimming and upper body exercises

Essential Steps

Preoperative Markings

Preoperative markings are precise and faithfully followed during the skin and soft tissue resection:

1. The upper arm is marked while extended 90° from the chest, and the lower arm is flexed about 90° at the elbow with the hand pronated. Later the arm is fully extended at the shoulder and elbow to confirm lengths and line congruity. The goal on the arm is to draw a hemi-elliptical excision that removes all excess skin, suspends the proximal posterior arm, and raises the posterior axillary fold while leaving a medial posterior curvilinear scar from the medial elbow to near the posterior arm and then to rise up to the apex of the axilla. The closure turns 90° at the apex of the axilla to descend down the upper chest.
2. All surgical incisions are placed on the medial aspect of the arm, continued through the axilla to end along the mid-lateral chest.
3. Marking for the anterior incision starts with three dots placed slightly superior to the bicipital groove. The first dot is at the deltopectoral groove, the second dot is at the midportion of the arm within a centimeter superior to the bicipital groove, and the third dot is near the medial epicondyle. These dots are then connected as a sloping straight line.
4. Marking the posterior incision line starts by doting the maximum width of skin resection by forcibly gathering the skin of the posterior arm to the middle dot of the anterior incision line and marking the fourth dot for the posterior incision line. This point is difficult to judge in adipose laden arms, requiring considerable liposuction. Based on the magnitude of skin excess, the posterior line slopes anteriorly toward the axilla to end at the fifth dot. That dot can be pinched approximated to dot 1 at the deltopectoral groove.

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5. Anterior straight line through the first three dots can now be tape measured in length and adjusted to be equal to posterior line 3-4-5 or roughly 25 cm.
6. The posterior line through dots 3, 4, and 5 turns 90° onto the chest taking care to leave an ample cuff of medial skin along the posterior axillary fold to end at dot 6 which can be at the second, third, or fourth rib, depending on the lateral chest skin laxity. A perpendicular is drawn from dot 1 to 6 posterior to the lateral pectoral fold. This anterior chest incision line bows from dot 1 to dot 6. Line through dots 1 through 6 equals the length of line through dots 5 to 6 and excess skin between these lines can easily be pinched together.
7. Mark the areas of excision site and needed cosmetic liposuction of the arm.
8. The width of resection is slightly underestimated, which allows for safe closure and expeditious wound edge excision for a tighter closure.

Intraoperative Details

1. As an isolated operation, circumferentially prep patient's arms and lateral chest, and then dress in a paper surgeon's gown, opened in the front.
2. Placed in supine position with arms loosely strapped to articulating arm boards about 80° away from the operating room table.
3. General anesthesia or monitored anesthesia care.
4. Untie and open the gown, and with sterile scissor, slit open the sleeves.
5. Continue sterile towel and sheet draping.
6. Infiltrate the excision site with your usual liposuction tumescent fluid that includes epinephrine. Then infuse further fluid into cosmetic areas of liposuction as needed.
7. Complete excision site liposuction (ESL) followed by cosmetic liposuction as indicated with ultrasonic assisted liposuction (UAL).
8. Incise the perimeter markings until the subcutaneous tissues open up.
9. Undermine skin edges slightly.
10. Avulse/resect the arm skin at the dermal subcutaneous junction in the arm and deeper as needed in the lateral chest. A defatted subcutaneous architecture with most retained neurovasculature is seen.
11. Suture suspend the subcutaneous tissue from dot 5 of the posterior line to dot 1 into the deltopectoral fascia.
12. Confirm adequacy of width of resection, and resect more skin along the wound margins as needed.
13. Two-layer closure starts with #1 PDO Quill in the subQ and ends with intradermal 3-0 Monoderm.
14. Skin glue, followed by elastic sleeves, taking care to alleviate excessive compression across the axilla.
15. Save resected skin in refrigerator or later grafting of the wound, if there is any concern for over resection or vascular compromise.

Postoperative Care

1. Control blood pressure and pain. Arms are elevated on pillows.
2. Severe pain, distal swelling, or discoloration prompts return visit, adjustment of wraps and possible opening of the incision to avoid skin or vascular compromise.
3. Patient is seen in 72 h to change the dressing and check the wound. Note ischemic tissues and treat appropriately.
4. Patient can shower and then reapply garment or an ace wrap.
5. Any suture line healing delay or wound collections are managed on a weekly basis.
6. Daily use of elastic support of the upper arms is discontinued in a month but may be prolonged until there is no further issue with swelling.
7. Patients with a tendency toward thickened scars are encouraged to purchase the Embrace program and use it for a month.
8. Patients cautioned that fully mature scar healing may take over 3 years, especially near the elbow.

Possible Complications

1. Delayed healing along the closure due to dehiscence, drainage, and edgewise skin necrosis
2. Scar constriction at the axilla requiring a secondary Z-plasty
3. Permanent long thickened scar
4. Prolonged pain, arm swelling
5. Prolonged numbness and/or distal arm weakness due to nerve injury
6. Asymmetry in contour and/or scar position
7. Excessive tightness or residual skin laxity

Operative Dictation

Diagnosis: Laxity of the skin of the upper arm, axilla, and lateral chest with excess adiposity.

Procedure: L brachioplasty with excision site and cosmetic ultrasonic assisted liposuction (UAL).

Indication

This is a woman with significant skin laxity and excess adiposity of the upper arm, axilla, and lateral chest. She desires smaller and better contoured upper arms with reduction in the size of the axillae and some reduction of the lateral chest rolls. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room. While sitting, her upper body outstretched arms, breasts, and neck were prepped with antiseptic solution. She was dressed in a surgeon's gown with the opening tied in the front. She was laid supine with her arms placed on arm board that were articulated at 80° from the operating room table. Time out among operating room staffs was taken. Monitor anesthesia care was instituted. Preoperative intravenous antibiotics were infused. As the patient was induced under anesthesia, the surgeon's gown was untied and opened along the arms with sterile scissors, and sterile draping was completed. The patient's and surgeon's name, operation, and all safety and fire precautions were announced.

For the purpose of liposuction, buffered normal saline with Xylocaine and epinephrine were infused, first within the arm excision site until tensely expanded and then elsewhere in the planned areas of UAL until the tissues were firm. While the epinephrine was taking effect, the ultrasonic system was set up. A three-ringed, 2.7 mm diameter solid probe was tightly screwed to the VASER electronic handle. Fifteen minutes after the start of infusion, this ultrasonic probe was introduced through an unprotected skin incision within the excision site near the elbow. With the VASER mode set at 8, the probe was passed with deliberate long strokes through the excision site fat. At first, the passes were firmly against the dermis and then progressively deepened in a laminar manner. The helping hand was delivering the fatty tissue to the probe. When no significant resistance was felt, the UAL probe was moved to the other areas of the arm needing cosmetic reduction of fat. Then a 3 mm diameter, three-holed VenTx cannula was attached to the suction tube. All layer vigorous suction passes evacuated most all fat from the excision site, leaving a visible depression outlined by the perimeter excision markings. Far less fat was removed from the cosmetic areas of excess fat.

With the assistant retracting the medial skin, the surgeon made the posterior incision through the dermis from the lateral chest, across the axilla, to the posterior margin of the arm, ending at the elbow. The wound margin was undermined several centimeters. The posterior flap was temporarily aligned to the proposed anterior incision with towel clips and found to be suitable. The towel clips were removed. The entire anterior incision was made from the lateral chest, across axilla, and then along the upper arm. The isolated excess skin and fat were excised down to the lateral muscular chest wall. Hemostasis was obtained by electrosurgery. The excision was sharply continued between the subdermis of the

axilla and the clavipectoral fascia. Upon reaching the arm, the skin was broadly and firmly retracted distally with a Friedman multipronged facelift retractor to avulse the skin with assisting scalpel cuts. The skin scalpel avulsion was virtually bloodless. A 2-0 Vicryl suture was passed through the subcutaneous fascia of the proximal posterior based triangular flap and then passed through the Deltopectoral fascia. Tying this suture advances point 5 to point 1 to suspend the posterior arm incision. Starting at the proximal arm, a #1 PDO Quill, double armed suture was passed horizontally to close the subcutaneous tissue of the arm, axilla and proximal lateral chest. 3-0 Monoderm was run intradermally to complete the two-layer closure. No drains were used. The dermal glue sealed and supported the skin.

First, the right arm was treated and then the left. My assistant evacuated the excess fat from the opposite site as I was completing the right arm. The left arm was completed as marked. Symmetry appeared to be achieved.

Labia Minora Reduction

25

Christopher J. Salgado, Lydia A. Fein, Noor Joudi, and Rebecca C. Novo

Indications

1. Congenital or acquired labia minora hypertrophy
2. Emotional or psychological distress caused by appearance of labia minora or sequelae of hypertrophic labia minora such as sexual dysfunction, dyspareunia, chronic irritation, or limitation of certain physical activities

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Essential Steps

Preoperative Markings

1. Minimal tension on each labium minora outwardly to determine the appropriate area for resection.
2. Mark the central wedge to be resected keeping a minimum of 1–2 cm of labia minora tissue from its base. On the internal and external aspects of each labium minora, draw a line from the free edge of the upper third of the labium to the base of the labium (1–2 cm from the actual base of the labium minora). Draw a second line below the first line again from the free edge to the base, converging on the same point to form a "V." (*Alternatively, two Z-plasties can be drawn instead of straight lines*.)

Intraoperative Details

1. Positioning: Lithotomy or supine with hips and knees flexed and heels together (pad common peroneal nerve if in lithotomy position).
2. Anesthesia: General, monitored anesthesia care with local or straight local anesthetic.
3. Shave the vulva for optimal exposure of surgical site.

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4. Infiltrate the site using a 27–30 gauge needle with local anesthetic plus 1:100,000 epinephrine after marking with surgical pen.
5. Use the same amount of local anesthetic on each side.
6. Incise the skin/mucosa and subcutaneous tissue along the markings to resect a central wedge of labium minora. Do not over-excise subcutaneous tissue in order to ensure a good cosmetic result.
7. After obtaining hemostasis, close the subcutaneous tissue in two layers (external and internal) using 4-0 absorbable sutures on a tapered needle.
8 Re-approximate the skin, and close without tension using a 5-0 absorbable suture on a tapered needle in a vertical mattress fashion.
9. Repeat the resection and closure on the other labium minora, and compare the labia for symmetry.

Postoperative Care

1. Control blood pressure and pain in the immediate postoperative setting. Patients can typically be discharge home the day of procedure if vital signs are stable and pain controlled.
2. Postoperative instructions for patients include:

(a) Keep incisions clean and dry and topical Estrace cream applied daily.
(b) Avoid sexual intercourse and strenuous activity for 6 weeks.
(c) Shower after 24 h, and cleanse the wounds with soap and water, being sure to dry well afterwards; wounds should be cleansed daily.

Possible Complications

1. Over-resection
2. Wound dehiscence
3. Scarring, asymmetry
4. Dyspareunia
5. Hematoma
6. Infection

Operative Dictation

Diagnosis: Labial hypertrophy.
Procedure: Central wedge resection labiaplasty.

Indication

This is a 24-year-old woman with hypertrophic labia minora that causes pain, irritation, dyspareunia, and interference with sexual function and physical activity to the point of causing significant emotional and psychological distress. The patient understands the benefits, risks, and alternatives associated with the procedure. She wishes to proceed.

Description of the Procedure

Following informed consent verification, the patient was taken to the operation room and transferred to the operating table in a supine position. Sequential compression devices were placed on bilateral lower extremities. Anesthesia was induced and preoperative antibiotics administered. Time out among operating room staff was performed. The patient was placed in lithotomy position, the vulva was shaved, and the patient was prepped and draped in normal sterile fashion. The skin around the incision marking was infiltrated with 1 % lidocaine with 1:100,000 epinephrine using a 30 gauge needle. A similar amount was used on each side. Using 2.5 loupe magnification, a #15 surgical scalpel, the skin was incised along the markings through the subcutaneous tissue and a central wedge excised to create anterior and posterior labial flaps. Hemostasis was achieved with electrocautery. The subcutaneous tissue was closed in two layers with absorbable sutures and the skin edges re-approximated with 5-0 absorbable suture in vertical mattress fashion. Attention was then turned to the next labium minora, and excision of the central labial wedge through to the subcutaneous tissue and within the demarcated area occurred.

Hemostasis was again achieved and the subcutaneous and skin layers closed as previously described. The labia minora were then compared for symmetry. Two fingers were inserted into the vagina to ensure appropriate patency of the vaginal canal and integrity of introitus. Topical antibiotics were placed on the suture lines, and the wounds were dressed. The patient tolerated the procedure well. All instrument, needle, and sponge counts were correct. The patient was taken to recovery in stable condition.

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Lateral Colporrhaphy

26

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Indications

1. Vaginal laxity
2. Decreased vaginal sensation

Essential Steps

Preoperative Markings

1. The posterolateral aspect of the vaginal wall can be marked bilaterally at the introitus to ensure that the surgical incisions are symmetrical.

Intraoperative Details

1. General anesthesia.
2. Place patient in lithotomy position.
3. Properly prep the vulva (including mons pubis), vagina, and perineum.
4. Drain bladder with in-and-out catheter and avoid placing a Foley catheter.
5. Use a Lone Star retractor or Allis clamps to retract labia majora, labia minora, and introitus laterally (level of hymenal ring).
6. Infiltrate the bilateral posterolateral vaginal walls with lidocaine with 1:100,000 epinephrine.
7. On each side of the vagina, resect an ellipse-shaped region of vaginal mucosa at the border of the lateral and posterior vaginal wall, extending from the introitus to the apex. The size of each ellipse depends on the desired level of tightening.
8. Reapproximate and close the remaining vaginal mucosa in one or two layers.

Postoperative Care

1. If patient cannot void spontaneously following surgery, insert a Foley catheter, and drain the bladder for the next 24 h.
2. Patients should be instructed to refrain from activities for several weeks that will cause strain on the surgical site, including lifting,

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coughing, long periods of standing, sneezing, and straining with bowel movements. Pelvic rest for a minimum of 4–6 weeks (nothing introduced into the vagina/no sexual intercourse).
3. Postoperative follow-up scheduled at 1–2 week, 6 weeks, 3 months, and 6 months.

Possible Complications

1. Localized infection.
2. Postoperative bleeding.
3. Wound breakdown.
4. Recurrent vaginal laxity or decreased sensation.
5. Overcorrection resulting in a very narrow vaginal canal.
6. Vaginal pain.
7. Dyspareunia.
8. Granulation tissue.
9. Other complications are very rare but may include cystotomy, proctotomy, fistula, and others.

Operative Dictation

Diagnosis: Vaginal laxity
Procedure: Lateral colporrhaphy

Indication

This is a __ yo P__ woman with long-term history of decreased vaginal sensation due to laxity of the vaginal wall.

Description of the Procedure

The patient was taken to the operating room and placed in supine position. Sequential compression devices were applied to lower extremities. General anesthesia was induced. Once under anesthesia, she was placed in lithotomy position. A time-out was done and the patient examined. The vagina, vulva, and perineum were prepped and draped in the usual sterile fashion. A 12–14 French catheter was used to drain the bladder. A Lone Star retractor was used to retract the labia majora/minora and vaginal opening (*this can also be retracted with Allis clamps or stay sutures*). The right posterolateral vaginal wall was infiltrated with Lidocaine with 1:100,000 epinephrine. A 15-blade scalpel was used to make an elliptical incision extending from the vaginal apex to the posterior introitus centered on and around the right posterolateral edge of the vagina. The mucosa was sharply resected away from the underlying muscularis layer using curved Metzenbaum scissors. The remaining vaginal mucosa was reapproximated and closed in two layers using 2-0 Vicryl suture in a running fashion. This same procedure was then performed on the contralateral or left side. Two fingers were inserted into the vagina to ensure appropriate patency of the vaginal canal and integrity at the level of the introitus. The patient tolerated the procedure well. All counts were correct times two. The patient was extubated and taken to recovery in stable condition.

Suggested Reading

Adamo C, Corvi M. Cosmetic mucosal vaginal tightening (lateral colporrhaphy): improving sexual sensitivity in women with a sensation of wide vagina. Plast Reconstr Surg. 2009;123(6):212e–3.

Part II

Breast

Inframammary Fold (IMF) Approach to Subpectoral Breast Augmentation

27

Urmen Desai and Wrood Kassira

Introduction

Breast augmentation is the most common aesthetic surgical procedure performed in the United States [1]. Because of this, adequate preoperative surgical planning, mastery of the intraoperative surgical technique, thorough postoperative care, and ability to recognize potential postoperative complications are vital. In order to address patient goals and expectations, a discussion with your patient regarding the type of implant (silicone vs. saline, smooth vs. textured, anatomic vs. round), location of incision (inframammary, periareolar, transaxillary, transumbilical), and location of implant pocket (subfascial, subglandular, submuscular, subpectoral with dual plane I, II, or III) should take place. Thorough preoperative planning and patient education are essential for an ideal aesthetic result and patient satisfaction [2].

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Indications

1. Correct significant breast hypoplasia
2. Improve upper breast pole fullness and establish medial cleavage
3. Provide symmetry to developmentally asymmetric breast
4. Reestablish breast fullness after postpartum deflation
5. Create proportionality between upper body and lower body contour
6. Enhance patient self-image and self-confidence

Essential Steps

Preoperative Markings and Preparation

1. Obtain detailed preoperative History and Physical, American Society of Plastic Surgeons (ASPS) consent titled "Breast Augmentation—Silicone Gel" or "Breast Augmentation—Saline Implant," and preoperative photo-documentation.
2. Examine the patient with careful documentation of any signs of chest wall deformity, spinal curvature, asymmetry of breast size, nipple position, or inframammary fold (IMF) position. While palpating the breast

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for dominant masses or suspicious lymph nodes, carefully assess the quantity and compliance of the breast parenchyma and soft tissue envelope as well as skin elasticity with a pinch test.

3. With the patient standing in the upright position, measure the patient's breast base diameter (BD), the breast height, distance from the nipple-areolar complex (NAC) to the inframammary fold (IMF), the distance from the suprasternal notch to the nipple-areolar complex, and the intermammary distance [3].
4. Mark the patient's sternal notch, followed by a vertical marking along the midline chest from the suprasternal notch to the xiphoid process.
5. Next, mark the existing inframammary fold.
6. Finally, mark the surgical incision at the projected inframammary fold rather than in the existing fold in order to best camouflage the scar. The planned incision should be 2–4 mm or greater (depending on the size of the implant being used) below the preexisting inframammary fold. This allows for the scar to be best camouflaged into the postoperative inframammary fold, as the chest wall skin will rise by a few millimeters after the implant is inserted, so that the scar will be well concealed within the new inframammary fold.
7. Once the vertical position of the planned incision is determined, mark the horizontal incision 1 cm medial and 3 cm lateral (2 cm if saline is being used) to an imaginary vertical line from the nipple.
8. Start preoperative antibiotics (vancomycin 1 g IV one-hour prior to incision and Ancef 1 g IV).
9. Confirm operating table can properly flex for intraoperative breast implant evaluation.
10. Place preoperative photographs in clear view in operating room.
11. Discuss strict blood-pressure control with anesthesia colleague.
12. Make sure SCDs are on patient and power turned on prior to induction.
13. Secure arms abducted at 90° to the torso, shoulders square, wrapped in Kerlix roll and ACE bandage, with joint surfaces padded.

Intraoperative Details

1. Prep and drape patient in supine position.
2. Place Tegaderm over NAC to prevent contamination from organisms residing within mammary ducts.
3. Perform time-out.
4. Inject marked IMF incisions and subpectoral pocket with 50 mL of a 50:50 mixture of injectable normal saline and 1% lidocaine with 1:100,000 epinephrine.
5. Use #15 scalpel to make incision through epidermis 3 cm in length lateral to midline nipple and 1 cm medial.
6. Transition to Bovie to dissect through the dermis and subcutaneous skin.
7. Continue dissection through Scarpa's fascia.
8. With the assistance of a fiber-optic lighted retractor or headlight, identify the lateral boarder of the pectoralis major muscle.
9. Continue to release the pectoralis major muscle from lateral to medial until the sternal border (right: 7 o'clock position to the 3 o'clock position; left: 5 o'clock to the 9 o'clock position).
10. Transition to extended electrocautery tip.
11. Perform minimal lateral blunt dissection with a finger to avoid injury to the lateral neurovascular bundle to minimize postoperative paresthesias.
12. Leave pectoralis minor muscle down on chest wall.
13. Obtain meticulous hemostasis.
14. If a dual-plane dissection is preoperatively planned, retract pectoralis major muscle with an Allis clamp, and dissect along superficial surface of the muscle [4].
15. Place breast implant sizers.
16. Temporary closure with 2-0 Vicryl.
17. Sit patient upright for implant evaluation.
18. Mark areas which are under-dissected or any asymmetry.

19. Irrigate implant pocket with an antibiotic solution containing 50,000 units of bacitracin, 1 g of cefazolin, and 80 mg of gentamicin per 500 mL of saline [5].
20. Re-prep the skin with Betadine and redrape with four new surgical towels.
21. Change gloves prior to handling the implant.
22. Place implants with "no-touch" or "minimal touch" technique.
23. Temporary closure again with 2-0 Vicryl.
24. Sit patient upright for final implant evaluation.
25. Close with 2-0 Vicryl (superficial breast fascia), 3-0 Monocryl (dermal), and 4-0 Monocryl (skin).
26. Photo-document immediate postoperative result.
27. Apply dermabond or Steri-Strips.

Postoperative Care

1. Place surgical compression bra on patient.
2. Place breast bandeau superiorly.
3. Monitor in PACU for blood pressure, heart rate, nausea, and pain control.
4. Evaluate patient in PACU prior to discharge.
5. Patients should be discharged on a 3–5-day course of prophylactic oral antibiotics.
6. On the evening of POD#0, patients should sleep on their back with their head elevated.
7. Patients should be seen in follow-up at least 1 day, 1 week, 1 month, and 3 months after surgery with photo-documentation at each visit.
8. Instruction on implant massage should be performed at the 1-week postoperative visit.
9. Patients should refrain from taking aspirin, NSAIDs, smoking, drinking alcohol, and traveling for 2 weeks postoperatively.

Possible Complications

1. Ecchymosis
2. Paresthesias
3. Capsular contracture
4. Infection
5. Hematoma
6. Seroma
7. Tissue necrosis/poor healing
8. Implant rupture or deflation
9. Implant rippling
10. Implant malposition
11. Double-bubble deformity
12. Anaplastic large cell lymphoma (ALCL)

Operative Dictation

Diagnosis: Mammary hypoplasia
Procedure: Bilateral breast augmentation with silicone prosthesis, dual plane I
Implants:
Right: 550 cm^3 silicone high profile prosthesis
Left: 550 cm^3 silicone high profile prosthesis

Implant information:

	Left	Right
Reference number:	350-5504 BC	350-5504 BC
Lot number:	1234567	7654321
Serial number:	1234567-003	7654321-054

Brief History and Indications for Procedure

This is a woman who presented in consultation for breast enhancement. She complained of under projected breasts and lack of desired fullness particularly in the medial and superior aspect of her breasts. She was seeking prosthetic placement with silicone implants to meet this objective. After extensive consultation, she was deemed an appropriate candidate for surgery. Risks, benefits, and alternatives to the procedure were discussed, including but not limited to bleeding, infection, need for implant removal, implant extrusion, implant rupture, implant malposition, contour irregularities, seroma, changes in lactation, residual breast asymmetry, capsular contracture, breast ptosis, scarring, change or loss of nipple sensation, need for implant surveillance, and the need for reoperation. The more recent finding of a possible association of silicone breast implants with a rare lymphoma (ALCL) was also discussed. The patient was allowed to ask questions

throughout this discussion, and these were answered to the patient's satisfaction. She was an active participant regarding the choice of procedure, including incision site and implant type as well as the final breast prosthesis size. The surgery was scheduled following the signing of informed consent documents.

Description of the Procedure

The patient was seen in preoperative holding, and the medical records, lab values, preoperative photos, American Society of Plastic Surgeons (ASPS) consent, and patient expectations were reviewed. The procedure, risks as listed above, and benefits were again discussed in detail. Preoperative markings were made with patient awake in the standing position. These markings were discussed and demonstrated to the patient in a mirror. The planned incision, implant type, location, and approximate size were again confirmed with the patient who understood and agreed with the operative plan.

The patient was then taken to the operating room and placed in the supine position on the operating room table. All boney prominences were appropriately padded and protected. The arms were placed in 90° of abduction, and SCD's were applied to both lower extremities. A time-out was then performed, confirming the patient and the procedures to be performed. Uneventful general anesthesia was then established. Surgical prepping and draping was then done using Betadine solution in the usual sterile fashion after which a final time-out was taken to confirm the patient and procedure. Sterile Tegaderm dressings were placed over each nipple to prevent contamination of organisms from the mammary ducts onto the surgical field. A 50:50 mixture of injectable normal saline and 1 % lidocaine with 1:100,000 epinephrine were injected for hemostasis and postoperative analgesia with a total volume of 50 cm^3 into proposed incision sites, breast parenchyma, and beneath the pectoralis major muscle, particularly in the region of the sternal insertion.

Attention was then directed to the breasts. An incision was made along the inframammary fold with a #15 scalpel of approximately 4 cm in length. This incision was extended through the dermis with Bovie electrocautery. Hemostasis was achieved with continued use of electrocautery, and the Bovie was used to extend the incision in the superior direction down to the Scarpa's fascia. The lateral border of the pectoralis muscle was then grasped and elevated with an Allis clamp, and the subpectoral space was entered bluntly with finger dissection overlying a rib. The subpectoral space was confirmed with digital inspection. At this time, a fiber-optic lighted retractor was inserted, and the muscle and breast tissue was distracted superiorly. Blunt dissection was used at the lateral border of the pectoralis muscle, and electrocautery was used to undermine deep to the pectoralis in the subpectoral loose areolar plane superiorly. Next, an extended electrocautery tip was used to transect the inferior insertions of the pectoralis major approximately 0.5 cm anterior to the chest wall, taking caution to watch for and address any perforating vessels. This transection was started at the 7 o'clock position and was extended just to the underlying pre-pectoral fascia to the 3 o'clock position, thereby minimally lowering the inframammary fold. Minimal blunt dissection was performed laterally to continue the gentle round smooth contour to complete the implant pocket. At this time, visual and manual inspection of the pocket was performed to ensure a smooth contour and hemostasis. The pocket was irrigated with saline solution. A breast implant sizer was placed into the newly created pocket. A single 2-0 Vicryl suture was used to close the dermis and allow temporary approximation of the tissue to better evaluate the breast shape.

Attention was then turned to the left breast where an identical procedure was performed. The pectoralis muscle was freed from the 5 o'clock to the 9 o'clock position to create a pocket symmetric in size and shape to the right side. Once again, the newly created pocket was irrigated and breast implant sizer was placed. A single 2-0 Vicryl suture was used to temporarily close the dermis.

The patient was sat upright to evaluate for any asymmetry or under-dissection. Final corrections were performed, and the patient was seated back to the supine position.

Incisions were opened again, the pocket was irrigated with saline, and any necessary hemostasis was achieved with electrocautery and insulated forceps. The cavity was irrigated with an antibiotic solution containing 50,000 units of bacitracin, 1 g of cefazolin, and 80 mg of gentamicin per 500 mL of saline. The chest wall and inferior pole of the breast were re-prepped with Betadine and redraped with four new surgical towels. Surgical gloves were changed at this point in the procedure. The silicone prosthesis was opened and bathed in the antibiotic solution. Next, the implant was inserted into the subpectoral space in a "minimal-touch" technique. A single 2-0 Vicryl suture was used to close the dermis and allow temporary approximation of the tissue to better evaluate the final breast shape. The identical procedure was followed on the left side. Hemostasis was ensured, the cavity and implant were irrigated with antibiotic solution, and the implant was inserted and the dermis approximated.

The breasts were then evaluated for implant position and symmetry in both in the sitting and supine position from multiple angles and with distraction in multiple directions. Any necessary adjustments in pocket conformation were addressed at this time. Once satisfactory implant position and pocket shape were achieved, the patient was again placed in supine position, and the breast fascia was approximated with 2-0 Vicryl suture, followed by deep dermal approximation with 3-0 Monocryl and subcuticular approximation of the skin with a 4-0 subcuticular Monocryl suture. Finally, nipple-areolar viability was reassessed.

Steri-Strips were placed over the incisions, followed by a surgical compression bra which was placed on the patient. The patient was awakened uneventfully from anesthesia. The patient was then transferred to a stretcher and transported to the recovery room awake and in stable condition. The patient tolerated the procedure well and there were no complications. Confirmation was made that all sponge and needle counts were correct.

References

1. American Society of Plastic Surgery Top Five Cosmetic Surgical Procedures. http://www.plasticsurgery.org/news/plastic-surgery-statistics/2014-statistics/top-five-cosmetic-surgery-procedures-2014.html.
2. Adams Jr WP. The process of breast augmentation: four sequential steps for optimizing outcomes for patients. Plast Reconstr Surg. 2008;122(6):1892–900.
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Periareolar Approach to Dual-Plane Breast Augmentation

28

Urmen Desai and Wrood Kassira

Introduction

Over the last several decades, there have been significant changes in societal expectations of body image and an increasing acceptance of aesthetic surgery. This increased popularity demands improved preparedness and surgical expertise in breast augmentation [1]. Thorough preoperative planning and patient education are essential for an ideal aesthetic result and patient satisfaction [2]. Adequate preoperative surgical planning, mastery of the intraoperative surgical technique, thorough postoperative care and ability to recognize potential postoperative complications are vital. In order to address patient goals and expectations, a discussion with your patient regarding the type of implant (silicone vs. saline, smooth vs. textured, anatomic vs. round), location of incision (inframammary, periareolar, transaxillary, transumbilical), and location of implant pocket (subfascial, subglandular, submuscular, subpectoral with dual plane I, II, or III) should take place.

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Indications

1. Correct significant breast hypoplasia.
2. Improve upper breast pole fullness and establish medial cleavage.
3. Provide symmetry to developmentally asymmetric breast.
4. Reestablish breast fullness after postpartum deflation.
5. Create proportionality between upper body and lower body contour.
6. Enhance patient self-image and self-confidence.

Essential Steps

Preoperative Markings and Preparation

1. Obtain a detailed preoperative History and Physical, American Society of Plastic Surgeons (ASPS) consent titled "Breast Augmentation—Silicone Gel" or "Breast Augmentation—Saline Implant," and preoperative photo documentation.
2. Examine the patient with careful documentation of any signs of chest wall deformity,

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spinal curvature, asymmetry of breast size, nipple position, and inframammary fold (IMF) position. While palpating the breast for dominant masses or suspicious lymph nodes, carefully assess the quantity and compliance of the breast parenchyma and soft tissue envelope as well as skin elasticity with a pinch test.

3. With the patient standing in the upright position, measure the patient's breast base diameter (BD), the breast height, distance from the nipple-areola complex (NAC) to the inframammary fold (IMF), the distance from the suprasternal notch to the nipple-areola complex, and the intermammary distance [3].
4. Mark the patient's sternal notch, followed by a vertical marking along the midline chest from the suprasternal notch to the xiphoid process.
5. Next, mark the existing inframammary fold.
6. Finally, mark the surgical incision along the inferior half of the border between the areola and the breast skin from 9 o'clock to 3 o'clock positions. The length of this incision is the limiting factor for placement of larger silicone implants.
7. Start preoperative antibiotics (vancomycin 1 g IV 1 h prior to incision and Ancef 1 g IV).
8. Confirm operating table can properly flex for intraoperative breast implant evaluation.
9. Hang preoperative photographs in clear view in the operating room.
10. Discuss strict blood pressure control with anesthesia colleague.
11. Make sure Sequential Compression Devices (SCDs) are on patient and power turned on prior to induction.
12. Secure arms abducted at 90° to the torso, shoulders square, wrapped in Kerlix roll and ACE bandage, with joint surfaces padded.

Intraoperative Details

1. Prep and drape patient in supine position.
2. Place Tegaderm over Nipple-Areola-Complex (NAC) to prevent contamination from organisms residing within mammary ducts.
3. Perform a time-out.
4. Inject marked periareolar incisions and subpectoral pocket with 50 mL of a 50:50 mixture of injectable normal saline and 1% lidocaine with 1:100,000 epinephrine.
5. Use #15 scalpel to make incision through the epidermis.
6. Transition to Bovie to dissect through the dermis and subcutaneous skin.
7. Create a stair-step incision by dissecting in a subcutaneous plane to the inferior edge of the breast mound, as less of the breast parenchyma is disrupted and decreased trauma to mammary ducts.
8. Alternatively, dissect directly down to the pectoralis major fascia.
9. With the assistance of a fiber-optic lighted retractor or headlight, identify the lateral border of the pectoralis major muscle.
10. Continue to release the pectoralis major muscle from lateral to medial until the sternal border (right: 7 o'clock position to the 3 o'clock position; left: 5 o'clock position to the 9 o'clock position).
11. Transition to extended electrocautery tip.
12. Perform lateral blunt dissection with a finger to avoid injury to the lateral neurovascular bundle and to minimize postoperative paresthesias.
13. Leave the pectoralis minor muscle down on the chest wall.
14. Obtain meticulous hemostasis.
15. If a dual plane dissection is preoperatively planned, retract the pectoralis major muscle with an Allis clamp inferiorly and dissect along the superficial surface of the muscle until the inferior edge of the pectoralis major muscle is below the inferior border of the areola (dual plane I), at the level of the inferior border of the areola (dual plane II), or at the level of the superior border of the areola (dual plane III) [4].
16. Place breast implant sizers.
17. Temporary closure with 2-0 Vicryl.
18. Sit patient upright for implant evaluation.
19. Mark areas which are under-dissected or have any asymmetry.
20. Irrigate implant pocket with an antibiotic solution containing 50,000 units of bacitracin, 1 g of cefazolin, and 80 mg of gentamicin per 500 mL of saline [5].

21. Re-prep the skin with Betadine and redrape with four new surgical towels.
22. Change gloves prior to handling the implant.
23. Place implants with "no touch" or "minimal touch" technique.
24. Temporary closure again with 2-0 Vicryl.
25. Sit patient upright for final implant evaluation.
26. Close with 2-0 Vicryl (superficial breast fascia), 3-0 Monocryl (dermal), and 4-0 Monocryl (skin).
27. Photodocument immediate postoperative result.
28. Apply Dermabond or Steri-Strips.

Postoperative Care

1. Place surgical compression bra on patient.
2. Place breast bandeau superiorly.
3. Monitor in PACU for blood pressure, heart rate, nausea, and pain control.
4. Evaluate patient in PACU prior to discharge.
5. Patients should be discharged on a 3–5-day course of prophylactic oral antibiotics.
6. On the evening of POD#1, patients should sleep on their back with their head elevated.
7. Patients should be seen in follow-up at least 1 day, 1 week, 1 month, and 3 months after surgery with photodocumentation at each visit.
8. Instruction on implant massage should be performed at the 1-week postoperative visit.
9. Patients should refrain from taking aspirin, NSAIDs, smoking, drinking alcohol, and traveling for 2 weeks postoperatively.

Possible Complications

1. Ecchymosis
2. Paresthesias
3. Capsular contracture
4. Infection
5. Hematoma
6. Seroma
7. Tissue necrosis/poor healing
8. Implant rupture or deflation
9. Implant rippling
10. Implant malposition
11. Double-bubble deformity
12. Pneumothorax
13. Anaplastic large cell lymphoma (ALCL).

Operative Dictation

Diagnosis: Mammary hypoplasia

Procedure: Bilateral breast augmentation with silicone prosthesis, dual plane I.

Implants:

Right: 600 cm^3 silicone high profile prosthesis.

Left: 600 cm^3 silicone high profile prosthesis.

Implant information:

	Left	Right
Reference number:	350-5504 BC	350-5504 BC
Lot number:	1234567	7654321
Serial number:	1234567-003	7654321-054

Brief History and Indications for Procedure

This is a woman who presented in consultation for breast enhancement. She complained of under projected breasts and lack of desired fullness particularly in the medial and superior aspect of the breasts. She is seeking prosthetic placement with silicone implants to meet this objective. After extensive consultation she was deemed an appropriate candidate for surgery. Risks, benefits, and alternatives to the procedure were discussed, including but not limited to bleeding, infection, need for implant removal, implant extrusion, implant rupture, implant malposition, contour irregularities, seroma, changes in lactation, residual breast asymmetry, capsular contracture, breast ptosis, scarring, change or loss of nipple sensation, need for implant surveillance, and the need for reoperation. The more recent finding of a possible association of silicone breast implants with a rare lymphoma (ALCL) was also discussed. The patient was allowed to ask questions throughout this discussion, and these were

answered to the patient's satisfaction. She was an active participant regarding the choice of procedure, including incision site and implant type as well as the final breast prosthesis size. The surgery was scheduled following the signing of informed consent documents.

Description of the Procedure

The patient was seen in preoperative holding, and the medical records, lab values, preoperative photos, American Society of Plastic Surgeons (ASPS) consent, and patient expectations were reviewed. The procedure, risks as listed above, and benefits were again discussed in detail. Preoperative markings were made with the patient awake in the standing position. These markings were discussed and demonstrated to the patient in a mirror. The planned incision, implant type, location, and approximate size were again confirmed with the patient who understood and agreed with the operative plan.

The patient was then taken to the operating room and placed in the supine position on the operating room table. All bony prominences were appropriately padded and protected. The arms were placed in 90° of abduction and SCDs were applied to both lower extremities. A time-out was then performed, confirming the patient and the surgical procedures to be performed. Uneventful general anesthesia was then established. Surgical prepping and draping were then done using Betadine solution in the usual sterile fashion after which a final time-out was taken to confirm the patient and procedure. Sterile Tegaderm dressings were placed over each nipple to prevent contamination of organisms from the mammary ducts onto the surgical field. A 50:50 mixture of injectable normal saline and 1% lidocaine with 1:100,000 epinephrine was injected for hemostasis and postoperative analgesia with a total volume of 50 mL into proposed incision sites, breast parenchyma, and beneath the pectoralis major muscle, particularly in the region of the sternal insertion.

Attention was then directed to the right breast. An incision was made with a #15 scalpel approximately 4 cm in length along the inferior half of the border between the areola and the breast skin from 9 o'clock to 3 o'clock positions. This incision was extended through the dermis with sharp dissection. Hemostasis was achieved with electrocautery. Next, the Bovie was used to deepen the incision directly down to the fascia of the pectoralis major muscle. The lateral border of the pectoralis muscle was then grasped and elevated with an Allis clamp, and the subpectoral space was entered bluntly with finger dissection overlying a rib. The subpectoral space was confirmed with digital inspection. At this time, a fiber-optic lighted retractor was inserted, and the muscle and breast tissue were distracted superiorly. Blunt dissection was used at the lateral border of the pectoralis muscle, and electrocautery was used to undermine deep to the pectoralis in the subpectoral loose areolar plane superiorly. Next, an extended electrocautery tip was used to transect the inferior insertions of the pectoralis major approximately 1 cm superior to the chest wall, taking caution to watch for and address any perforating vessels. This was performed in a dual plane I fashion. This transection was started at the 7 o'clock position and was extended just to the underlying prepectoral fascia to the 3 o'clock position thereby minimally lowering the inframammary fold. Minimal blunt dissection was performed laterally to continue the gentle round smooth contour to complete the implant pocket. At this time, visual and manual inspection of the pocket was performed to ensure a smooth contour and hemostasis. The pocket was irrigated with saline solution. A breast implant sizer was placed into the newly created pocket. A single 2-0 Vicryl suture was used to close the dermis and allow temporary approximation of the tissue to better evaluate the breast shape.

Attention was turned to the left breast where an identical procedure was performed. The patient was sat upright to evaluate for any asymmetry or under-dissection. Final corrections were performed, and the patient was laid back into the supine position.

Incisions were opened again, and the pocket was irrigated with saline, and any necessary hemostasis was achieved with the electrocautery

and insulated forceps. The cavity was irrigated with an antibiotic solution of 50,000 units of bacitracin, 1 g of cefazolin, and 80 mg of gentamicin per 500 mL of saline. The chest was reprepped with Betadine and redraped with four new surgical towels. Surgical gloves were changed at this point in the procedure. The silicone prosthesis was opened and bathed in the antibiotic solution. Next, the implant was inserted into the subpectoral space in a "minimal touch" technique. A single 2-0 Vicryl suture was used to close the dermis and allow temporary approximation of the tissue to better evaluate the final breast shape. The identical procedure was followed on the left side.

The breasts were then evaluated for implant position and symmetry in both the sitting and supine position from multiple angles and with distraction in multiple directions. Any necessary adjustments in pocket conformation were addressed at this time. Once satisfactory implant position and pocket shape were achieved, the patient was again placed in supine position. The breast fascia was approximated with 2-0 Vicryl suture, followed by deep dermal approximation with 3-0 Monocryl and subcuticular approximation of skin with a 4-0 subcuticular Monocryl suture. Finally, nipple-areolar viability was reassessed.

Steri-Strips were placed over the incisions, followed by a surgical compression bra which was placed on the patient. The patient was awakened uneventfully from anesthesia. The patient was then transferred to a stretcher and transported to the recovery room awake and in stable condition. The patient tolerated the procedure well, and there were no complications. Confirmation was made that all sponge and needle counts were correct.

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1. American Society of Plastic Surgery Top Five Cosmetic Surgical Procedures. http://www.plasticsurgery.org/news/plastic-surgery-statistics/2014-statistics/top-five-cosmetic-surgery-procedures-2014.html.
2. Adams Jr WP. The process of breast augmentation: four sequential steps for optimizing outcomes for patients. Plast Reconstr Surg. 2008;122(6):1892–900.
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4. Tebbetts JB. Dual plane breast augmentation: optimizing implant-soft-tissue relationships in a wide range of breast types. Plast Reconstr Surg. 2001;107(5):1255–72.
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Transaxillary Endoscopic Breast Augmentation

29

Louis L. Strock, Tuan Anh Tran,
and Alexa M. Franco

Indications

1. Correct hypoplastic breasts
2. Desire for a remote or hidden incision
3. Absence of a well-developed inframammary fold to hide a crease incision below the horizontal visual axis
4. Absence of significant ptosis or tuberous breasts
5. Any patient who is otherwise a candidate for breast augmentation (as an isolated procedure)

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Essential Steps

Preoperative Markings

1. Mark the midline of the chest from the sternal notch to the level of costal margins, preoperative inframammary folds (both level and shape), planned modifications of the inframammary folds, and proposed axillary incisions.

Intraoperative Details

1. Placed in supine position with shoulders abducted to 90°.
2. General anesthesia with quick-acting muscle relaxation (to be used during muscle release).
3. Incision is centered in existing axillary crease, with posterior extension in a superior direction (mimicking a boomerang shape).
4. Superficial subcutaneous dissection anterior to the lateral border of the pectoralis major.
5. Entry into the subpectoral space under direct vision.
6. Bring a 10 mm 30° angled endoscope into the operative field and place in the Emory retractor.
7. Creation of an optical cavity between the pectoralis major and minor muscles, using endoscopic assistance.

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8. Endoscopic division of the pectoralis major and overlying fascia as planned for the given patient.
9. Agris-Dingman dissectors are used to confirm the peripheral extent of the tissue pocket medially, inferiorly, and laterally.
10. Hemostasis confirmed with endoscopic assistance.
11. Exact pocket dimensions tailored to the dimensions of the device selected.
12. Place the patient in a 45° sitting position.
13. Tissue pockets irrigated with normal saline followed by antibiotic solution.
14. Device placed with tissue retraction (Deaver retractors) adjacent to incisions.
15. Insertion sleeve (funnel) routinely used for gel implants.
16. Patient positioned in the upright position to assess device position and shape.
17. Identical procedure performed on contralateral side.
18. Assessment for symmetry and adjustments.
19. Subcutaneous and skin layers closed. Drains can be used if needed.
20. Pressure dressing to the chest, upper tissue tunnel, and incision areas placed.

Postoperative Care

1. Pressure dressing for 24–48 h.
2. Elastic wrap worn on upper chest above implants for 7–21 days, depending upon situation.
3. Ice packs applied to the chest.

Possible Complications

1. Hematoma
2. Capsular contracture
3. Implant malposition
4. Change in nipple or inner arm sensation (temporary if at all)
5. Seroma
6. Axillary banding (temporary with resumption of range of motion of arms)

Operative Dictation

Diagnosis: Hypoplastic breasts
Procedure: Transaxillary breast augmentation (endoscopic assisted)

Indications

This patient presents for breast enlargement. She is an appropriate candidate for breast implant placement. She specifically prefers that a hidden incision approach be used utilizing an incision at the top of her armpit. She has selected the implant type agreed upon during the consultation and is aware of the relative advantages and drawbacks of the device type chosen. She understands the benefits, risks, and alternatives associated with the procedure. She has reviewed and signed the practice/professional society consent form, the product manufacturer (as indicated) consent forms, and the surgical informed consent.

Description of the Procedure

The patient was given intravenous antibiotics. Sequential compression device was placed in preoperative holding area. The patient was taken to the operating room and placed in a supine position. Following the induction of general anesthesia, she was positioned with her shoulders abducted 90°. Her arms were padded and secured to the arm boards. She was prepped and draped to allow exposure to the entire chest including the axillary areas bilaterally.

An incision was placed, centered in an existing skin crease, in the apex of the patient's right axilla per preoperative marking. This incision was carried slightly superiorly in a posterior direction from the center point of the axillary apex, totaling 5 cm in length. Immediate subcutaneous dissection was performed to the lateral border of the pectoralis major muscle, following which the subpectoral space was entered under direct vision. A finger sweep technique was employed to facilitate creation of the initial separation plane between

the pectoralis major and minor muscles. Hemostasis was checked with the aid of a fiber-optic retractor. A 10 mm 30° angled endoscope was brought into the operative field and placed in the Emory retractor. The correct orientation of the camera was confirmed. With the aid of a spatulated suction cautery, an optical cavity was created under direct vision just below the undersurface of the pectoralis major muscle until the rib cage anatomy was delineated. Any bleeding points were addressed in a proactive manner. Once the optical cavity has been created, the undersurface of the pectoralis major muscle was visible in its entirety. Relative to the existing and desired inframammary fold levels, external markings were correlated with internal anatomy. The pectoralis major muscle and overlying fascia were divided at the desired level. A 1 cm cuff of pectoralis major muscle was left at the time of the release. Any bleeding points were addressed. The degree of dual plane tissue separation, or the distance between the cut surfaces of the pectoralis major muscle, was adjusted as desired. Agris-Dingman dissectors were used to confirm the peripheral extent of the tissue pocket medially, inferiorly, and laterally. The endoscope was reintroduced to facilitate any adjustments needed using direct visualization. The implant to be placed was selected, with the tissue pocket dimensions adjusted accordingly. The patient was then placed in a 45° sitting position, and the tissue pocket was irrigated with saline, followed by antibiotic solution. One inch Deaver retractors were used to create an adequate opening through the opening of the tissue tunnel for implant placement. An insertion sleeve (funnel) was used to facilitate implant placement. The patient was placed in 90 and 45° sitting positions to confirm adequate shape and device location. She was then returned to a supine position, and an identical procedure was performed on the contralateral side. The patient was again placed in sitting positions to facilitate any adjustments needed for optimal symmetry. On completion of this, she was returned to the supine position, and incisions were closed using 3-0 PDS in the deep dermal layer and 6-0 chromic on the skin edges. A pressure dressing was placed to maintain device position and keep the upper tissue pocket compressed. The patient was kept in a 45° sitting position with ice packs on the side of her chest in the recovery area.

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Transumbilical Breast Augmentation

30

Victoria Vitale-Lewis

Indications

1. Micromastia
2. Desire for larger breasts with smooth, round, saline implants
3. Correction of a mild breast size asymmetry
4. Camouflage mild ptosis and pseudoptosis

Essential Steps

Preoperative Markings

1. Mark the midline from the sternal notch to the umbilicus, a line from the superior umbilicus to each lateral nipple, the inframammary folds, and the implant pockets.

Intraoperative Details

1. Infiltrate the breasts and the abdominal tunnels along the marked line from the umbilicus to the breast with tumescent mixture of 0.75 cm^3 of epinephrine 1:1000 in 250 cm^3 of normal saline.
2. Incise the upper umbilicus from 3 to 9 o'clock, and dissect through subcutaneous tissue down to abdominal wall.
3. Make abdominal-to-breast tunnels by placing the triangular (bullet)-tipped dissector followed by the round-tipped dissector in deep subcutaneous tissue over abdominal wall and advance toward lateral nipple retracting breast and pectoralis muscle off chest wall by grasping externally.
4. Place a large retraction 0-Prolene suture under the muscle using a Keith needle to aid in retracting.
5. Pass notched right angle dissector through the tunnel into the breast, confirm subpectoral placement by tenting upward under lateral pectoralis, and dissect the preliminary pocket to the marked pocket limits.
6. Roll a deflated saline implant sizer and tubing into a sausage around the end of the endoscope, and pass into breast pocket. Grasping sizer externally to maintain placement, remove the endoscope.
7. Place endoscope into breast pocket and visualize correct placement of sizer in dual plane pocket.
8. Fill sizer to twice the anticipated implant volume with sterile normal saline and deflate to expected implant fill.
9. Refine pocket with blunt right angle dissector while sitting patient up to 90° to make adjustments with dissector until the result looks satisfactory.

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10. Deflate and remove sizer.
11. Using a catheter placed into breast pocket, irrigate pocket until clear with saline then with triple antibiotic solution.
12. Insert rolled, deflated, smooth, round, saline implant into pocket with no touch technique using fingers only to massage implant through tunnel into breast pocket.
13. Fill implant using closed filling system.
14. Sit patient up to 90° to check result.
15. Remove fill tube and close incision.
16. Apply TopiFoam to abdomen and wrap with ace wrap. Apply upper and lower strap type of brasserie.

Postoperative Care

1. Patient is seen in 1–3 days for breast and wound check. Dressings are removed and the patient is started on breast implant massage.
2. If an abdominal seroma is present, sterilely aspirate and reapply TopiFoam and ace wrap to abdomen for additional 48 h.
3. Patient is seen on day 7 postoperative for removal of subcuticular pullout suture.

Possible Complications

1. Abdominal seroma and/or temporary induration along tunnels.
2. Abdominal irregularities.
3. Precursors to this technique had higher rates of implant deflation leading to current modifications in the technique negating this issue.
4. Usual possible complications of breast augmentation by any approach which may require counter incision on breast to correct when using this approach.

Operative Dictation

Diagnosis: Bilateral micromastia

Procedure: Transumbilical subpectoral bilateral augmentation mammoplasty with smooth round saline implants

Indication

This female desires larger breasts. The risks and benefits of an augmentation mammoplasty to increase the size of her breasts are explained and she wishes to proceed.

Description of the Procedure

In the pre-operative holding room, in the upright position, the markings were placed on the patient, including the planned pockets, the midline, the inframammary fold, as well as a line subcutaneous tunnel from the umbilicus just lateral to the nipple, bilaterally. Preoperative antibiotics were given. The patient was taken to the operating room and placed on the operating table in the supine position with the arms at her sides. After general endotracheal anesthesia was achieved with anesthesia monitoring, the chest, upper arms, neck, and abdomen were all scrubbed and prepped with Betadine and sterilely draped. *If subglandular placement is desired*, *place arms at 90° and do not paralyze patient*. The supraumbilical area as well as the subcutaneous tunnels and breasts were infiltrated with a solution of 0.75 cm^3 of epinephrine 1:1000 in 250 cm^3 of sterile normal saline. The tunnels and breasts were infiltrated using the fine tumescent infiltrator.

After waiting adequate time for the hemostatic effect of the epinephrine, a curvilinear incision was made inside the superior portion of the umbilicus, and the dissection was carried down through the subcutaneous tissue to the abdominal wall using the scissors. A triangular-tipped dissector followed by a bullet-shaped dissector was introduced into the deep subcutaneous space over the abdominal wall, gently retracting the abdominal soft tissue off the underlying muscle and fascia and advanced toward the lateral aspect of each nipple. Passage of these dissectors beneath the pectoralis muscle was facilitated by manually holding the breast and pectoralis muscle upward applying upward traction. *If subglandular placement is desired*, *leave breast flat on the chest wall*. The notched right angle breast pocket dissector

was then passed into the pocket. The pocket was enlarged after confirming subpectoral placement by visualizing tension on the lateral aspect of the pectoralis major with the dissector. An implant sizer was then removed of air, rolled, and introduced using the endoscope tube into the submuscular pocket. Again, using the endoscope tube, now containing a 10.0 mm. zero degree endoscope with video monitoring, the subpectoral pocket was confirmed by visualizing the pectoralis major muscle anterior to the sizer at least in the upper portion of the breast to the nipple level. On the lower pole of the breast, the implant was confirmed in the subglandular space, confirming the dual plane nature of the pocket. *Some surgeons do not believe the procedure requires endoscopic assist*. The sizer was then inflated with sterile normal saline to twice the size of the anticipated implant. A blunt right angle breast pocket dissector was used to further dissect the breast pocket after deflating the sizers by one-half until the pocket appeared of the appropriate size and shape.

The patient was then placed in the upright position and adjustments were made in the pocket using the dissectors until in the upright position the breasts looked excellent, both in symmetry of size and shape as well as the level of the inframammary folds with the sizers in place filled to the anticipated amount of the implant. The patient was placed back again supine. The sizer was then deflated and removed. The pockets were irrigated with saline until the irrigant appeared clear. The pockets were then irrigated with a solution of 1 g of Ancef, 80 mg of gentamicin, and 50,000 units of bacitracin in 500 cm^3 of normal saline.

_____ *cc.,* _____ *profile* smooth, round, saline implants were then opened, checked for leaks, and evacuated of air. The implant was then rolled and placed in the pockets bilaterally using no touch technique and guided into the pockets with fingers, only. All contact with the implant was performed only following glove change. Using a closed filling system, each of the implants was filled with the appropriate amount of sterile normal intravenous saline. The patient was then placed in the upright position to 90°. The breasts looked excellent and had an excellent shape and symmetry.

The patient was then placed back in supine position. The implant fill tubes were removed. The periumbilical incision was closed with interrupted 5-0 Monocryl sutures subcutaneously and subdermally with the knots carefully inverted followed by a subcuticular 5-0 Monocryl suture in the skin. Steri-Strips and a gauze dressing were applied. The patient was placed in an upper and lower strap type of brasserie. Topifoam was applied to the abdomen and wrapped with an ace wrap.

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Periareolar Mastopexy

31

Maurice Y. Nahabedian

Indications

1. To elevate the position of the nipple areolar complex on the breast
2. Grade 1 breast ptosis

Essential Steps

1. For mild breast ptosis without glandular ptosis
2. Dermal scoring with mild undermining

Preoperative Markings

1. Delineate sternal midline.
2. Delineate inframammary fold.
3. Mark ideal position of the nipple areolar complex.
4. Eccentric or circular periareolar pattern.

Intraoperative Details

1. Eccentric periareolar incisions.
2. De-epithelize crescent of skin.
3. Score dermis.
4. Dermal and epidermal closure.

Postoperative Care

1. Keep incisions covered and dry × 72 h.
2. Postoperative antibiotics × 2–5 days.

Possible Complications

1. Delayed healing
2. Diminished nipple areolar sensation
3. Complex scar
4. Asymmetry

Operative Dictation

Diagnosis:

1. History of breast cancer
2. Contralateral breast ptosis
3. Breast asymmetry

Procedure: Unilateral periareolar mastopexy

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Indications

This is a middle-age female with breasts that demonstrate grade 1 ptosis. The plan is to perform an eccentric periareolar mastopexy for symmetry.

Description of the Procedure

The patient is marked in the preoperative holding area. The sternal midline and the inframammary fold were delineated. The ideal nipple position was marked and correlated to the level of the inframammary fold. The patient was taken to the operating room and placed in the supine position. Pneumatic compression garments were applied. Preoperative intraoperative antibiotics were intravenously administered. The patient was prepped and draped in the usual sterile fashion. A time-out was performed. The existing diameter of the nipple areolar complex was desired and delineated. An eccentric, superiorly oriented pattern was drawn around the nipple areolar complex. A #15 scalpel was used to incise around the eccentric pattern and the outlined nipple areolar complex. The upper crescent of skin was de-epithelized. The dermis was scored along the outer pattern and the peripheral skin of the breast was undermined approximately 1–2 cm using electrocautery. The field was irrigated with an antibiotic solution. Hemostasis was ensured using electrocautery. A 3-0 absorbable monofilament suture was used to align and suture the dermis of the nipple areolar complex to the dermis of the surrounding skin. A 4-0 absorbable monofilament suture was used as a subcuticular. This procedure was well tolerated without complications. Dressings were applied. Needle and sponge counts were correct.

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Vertical Mastopexy

32

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Indications

1. To elevate the position of the nipple areolar complex on the breast
2. Breast ptosis, grades I and II

Essential Steps

Preoperative Markings

1. With the patient standing upright, mark the sternal midline, bilateral breast meridian lines, and inframammary folds.
2. Mark ideal position of the nipple areolar complex.
3. Based around the selected nipple position, draw a circumareolar pattern, with the superior aspect 2 cm above the new nipple position.
4. The lateral, medial, and inferior markings should skirt borders of the areola, creating an oval (mosque-dome) shape, which includes the existing areola.
5. Important: The vertical component of the scar should not cross the inframammary fold.

Intraoperative Details

1. General anesthesia.
2. Place patient in supine position.
3. Inject the incision lines prior to initial incision with tumescent solution consisting of 1% lidocaine with 1:200,000 epinephrine.
4. Incise skin based on preoperative markings.
5. Mobilize a superiorly based parenchymal flap over the pectoralis fascia.
6. Suture the medial and lateral pillars together to narrow the breast and add support.
7. Close surgical incisions in layers.

Postoperative Care

1. Keep incisions covered and dry × 72 h.
2. Postoperative antibiotics × 2–5 days.

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3. Patient can return to desk work in 1 week.
4. Patients should be cautioned against heavy lifting or strenuous physical activity for a minimum of 6 weeks following the procedure.
5. Patient should be counseled that the initial postoperative appearance of the breast will be of an "upside-down" breast with exaggerated upper-pole fullness and that the final breast shape will not be apparent for 3 months.

Possible Complications

1. Delayed healing
2. Fat necrosis
3. Seroma
4. Diminished nipple areolar sensation
5. Complex scar
6. Asymmetry

Operative Dictation

Diagnosis: Breast ptosis and/or breast asymmetry
Procedure: Vertical mastopexy

Indication

This is a _____ with significant breast ptosis/breast asymmetry, who wants to restore a youthful appearance of her breasts. The risks, benefits, and alternatives to surgical intervention are discussed with the patient, who agrees to proceed.

Description of the Procedure

After the informed consent was obtained, the patient was marked preoperatively in the holding area. Patient was taken to the operating room and placed in supine position. Lower extremity sequential compression devices were placed and preoperative intravenous antibiotics were administered. General endotracheal anesthesia was induced. The patient's body was centered and the arms were padded and secured to allow the patient to be sat up intraoperatively. The patient was prepped and draped in the usual sterile fashion. A presurgical time-out was performed.

The incision lines, areas to be de-epithelialized, and surrounding area of resection were infiltrated with diluted 1% lidocaine plus epinephrine 1:200,000 to help with hemostasis and to provide additional anesthesia. A (38 or 42 mm) cookie cutter was centered over the nipple without undue tension on the skin. A skin incision was made around the newly marked areola, using #15 scalpel. The skin between the reduced areola and the outside border of the new areola window was de-epithelialized. Incisions were made along the preoperative markings. The intervening skin was de-epithelized. Skin along the lower half of the breast was widely undermined, leaving approximately 5 mm of fat on the skin flaps. Skin was undermined laterally, medially, and inferiorly down to the inframammary fold. Dissection was continued deep to the breast gland over the pectoralis major muscle along the lower half of the breast. The lower pole of the breast was delivered, and the gland was displaced medially and laterally. The lower pole was then divided along the medial edge of the window, allowing the mobilization of all the exposed breast tissue on a laterally based flap. The lateral glandular tissue was mobilized and superomedially advanced to fill out the central region of the breast behind and above the nipple-areola. Absorbable sutures were used to attach the lateral pillar glandular tissue to the pectoralis fascia at the base of the medial pillar. The medial glandular pillar was then approximated to the base of the lateral flap. Plication of the pillars from the inframammary fold to just below the areola was performed using absorbable sutures. The field was irrigated with saline solution, and hemostasis was meticulously achieved with Bovie electrocautery. The overlying vertical skin incision was closed temporarily with skin staples. The patient was placed in the sitting position to assess for symmetry, nipple position, shape, volume, and skin excess. A 3-0 absorbable monofilament suture was used to align and suture the dermis of the nipple areolar complex to the dermis of the surrounding skin. A 4-0 absorbable monofilament suture was used as a subcuticular. The vertical incision

was closed with interrupted 3-0 absorbable monofilament in the dermis. 4-0 Monocryl was used to close the skin in the subcuticular fashion. Steri-Strips were applied over the incisions followed by dry gauze and Tegaderm. A non-compressing surgical brassiere was applied. Patient tolerated the procedure well without any complications. She was extubated successfully and taken to post anesthesia care unit in satisfactory condition.

Suggested Reading

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Inferior Pedicle Reduction Mammaplasty

33

Maurice Y. Nahabedian

Indications

1. Breast reduction
2. Preservation of the nipple areolar complex on a pedicle

Essential Steps

1. Document mammary hypertrophy and symptomology.
2. Preauthorization for procedure.
3. Thorough understanding of the risks and complications.
4. Understand the vascularity to the breast and the nipple areolar complex.
5. Pedicle selection based on breast parameters.

Preoperative Markings

1. Sternal midline
2. Breast meridian
3. New position of the nipple areolar complex at the level of the IMF
4. Inverted T marking
5. Inferior pedicle marking

Intraoperative Details

1. Completed breast markings.
2. Periareolar incision.
3. De-epithelize the inferior pedicle.
4. Maintain vascularity of the nipple areolar complex via the subdermal plexus and the fourth intercostal artery and vein.
5. Dermoglandular parenchymal excision medially, laterally, and superiorly.
6. Temporary closure and contour assessment.
7. Irrigation, hemostasis, and drain placement.
8. Lateral revision via tailor-tack method following the lateral mammary fold.
9. Closure with absorbable sutures in dermis and subcuticular.

Postoperative Care

1. Drain care
2. Incisional care
3. Nipple areolar assessment
4. Postoperative bra (no underwire)
5. No strenuous activity for 4–6 weeks

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Possible Complications

1. Bleeding
2. Infection
3. Complex scar
4. Nipple necrosis
5. Incisional dehiscence
6. Fat necrosis
7. Loss of nipple areolar sensation
8. Inability to breast feed
9. Contour abnormality
10. Delayed healing
11. Poor outcome
12. Further surgery

Operative Dictation

Diagnosis:

1. Mammary hypertrophy
2. Back and neck pain
3. Bra strap indentations
4. Intertrigo

Procedure: Bilateral reduction mammaplasty

Indications

This is a woman with a history of bilateral mammary hypertrophy. Her primary complaints and reasons for the procedure are to reduce her back pain and neck pain. She has bra strap indentations and postural changes. Her current weight is 200 pounds and her height is 5'6" tall. Bra size is 38 DD. Dieting and weight loss measures have been ineffective. Mammogram is current and normal. She has no history of breast disease. She has been seen and evaluated in the office and found to be a good candidate for reduction mammaplasty. The procedure and the risks have been described in detail. She understands and wishes to proceed.

Description of the Procedure

The patient was marked in the preoperative holding area. Breast measurements were obtained and included the sternal notch to nipple distance, nipple to IMF distance, and the base diameter of the breast. The sternal midline, breast meridian, and the inframammary fold were marked bilaterally. The new position of the nipple areolar complex was marked and correlated to the level of the inframammary fold along the breast meridian. An inverted T pattern was delineated. The inferior pedicle was delineated with a base of 10 cm.

The patient was then transported to the operating room and placed in the supine position. Pneumatic compression devices were applied to both lower extremities. Intravenous antibiotics were administered. General endotracheal anesthesia was initiated. A surgical timeout was performed. A surgical timeout was performed. The chest was prepped and draped in the usual sterile fashion. The markings were re-delineated. The nipple areolar complex was inscribed with a 45 mm cookie cutter. A scalpel was used to incise around the epidermis of the nipple areolar complex. The inferior pedicle was also incised. The inferior pedicle was de-epithelized. The remaining incisions were then created. Medial and lateral dermoglandular wedge excisions were created taking care not to narrow the base of the inferior pedicle. The nipple areolar complex was maintained on a dermoglandular inferior pedicle of tissue. The chest wall attachments were maintained in order to include the intercostal and chest wall perforating vessels. The perfusion of the nipple areolar complex was assessed based on arterial and venous bleeding from the cut edges. The upper breast skin flaps were undermined to the pectoral surface. These upper skin flaps were contoured by excision additional fat and parenchyma to better contour the breast. The excised tissues were weighed in grams. The wounds were irrigated with an antibiotic solution. Hemostasis was achieved using electrocautery. The skin was temporary closed with staples and the patient was sat up to approximately 45°. The contour, volume, and symmetry were assessed. Laterally, the skin was plicated with staples using a tailor-tack approach to reduce the fullness. This was outlined, the staples removed, and the area was redelineated. A scalpel was used to excise the excess skin. The staples were all removed. The field was inspected for hemostasis and irrigated with a triple antibiotic solution. The inferior ped-

icle and nipple areolar complex were inspected for bleeding and tissue viability. The pedicle was oriented and the skin was realigned with staples. A closed suction drain was placed through the apex of the lateral incision and sutured with a 3-0 nylon. The area was reinspected for hemostasis. The skin was closed with a 3-0 absorbable monofilament in the dermis and a 4-0 as a subcuticular. A cookie cutter was used to delineate the site of the nipple areolar complex. The base of the areola was positioned at 5–6 cm from the inframammary fold. A scalpel was used to excise the skin. The nipple areolar complex was exteriorized and sutured in the same fashion. Steri-Strips and iodoform gauze were applied over the incisions followed by dry gauze and Tegaderm. A surgical bra was applied.

This procedure was well tolerated without complications. Needle and sponge count were correct.

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Expander to Implant-Based Reconstruction

34

Renee J. Gasgarth and Wrood Kassira

Indications

1. Desire for implant-based breast reconstruction
2. Ideally no radiation therapy to the site
3. Patient with previously placed tissue expander that recruited additional soft tissue coverage for an implant

Essential Steps

Preoperative Markings

1. The patient is marked in standing position.
2. The midline is marked with a vertical line extending from the sternal notch to umbilicus.
3. The current position of the inframammary fold is marked.
4. If there is asymmetry between inframammary folds, the desired location of the inframammary fold is marked by comparing the two sides.
5. The superior breast mound is marked.
6. Areas for capsulorrhaphy/capsulotomy are then marked with careful attention to the current versus desired position of the expander in a horizontal and a vertical plane.

Intraoperative Details

1. The patient is placed in supine position with bilateral sequential compression devices in place.
2. After induction of general endotracheal anesthesia, the arms are abducted and secured to the arm board with Kerlix roll and/or ACE bandage wraps.
3. IV prophylactic antibiotics are administered.
4. The entire chest is prepped carefully to include the anterior aspect of the shoulder and draped in the standard sterile fashion.
5. The skin is incised through the previous mastectomy and tissue expander scar to the level of the pectoralis muscle. Judicious excision of scar can be used for widened or irregular scars. *(Note that some surgeons prefer to use a new incision, which may be at the site of the desired inframammary fold. Also, we prefer to use a stair-step technique, but some surgeons make an incision directly from skin to capsule).*
6. A plane between the muscle and skin/subcutaneous tissue is raised superiorly.

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7. Electrocautery is used to incise the muscle parallel to the fibers through a separate incision, which is continued through the capsule.
8. The tissue expander is removed and sent as a gross specimen.
9. A capsulotomy is then performed by scoring the capsule 3–5 mm above the chest wall with electrocautery superiorly, medially, and inferiorly to reshape the pocket to an appropriate size. (It is rarely needed laterally). Superiorly the avascular plane between the chest wall and the pectoralis is entered and raised cephalad. Inferiorly, it is released to the level of the desired inframammary fold.
10. Warm saline is used to irrigate, and hemostasis is obtained with direct visualization and a lighted retractor.
11. Temporary sizers are placed and the skin is loosely re-approximated with interrupted sutures or staples. The patient is sat up. The form and position of each implant are assessed and adjusted as necessary.
12. The patient is returned to supine position and the sizers are removed.
13. After ensuring adequate hemostasis, the chest skin is re-prepped and draped with clean towels.
14. Clean gloves are then placed, and the pockets are irrigated with antibiotic irrigation consisting of 500 mL of normal saline mixed with 80 mg of gentamicin, 1 g of Ancef, and 50,000 units of bacitracin per side.
15. Using a no or minimal touch technique, the permanent implant is placed with careful avoidance of contact between the implant and skin.
16. The incision is then closed in layers: the muscle is re-approximated with 2-0 Vicryl or PDS, followed by closure of the dermis and then the skin.
17. Surgical glue is then applied.

Postoperative Care

1. If significant capsular work occurs, a round Jackson Pratt may be placed. It usually is removed at the first postoperative visit.
2. A surgical bra may be adorned.
3. Patients are instructed to avoid strenuous activity, heavy lifting, and raising arms above shoulder level for 3 months postoperatively.
4. Patients may shower 48 h after surgery or after the JP drain is removed.

Variations

1. *If the pocket is still contracted after capsulotomy, radial scoring can also assist in release.*
2. *A capsulectomy with removal of a portion of the capsule can also be added for if the pocket remains too constricted.*
3. *If the pocket is too large, a capsulorrhaphy can readjust the shape. Electrocautery is used to score the capsule lateral to the capsulotomy. Buried 2-0 PDS in an interrupted figure of eight or continuous fashion is then used to tighten the pocket.*
4. *If the inframammary fold remains ill-defined, reconstruction of the fold with interrupted or continuous sutures between the rib periosteum/underlying thoracic wall and the capsule/superior fascia can be used to create a new fold.*
5. *Acellular dermal matrix can also be placed as an inframammary sling to reconstruct the inframammary fold or to reinforce areas of capsulectomy.*

Possible Complications

1. Capsular contraction
2. Asymmetry
3. Skin rippling/wrinkling
4. Implant extrusion/skin necrosis
5. Infection
6. Implant rupture
7. Delayed wound healing or wound dehiscence
8. Bleeding
9. Firmness
10. Damage to nearby structures (including pneumothorax)
11. Need for further procedures, such as fat grafting

Operative Dictation

Diagnosis:

1. History of left breast cancer with bilateral mastectomy defects
2. History of immediate bilateral breast reconstruction with tissue expanders

Procedure: Exchange of bilateral tissue expanders with permanent saline/silicone implants with extensive capsulotomy

Indication

The patient is a __-year-old female who was diagnosed with left breast cancer and has elected to undergo a left skin sparing mastectomy with prophylactic right mastectomy with immediate reconstruction with bilateral tissue expanders. She subsequently underwent serial expansion to a size of ___ cc. After reviewing the information on silicone and saline implants, she elected to undergo the second stage of her planned reconstruction with exchange of the expanders for permanent silicone implants. She verbalized understanding of the risks and benefits, and an operative consent was obtained.

Description of the Procedure

After the patient was identified in preoperative holding, she was marked in standing position. She was then taken to the operating room and placed in supine position. All pressure points were padded and she had bilateral sequential compression devices in place. General endotracheal anesthesia was induced. Her arms were abducted and secured to a padded arm board with Kerlix rolls and ACE bandage wraps. Her chest and anterior shoulders were prepped with ChloraPrep, and she was draped in the standard sterile fashion. She received Ancef 2 g and vancomycin 1 g prior to the skin incision. After a time-out verifying the patient's name, identity, procedure, and site, a #15 scalpel was used to incise the skin through the transverse prior scar of the right and left chest. Bovie electrocautery was then used to incise through the subcutaneous tissue to the level of the pectoralis muscle. Skin hooks were placed and used to gently retract the superior skin flap so that 1 cm of skin and subcutaneous flap could be raised above the muscle. This allowed a "stair-step" separate incision to be made through the pectoralis parallel with the muscle fibers and then through the capsule using electrocautery. The right and left tissue expanders were then removed and sent for gross pathology. Using a lighted retractor, an extensive capsulotomy in the right chest pocket was made in the superior pole with Bovie electrocautery. To prevent constriction of the superior pole, the capsulotomy was performed deep to the pectoralis fascia and continued cephalad. In addition, radial scoring of the capsule was necessary. The right inframammary fold was also needed to be lowered, so a capsulotomy was performed inferiorly and medially. This created a larger pocket than the implant base width. Therefore, laterally an ellipse at the edge of the capsule was marked 6×2 cm in size and scored with electrocautery. A lateral capsulorrhaphy was performed using buried 2-0 running PDS. We then carefully inspected for hemostasis and irrigated the pocket with warm saline. The left pocket needed to be medialized to a lesser degree. Therefore, we performed an extensive capsulotomy along the left pocket's superior pole, again entering the capsule and then dissecting to the avascular plane between the pectoralis major and pectoralis minor/chest wall. The capsulotomy was extended medially and to a lesser degree inferiorly. We once again ensured we had adequate hemostasis and irrigated with warm normal saline. We then proceeded to place temporary silicone sizers ___ cc in size. The skin was temporarily reapproximated with interrupted 3-0 Vicryl sutures and the patient was placed in a seated position. She appeared to have a good shape and form of each reconstructed breast, as well as good symmetry of her inframammary folds. Therefore, she was returned to supine position, and the Vicryl sutures and sizers were removed. The pockets were irrigated again with warm normal saline and hemostasis verified. The skin was prepped with betadine and re-draped with sterile green towels. All gloves were changed, and each breast

pocket was then irrigated with antibiotic solution consisting of 500 mL of normal saline, 80 mg of gentamicin, 1 g of Ancef, and 50,000 units of bacitracin. The permanent right silicone implant was placed using a no-touch technique (*include in the dictation brand, size, serial and reference number*). On the left side, the (*include in the dictation brand, size, serial and reference number*) implant was similarly placed. The muscle was then re-approximated with non-buried 2-0 Vicryl interrupted sutures. The soft tissue was then closed with buried 3-0 Vicryl interrupted simple sutures. Finally, the skin was re-approximated with deep dermal 3-0 Monocryl interrupted sutures and a running 4-0 Monocryl in a subcuticular fashion. Dermabond was then applied to the incision. The patient tolerated the procedure well, and there were no immediate intra- or postoperative complications. She was extubated successfully and transported to PACU with plans for discharge home. All instrument, sponge, and needle counts were correct.

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Latissimus Dorsi Flap Breast Reconstruction

35

Maurice Y. Nahabedian

Indications

1. Immediate or delayed breast reconstruction using autologous tissue
2. Alternative option when the abdominal donor site is not an option
3. Prior reconstructive failure using autologous tissue or device
4. Previous chest wall radiation or infection

Essential Steps

1. Sufficient donor site tissue
2. No prior thoracotomy

Preoperative Markings

1. Spinal midline
2. Tip of scapula
3. Outline of latissimus dorsi muscle
4. Skin paddle along resting skin tension lines and optimal tissue harvest

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Intraoperative Details

1. Proper markings.
2. Lateral decubitus position.
3. Prepare recipient site.
4. Incise flap.
5. Extended latissimus dorsi flap if additional fat needed.
6. Flap elevation.
7. Usually retain innervation.
8. Usually retain insertion.
9. Upper chest tunnel.
10. Inset flap with absorbable sutures from muscle to chest wall.
11. Donor site closure with quilting and drains.

Postoperative Care

1. Drain care
2. Incisional care
3. Flap monitoring

Possible Complications

1. Seroma
2. Incisional dehiscence
3. Delayed healing
4. Flap failure

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Operative Dictation

Diagnosis:

1. Acquired absence right breast
2. History of breast cancer
3. History chest wall radiation

Procedure: Delayed right breast reconstruction with a latissimus dorsi musculocutaneous flap

Indications

This is a woman with a history of right breast cancer status post bilateral mastectomy and immediate reconstruction with tissue expanders. Postoperative chemotherapy was necessary. The right expander became infected and required removal. Following chemotherapy radiation therapy was completed. She is now 6 months following radiation. The right chest tissues are relatively soft and supple. The risks and benefits have been explained to her. She is consenting to autologous breast reconstruction with latissimus dorsi musculocutaneous flap.

Description of the Procedure

The patient was marked in the preoperative holding area. The spinal midline was delineated. The tip of the scapula was marked. An outline of the latissimus dorsi muscle was created on the back. The resting skin tension lines were assessed and the soft tissues were pinched to assess the optimal orientation of the skin paddle. The mastectomy scar was delineated and the outline of the right breast footprint was created.

She was transported to the operating room and placed in the supine position. Pneumatic compression garments were applied to both lower extremities. Intravenous antibiotics were administered. General endotracheal anesthesia was instituted. A Foley catheter was inserted, and she was then positioned in lateral decubitus positions with the left side down and the right side up lying on a beanbag. An axillary roll was placed. The beanbag was inflated and the patient position was stabilized. The right arm was placed on a sterile padded Mayo stand. She was then prepped and draped in the usual sterile fashion.

A scalpel was used to first excise the right mastectomy scar. Dissection proceeded to the pectoralis major muscle. The subcutaneous tissues were elevated off the pectoralis major muscle corresponding to the inframammary fold, medial sternal border, anterior axillary fold, and the second rib.

Attention was then directed to the back. The skin paddle of the latissimus dorsi flap was redelineated. An extended latissimus dorsi flap would be created incorporating additional subcutaneous fat with the flap. A #10 scalpel was used to create the incisions through the dermis. The dissection progressed in a beveled fashion to obtain more fat. The borders of the latissimus dorsi muscle were identified. Small vessels were cauterized. The inferior edge of the latissimus dorsi muscle was then divided using electrocautery. The paraspinal and trapezius muscles were left intact. The lateral edge of the latissimus muscle was freed. The latissimus dorsi muscle was then elevated in the axillary direction. The thoracolumbar perforators were identified and clipped. The dissection continued over the scapular apex leaving the teres major and rhomboid muscles intact. The dissection continued toward the axilla. The posterior and anterior pockets were communicated toward the upper lateral chest wall. The fascial structures anchoring the axillary portion of the latissimus dorsi muscle were divided. Care was taken not to injure the thoracodorsal artery and vein. The serratus branch was divided. The thoracodorsal nerve was not divided. The insertion of the latissimus dorsi muscle was left intact. The latissimus dorsi flap was now completely elevated and attached to its pedicle. The flap was tunneled into the anterior breast pocket. The muscle and pedicle was inspected to ensure that it was not kinked or twisted. The color and capillary refill of the skin paddle of the flap was inspected for signs of congestion. Flap excursion was assessed to ensure that it would reach the sternal border without tension.

At this point, the back was again inspected for hemostasis. The area was irrigated with a triple antibiotic solution. Three closed suction drains

were obtained. Two were placed in the back and one in the breast. The drains were sutured in place. The back incision was closed using a 2-0 monofilament absorbable suture anchoring Scarpa's fascia to the fascia of the back in a quilting manner. The dermis was closed with a 3-0 absorbable monofilament and a 4-0 subcuticular was placed. Steri-Strips and xeroform were applied followed by gauze and a Steri-Drape. The bean bag was then deflated and removed.

The patient was then placed in the supine position and re-prepped and draped in the usual sterile fashion. The latissimus dorsi flap was temporarily positioned on the chest wall and secured with staples. The muscle was oriented to cover the pectoralis major muscle. The edges of the latissimus were sutured to the periphery of the space with 3-0 monofilament absorbable sutures. The patient was flexed at the hip to 30° to assess the overall breast contour. The drain was positioned over the lower pole of the breast. A two-layer closure was completed with a 3-0 and 4-0 monofilament as a dermal and subcuticular suture, respectively. Dressing was applied.

This procedure was well tolerated without complications. Needle and sponge count was correct.

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Pedicle TRAM Flap Breast Reconstruction

36

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Indications

1. To reconstruct the breast following total mastectomy
2. Desire to have autologous tissue
3. To improve the contour of the anterior abdominal wall

Essential Steps

1. Consider preoperative imaging with CTA or MRA if high risk or if with previous abdominal incisions.
2. The author preference is to use the ipsilateral flap; however, the contralateral flap is also acceptable.
3. A muscle-sparing pedicle TRAM flap or a full-width pedicle TRAM can be performed.
4. Patients must be informed about the risks and benefits of these procedures.
5. Consider VTE prophylaxis.

Preoperative Markings

1. Mark the ASIS, vertical midline, and proposed upper and lower abdominal incisions.
2. Consider delineation of the usual course of the deep inferior epigastric artery and vein on the abdominal wall.
3. Mark the inframammary fold and sternal midline.

Intraoperative Details

1. Place the patient in the supine position.
2. General anesthesia, Foley catheter, and pneumatic compressions.
3. Prep and drape the patient.
4. Incise upper abdominal skin and undermine to xiphoid process.
5. Partially flex the patient and delineate the location of the lower abdominal incision.
6. Begin flap elevation in a lateral to medial direction preserving an island of perforators.
7. Include a segment of the rectus abdominis muscle (MS-1 or MS-2) or the entire width of the rectus abdominis muscle (MS-0) with the adipocutaneous flap.
8. Create a communicating subcutaneous tunnel between the abdominal and breast compartment.
9. Incise the inferior aspect of the rectus abdominis muscle.

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10. Elevate and tunnel the TRAM flap into the breast space.
11. Shape and inset the TRAM flap.
12. Repair the anterior rectus sheet with or without surgical mesh.
13. Close the layers of the anterior abdominal wall.

Postoperative Care

1. Control blood pressure and pain.
2. The patient is seen in every 4 h for the first 24 h to monitor the flap.
3. Advance diet and begin ambulation on postoperative day 1.
4. Dressings are usually removed on postoperative day 2.
5. Patient may shower on postoperative day 3.

Possible Complications

1. Bleeding
2. Infection
3. Scar
4. Flap failure
5. Abdominal bulge/hernia
6. Delayed healing
7. Asymmetry
8. Seroma
9. Infection
10. Poor cosmetic result
11. Further surgery

Operative Dictation

Diagnosis: Acquired absence of breast status post unilateral mastectomy

Procedure: Immediate unilateral breast reconstruction with a pedicle TRAM flap

Indications

This is a middle-age woman with unilateral breast cancer. She has decided to have a unilateral skin-sparing mastectomy and immediate reconstruction with a pedicle TRAM flap. She has been informed of the risks and benefits of this operation that include but are not limited to bleeding, infection, scar, total flap failure, partial flap failure, fat necrosis, abdominal bulge or hernia, seroma, delayed healing, asymmetry, poor cosmetic result, and further surgery. She understands the risks and wishes to proceed.

Description of the Procedure

Following informed consent, the patient was marked in the holding area. The markings included the skin-sparing mastectomy and the abdominal donor site. The anterior superior iliac spine was palpated and marked bilaterally. The midline of the chest and abdomen was delineated. A line was drawn from the upper edge of the umbilicus to the ASIS marks bilaterally. The inferior extent of the flap was approximated and delineated.

The patient was then transported to the operating room and placed in the supine position under general endotracheal anesthesia. Foley was inserted, pneumatic compression garments were applied, and intravenous antibiotics were administered. The patient was prepped and draped in the usual sterile fashion. The mastectomy was performed by the general surgeon and will be dictated separately by them. When I entered the room, there was an acquired absence of the breast. The mastectomy specimens were approximately 650 g each. The patient was re-prepped and draped and new surgical instruments were obtained.

The abdominal markings were re-delineated. A #10 scalpel was used to incise the upper abdominal skin. Electrocautery was used to dissect through the fat to the level of the anterior rectus sheath. Hemostasis was achieved using electrocautery. The upper abdominal skin flap was elevated toward the xiphoid process leaving the loose areolar tissue on the fascia intact. A subcutaneous tunnel communicating the abdominal space with the breast space was created on the right and left sides. The tunnel was located along the medial position of the mastectomy pockets. The medial sternal attachments were not violated.

The patient was then flexed approximately 30° and the inferior aspect of the flap was delineated. A #10 scalpel was used to incise the lower

abdominal skin. Electrocautery was used to dissect to the level of the anterior rectus sheath. The superficial inferior epigastric veins were identified and a 3–4 cm segment was preserved with the flap. The midline of the flap was divided. The umbilicus was incised and dissected along its stalk to the base. We then began to elevate the bilateral flaps from a lateral to medial direction using a low-set electrocautery. The loose areolar fascia over the anterior rectus sheath was preserved. The linea semilunaris was identified bilaterally. The dissection continued until the lateral row of perforators was identified. The medial row of perforators were identified and preserved. The fascial island of perforators was delineated circumferentially. Low-set cautery was used to incise the anterior rectus sheath over the rectus abdominis muscle taking care not to injure the perforators. The anterior rectus sheath was incised in a cephalad direction along the midmuscle toward the costal margin. The anterior sheath was elevated off the rectus abdominis muscle medially and laterally. The plane between the rectus abdominis muscle and the posterior rectus sheath was entered, and the course of the deep inferior epigastric artery and vein was palpated and appreciated. A Doppler was used to determine the cephalad course of the superior epigastric artery and vein and marked on the surface of the muscle. The primary source vessel would be included in the muscle segment that would be harvested with the flaps. The caudal aspect of the medial two thirds of the rectus abdominis muscle below the fascial island was divided using electrocautery. The deep inferior epigastric artery and vein were divided bilaterally. A muscle-sparing TRAM flap (MS-1) was then elevated in a cephalad direction preserving the innervated lateral segment of the rectus abdominis muscle. The dissection proceeded to the costal margin. The MS-1 pedicle TRAM flap was tunneled into the ipsilateral breast space bilaterally. The rectus abdominis muscle was inspected to ensure that it was not twisted or kinked. The TRAM flap was positioned such that the cut edge of zone 1 was along the sternal border. The color and capillary refill of the flap were noted throughout the procedure to ensure no venous congestion or arterial occlusion. Arterial and venous bleeding at the cut edges of the flap was noted to ensure good inflow. The patient was flexed about 30° and the TRAM flap was temporarily inset. The visible skin territory was delineated and the periphery of the flap was de-epithelized using scissors. The space was irrigated and hemostasis was ensured. A closed suction drain was inserted. The TRAM flap was permanently inset using dermal and subcuticular monofilament absorbable sutures.

Attention was redirected to the abdomen. The anterior rectus sheath was reapproximated using a 0-gauge monofilament nonabsorbable suture in a figure-of-eight fashion. Both leaflets of the anterior rectus sheath were reapproximated. The degree of tension on the fascial closure was assessed to determine if a reinforcing mesh would be necessary. A second row of suture was placed to further reinforce the closure in a running continuous manner. Contralateral fascial sutures were placed as necessary to balance the abdominal wall and to centralize the umbilicus. The space was irrigated and hemostasis ensured. Two closed suction drains were inserted. The new umbilical position was delineated. Layered closure was completed using a 2-0 absorbable monofilament in Scarpa's layer, 3-0 absorbable monofilament in the dermis, and a 4-0 absorbable monofilament as a subcuticular. The umbilicus was exteriorized at the new site and sutured in place using 3-0 and 4-0 sutures in the dermis and skin, respectively. Appropriate dressings were applied and the suction was applied to the drains. The patient tolerated the operation well without complications; needle and sponge counts were correct.

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Superficial or Deep Inferior Epigastric Perforator Flap for Breast Reconstruction

37

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Indications

Desire for breast reconstruction in a patient with adequate abdominal tissue for reconstruction. This should especially be considered in patients who:

- Are undergoing delayed reconstruction
- Require radiation

Essential Steps

Preoperative Markings

Breast:

1. Mark sternal notch and midline.
2. Mark breast footprint: inframammary fold and breast height.

Abdominal donor site:

1. Mark midline.
2. Upper border—just above the umbilicus.
3. Lower border—close to pubic hairline, about 5 cm above the pubic cleft.
4. Generally 12–15 cm height and 30–45 cm width (height should equal the desired breast width).
5. Attempt to place apices in concavity to minimize dog-ears.

Intraoperative Details

1. Supine positioning.
2. Arms can be tucked or out depending on breast surgeon's preference if immediate reconstruction. If delayed, prefer tucked for better access.
3. Prepare the mastectomy pocket.
4. Expose the recipient vessels.
5. Harvest abdominal flap, can do simultaneously with recipient site preparation.
6. Anastamosis.
7. Inset flap.
8. Close donor site, can do simultaneously with flap inset.

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Postoperative Care

Overnight:

1. NPO in case there is a need to return to operating room.
2. Foley.
3. Bed rest.
4. Q1h flap monitoring—assess color, turgor, temperature, and Doppler signal.

Postoperative day 1:

1. Regular diet if no issues.
2. Out of bed.
3. Discontinue Foley.
4. Continue q1h flap checks.

Postoperative day 2:

1. Q2h flap checks

Postoperative day 3:

1. Q4h flap checks.
2. Discharge home if no issues.

Possible Complications

1. Partial or total flap loss
2. Hematoma
3. Seroma
4. Fat necrosis
5. Wound dehiscence
6. Mastectomy skin flap loss—increased in smokers, should quit 4 weeks prior
7. Abdominal bulge—increased in smokers, should quit 4 weeks prior
8. Abdominal flap necrosis—increased in smokers, should quit 4 weeks prior

Operative Dictation

Diagnosis: Personal history of breast cancer (*or acquired absence of the left breast and nipple*)

Procedure: Left breast reconstruction with deep *or superficial* inferior epigastric artery perforator free flap

Operative Findings

Deep inferior epigastric artery perforator flap based on the number of perforators *or superficial inferior epigastric artery perforator flap*

Flap weight—*** g

Ischemia time—*** minutes

Pedicle length—*** cm

Arterial and venous diameter—*** mm and *** mm, respectively

Indication

*** is a ***-year-old female with a personal history of left breast cancer and status post left mastectomy who desires immediate autologous reconstruction. Given her excess abdominal tissue, she was deemed an appropriate candidate for reconstruction utilizing her abdominal tissue.

Description of the Procedure

In the preoperative area, proper consent was acquired and the patient was marked in the upright and standing position. The patient was then brought to the operating suite, placed in supine position, and underwent general anesthesia. A time out was performed. DVT chemical prophylaxis and IV antibiotics were given. The patient was then prepped and draped in a sterile fashion. A left skin-sparing mastectomy was completed by the breast surgical oncology service; please see their separate operative note for details on that portion of the procedure. Then the reconstructive surgery portion of the case commenced. Hemostasis was obtained and the lateral inframammary fold was recreated with 2-0 Vicryl sutures. The third intercostal space was identified and the pectoralis major muscle was split in the direction of its fibers. The intercostal muscles were removed and the internal mammary artery and vein were identified. The third costosternal junction was removed to further enhance the exposure of the recipient internal mammary vessels. The vessels were cleaned under loupe

magnification and protected with an instrument wipe. Attention was then turned to the abdominal site.

Superficial inferior epigastric artery perforator flap harvest:

The inferior skin incision on the right hemiabdomen was made first, and dissection proceeded to Scarpa's fascia layer where the superficial inferior epigastric artery was identified just deep to the fascia. It was large in caliber and had a palpable pulse, so it was deemed adequate for use. The superficial inferior epigastric vein was identified more medial and slightly more superficial. It was also deemed large enough caliber for use. Next, the umbilicus was incised and the superior, inferior, and midline skin incisions were made on the right hemiabdomen. The flap was dissected off the abdominal wall in a suprafascial plane taking care to clip any perforators. Next, the superficial inferior epigastric artery and vein were dissected retrograde to the takeoff on the common femoral vessel. Small branches from the pedicle were carefully divided with bipolar electrocautery and microvascular clips to free the pedicle. The flap was temporarily secured, and Doppler signals were identified and marked with a 5-0 Prolene stitch for postoperative monitoring. Next, the artery and vein were each clipped and divided and the flap was brought up to the chest.

Deep inferior epigastric artery perforator flap harvest:

The inferior skin incision was made first, and dissection proceeded to identify the superficial inferior epigastric vessels bilaterally. The patient did not have superficial inferior epigastric arteries, and the superficial inferior epigastric veins were moderately sized. The vein was temporarily clamped, which did not affect the venous drainage, so it was clipped. Attention was then turned to the right hemiabdomen. The inferior incision was completed, the umbilicus was incised, and the superior incision was made. The flap was elevated laterally as dissection proceeded from lateral to medial in a suprafascial plane over the external oblique. Once the linea alba was encountered, dissection slowed and the Bovie cautery was turned down. Three good-sized, palpable, lateral row perforators that corresponded to the Doppler signals found on the flap were identified. It was decided to use these perforators for the flap design. The medial incision was made on the flap slightly past the midline to incorporate enough flap tissue for an adequately sized breast reconstruction, and the flap was elevated medial to lateral in a suprafascial plane. The fascia was split carefully along the lateral row, and meticulous dissection was performed around the perforators in a retrograde manner through the rectus muscle to the pedicle on the posterior rectus sheath. Dissection proceeded down to the origin of the deep inferior epigastric vessels from the external iliac vessels. Small branches from the pedicle were carefully divided with bipolar electrocautery and microvascular clips to free the pedicle. The flap was temporarily secured, and Doppler signals were identified and marked with a 5-0 Prolene stitch for postoperative monitoring. Next, the artery and venae comitantes were each clipped and divided and the flap was brought up to the chest.

The microscope was brought in and the internal mammary vessels were clamped and divided and the flap vessels were cleaned. The clamp on the internal mammary artery was released to ensure adequate inflow. The vein was anastomosed to the internal mammary vein using a 2.5 mm coupler. Excellent flow was noted out of the flap. Thereafter, the arterial anastomosis was performed with 9-0 nylon. Excellent flow was noted in and out of the flap. Thereafter, the flap was placed into the pocket taking care not to kink the pedicle. The inset was performed to ensure optimal size and shape. The skin areas to be buried on the flap were marked out and deepithelialized taking care not to pull on the pedicle. The flap was inset medially with three 2-0 Vicryl sutures. A 19 Blake drain was placed and the incisions were closed with 3-0 V-Loc, 3-0 Vicryl, and Prineo tape. Excellent Doppler signal was noted at the previously marked Prolene stitch.

While the flap was being inset, the abdominal donor site was closed. The remaining abdominal flap tissue was removed, and the superior abdominal flap was elevated to the xiphoid and subcostal margin taking care to preserve lateral intercostal perforators. The anterior rectus sheath

fascia was closed with a 0 Prolene stitch in a single running fashion, and a pain catheter was placed underneath the fascial closure. A 19 Blake drain was placed in the subcutaneous space. The patient was flexed to a semi-fowler position to allow no tension on the abdominal closure. The umbilicus was delivered to the midline through the superior abdominal wall flap with an ovoid excision and sutured into place with 4-0 Vicryl deep dermal sutures and 5-0 nylon half-buried horizontal mattress sutures. Scarpa's fascia was closed with 2-0 Vicryl, a 3-0 V-Loc was run in the deep dermal layer, and Prineo tape was placed over the incisions. The patient was placed in a mammary support bra and taken to the recovery room in stable condition. Please note that all counts were correct. The patient tolerated the procedure well.

Suggested Reading

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Superior Gluteal Artery Perforator Flap for Breast Reconstruction

38

Amanda K. Silva and David H. Song

Indications

Desire for autologous breast reconstruction in a patient who desires moderate-sized (B-cup) breasts:

- That does not have adequate abdominal tissue for reconstruction due to paucity of tissue or prior surgery, such as abdominoplasty
- With pear-shaped body type

Essential Steps

Preoperative Markings

Breast:

1. Mark sternal notch and midline.
2. Mark breast footprint: inframammary fold and breast height.

Buttock donor site:

1. Draw line from the posterior superior iliac spine to greater trochanter.
2. Most perforators at a point 1/3 the distance from the posterior superior iliac spine to trochanter.
3. May have more lateral perforator—usually septocutaneous and allows for longer pedicle.
4. Center flap as an ellipse over the perforators, options:
   (a) Body lift pattern
   (b) Superomedial to inferolateral
   (c) Superolateral to inferomedial

Intraoperative Details

1. If unilateral delayed reconstruction, the patient can be placed in lateral decubitus to begin to facilitate simultaneous flap harvest and recipient bed preparation.
2. If bilateral reconstruction, start supine to prepare recipient sites, go prone to harvest flaps, and go back to supine to inset flaps.
3. Arms can be tucked or out depending on breast surgeon's preference if immediate reconstruction. If delayed, prefer tucked for better access for microsurgery.
4. Prepare the mastectomy pocket.
5. Expose the recipient vessels.

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6. Reposition the patient if supine to prone to harvest flap.
7. Harvest SGAP flap.
8. *Place flap on ice (optional)*.
9. Close donor site.
10. Reposition the patient back to supine.
11. Preform microsurgical anastomosis.
12. Inset flap.

Postoperative Care

Overnight:

1. NPO in case there is a need to return to operating room
2. Foley
3. Bed rest
4. Q1h flap monitoring—assess color, turgor, temperature, and Doppler signal

Postoperative day 1:

1. Regular diet if no issues.
2. Out of bed.
3. Discontinue Foley.
4. Continue q1h flap checks.

Postoperative day 2:

1. Q2h flap checks

Postoperative day 3:

1. Q4h flap checks.
2. Discharge home if no issues.

Possible Complications

1. Partial or total flap loss
2. Hematoma
3. Seroma
4. Fat necrosis
5. Wound dehiscence
6. Mastectomy skin flap loss—increased in smokers, should quit 4 weeks prior

Operative Dictation

Diagnosis: Personal history of breast cancer (*or acquired absence of the left breast and nipple*)
Procedure: Immediate left breast reconstruction with superior gluteal artery perforator free flap

Operative Findings

Superior gluteal artery perforator flap based on the number of perforators
Flap weight—*** g
Ischemia time—*** minutes
Pedicle length—*** cm
Arterial and venous diameter—*** mm and *** mm, respectively

Indication

*** is a ***-year-old female with left breast cancer who will undergo a left simple skin-sparing mastectomy and desires immediate autologous reconstruction. Given her history of abdominoplasty and paucity of abdominal tissue, she was deemed an appropriate candidate for reconstruction utilizing her gluteal area.

Description of the Procedure

In the preoperative area, proper consent was acquired and the patient was marked in the upright and standing position. The patient was then brought to the operating suite, placed in supine position, and underwent general anesthesia. A time out was performed. DVT chemical prophylaxis and IV antibiotics were given. The patient was then prepped and draped in a sterile fashion. A left skin-sparing mastectomy was completed by the breast surgical oncology service; please see

their separate operative note for details on that portion of the procedure. Then the reconstructive surgery portion of the case commenced. Hemostasis was obtained and the lateral inframammary fold was recreated with 2-0 Vicryl sutures. The third intercostal space was identified and the pectoralis major muscle was split in the direction of its fibers. The intercostal muscles were removed and the internal mammary artery and vein were identified. The third costosternal junction was removed to further enhance the exposure of the recipient internal mammary vessels. The vessels were cleaned under loupe magnification and protected with an instrument wipe. The mastectomy flaps were temporarily stapled closed and Ioban was placed over the closure. The drapes were removed, and the patient was placed in the prone position, taking care to pad all pressure points and protect her shoulders. She was re-prepped and draped in sterile fashion. Dissection of the superior gluteal artery perforator flap was started. Doppler was used to identify perforators as previously marked at a point approximately one-third the distance from the posterior superior iliac spine to the greater trochanter. Additionally a more lateral perforator was able to be identified by Doppler and marked. An ellipse skin paddle was designed incorporating the perforators situated in a body lift-type design. The superior skin incision was made, and dissection was beveled slightly superior to recruit excess fatty tissue and then progressed down to the gluteus muscles. The flap was then elevated off the muscle starting laterally. A lateral superior gluteal artery perforator flap based on three perforators that went in between the septum of the gluteus maximus and gluteus medius all the way to the takeoff was dissected. This gave approximately 6.5 cm of pedicle based on three perforators. The flap was temporarily secured, and Doppler signals were identified and marked with a 5-0 Prolene stitch for postoperative monitoring. The flap was then divided, wrapped in a saline-soaked laparotomy pad, placed in a sterile plastic bag, and placed on a transplant ice slushy machine for cold ischemia time. The donor site was closed in multiple layers with 2-0 V-Loc suture, 3-0 V-Loc suture, and Prineo tape over a 19 Blake drain. The drapes were removed and the patient was placed back in a supine position, re-prepped, and draped. The mastectomy flap was reopened and retractors placed to expose the internal mammary vessels. The microscope was brought in, and the internal mammary vessels were clamped and divided, and the superior gluteal flap vessels were cleaned in preparation for anastomosis. The clamp on the internal mammary artery was released to ensure adequate inflow. One of the superior gluteal venae comitantes was anastomosed to the internal mammary vein using a 3 mm coupler. Excellent flow was noted out of the flap. Thereafter, the arterial anastomosis was performed with 9-0 nylon. Excellent flow was noted in and out of the flap after rewarming. The other vena comitans, which was temporarily clamped, was released to ascertain blood flow. This was then clipped with a medium hemoclip. Thereafter, the flap was placed into the pocket taking care not to kink the pedicle. The inset was performed to ensure optimal size and shape. The skin areas to be buried on the flap were marked out and de-epithelialized taking care not to pull on the pedicle. The flap was inset medially with three 2-0 Vicryl sutures. A 19 Blake drain was placed and the incisions were closed with 3-0 V-Loc, 3-0 Vicryl, and Prineo tape. Excellent Doppler signal was noted at the previously marked Prolene stitch. The patient was placed in a mammary support bra and taken to the recovery room in stable condition. Please note that all counts were correct. The patient tolerated the procedure well.

Suggested Reading

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Direct-to-Implant Breast Reconstruction with Acellular Dermal Matrix

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Amanda K. Silva and David H. Song

Indications

- Immediate breast reconstruction following nipple- or skin-sparing mastectomy in patients with a healthy mastectomy skin envelope.
- Ideal in patients with small- to medium-size breasts with grade 1 to 2 ptosis who desire the same or smaller breast size.
- Use with caution in patients who have either undergone or will undergo radiation therapy.

Essential Steps

Preoperative Markings

1. Mark sternal notch and midline.
2. Mark breast footprint: inframammary fold and breast height.
3. Measure base width.

Intraoperative Details

1. Position supine.
2. Arms out and secured to sit up intraoperatively.
3. Elevate and release the pectoralis major.
4. Inset AlloDerm along the inframammary fold.
5. Suture AlloDerm to the pectoralis major.
6. Place sizer if necessary.
7. Irrigate pocket with bacitracin, and change gloves.
8. Place implant.
9. Temporarily close with staples and sit up to ensure symmetry.
10. Make necessary adjustments.
11. Place drain.
12. Close incision.

Postoperative Care

1. Overnight hospital stay
2. Bactroban to nipples if nipple sparing
3. Antibiotics while drains in place

Possible Complications

1. Infection
2. Mastectomy flap necrosis
3. Implant exposure and/or loss

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4. Seroma
5. Hematoma
6. Capsular contracture
7. Need for revision surgery

Operative Dictation

Diagnosis: Personal history of breast cancer
Procedure: Immediate left breast reconstruction with breast implant and acellular dermal matrix

Operative Findings

Left breast reconstruction with 275 mL smooth, round, high-profile, gel-filled mammary prosthesis, reference #, lot #, and acellular dermal matrix 6 × 16 cm.

Indication

*** is a **-year-old female with a personal history of breast cancer. She comes for a left skin-sparing mastectomy and desires immediate reconstruction.

Description of the Procedure

In the preoperative area, proper consent was acquired and the patient was marked in the upright and standing position. The patient was then brought to the operating suite, placed in supine position, and underwent general anesthesia. A time out was performed. DVT chemical prophylaxis and IV antibiotics were given. The patient was prepped and draped in the sterile fashion. A left skin-sparing mastectomy was completed by the breast surgical oncology service; please see their separate operative note for details on that portion of the procedure. Then the reconstructive surgery portion of the case commenced. A left subpectoral pocket was created. The pectoralis major muscle was released inferolateral to approximately the 8 o'clock position. After this was done, acellular dermal matrix was secured to the lateral and inferior inframammary fold with interrupted 3-0 Maxon suture to create an inferolateral sling. It was then sutured to the cut edge of the inferior pectoralis major muscle with a running 3-0 Maxon medially and laterally, leaving a small window at the midline. Next, the pocket was irrigated with normal saline and bacitracin, gloves were changed, and using a no-touch technique, a 275 mL smooth, round, high-profile, gel-filled mammary prosthesis was placed in the pocket, and the pocket was closed with 3-0 Maxon. The skin was closed in multiple layers of 3-0 Maxon, 3-0 V-Loc, and Prineo tape over a 19 Blake drain. The drain was secured in place with a 2-0 nylon suture and dressed with an antibiotic impregnated disc and Tegaderm. The patient was placed in a mammary support bra and taken to the recovery room in stable condition.

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Thoracodorsal Artery Perforator Flap for Breast Reconstruction

40

Amanda K. Silva and David H. Song

Indications

- Additional bulk required in previously reconstructed breast
- Delayed implant-based breast reconstruction with history of radiation
- Exposure or near exposure of previous breast implant
- Immediate breast reconstruction in combination with implant
- Lumpectomy defect

Essential Steps

Preoperative Markings

1. Mark scapular tip, representing superior border of latissimus dorsi muscle.
2. Mark anterior border of latissimus dorsi muscle with the patient standing with her hands pressing on her hips.
3. Perforator usually 8–13 cm below posterior axillary fold and 2–5 cm behind latissimus dorsi border.
4. Orient skin paddle vertical or horizontal depending on donor scar preference and defect characteristics. Vertical will capture more perforators.

Intraoperative Details

1. If delayed reconstruction, the patient can be placed in lateral decubitus to begin to facilitate simultaneous flap harvest and recipient bed preparation; go supine for flap inset if necessary.
2. If immediate reconstruction, start supine to prepare recipient sites, go lateral decubitus to harvest flap, and go back to supine to inset flap if necessary.
3. Prepare the recipient site.
4. Reposition if necessary.
5. Harvest TAP flap.
6. Close donor site.
7. Reposition if necessary.
8. Inset flap.

Postoperative Care

1. One to two days in hospital for pain control.
2. Do not abduct the shoulder less than 45° to avoid pressure on the pedicle.

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Possible Complications

1. Partial or total flap loss
2. Hematoma
3. Seroma
4. Wound dehiscence

Operative Dictation

Diagnosis: Deformity and disproportion of reconstructed breast and personal history of breast cancer

Procedure: Thoracodorsal artery perforator flap to previously reconstructed left breast

Operative Findings

Concave deformity of the left superolateral breast.

Indication

*** is a ***-year-old female with a history of left breast cancer who underwent immediate breast reconstruction with a free deep inferior epigastric artery perforator flap followed by radiation. She has developed a large contour deformity of her superolateral reconstructed breast due to wound healing complications and radiation. She presents today for thoracodorsal artery perforator flap reconstruction to fill the defect.

Description of the Procedure

In the preoperative area, proper consent was acquired and the patient was marked in the upright and standing position. The patient was then brought to the operating suite, placed in supine position, and underwent general anesthesia. A time out was performed. DVT chemical prophylaxis and IV antibiotics were given. The patient was then placed in lateral decubitus position with the right side down and the arm abducted 90° and prepped and draped in a sterile fashion. The scar from the contour defect on the left superolateral breast was excised with a 10 blade, and Bovie electrocautery was used to release scar and open a pocket in the previous flap to restore adequate breast contour. Attention was then turned to thoracodorsal perforator flap harvest. Perforators were identified approximately 8 cm inferior to the posterior axillary fold and 2 cm posterior to the edge of the latissimus dorsi using a Doppler. An ellipse skin paddle was marked along the vertical axis centered to incorporate the perforators. A pinch test was performed to ensure the donor site would be able to be closed primarily. An incision was made on the anterior marking and dissection proceeded in a beveled fashion anterior to capture additional fat. Dissection then proceeded in the suprafascial plane and the anterior edge of the latissimus dorsi was identified. An incision was then made posterior and additional fat was captured in a beveled fashion. Dissection then proceeded in a suprafascial plane and a palpable, pulsating perforator was identified. Dissection then proceeded intramuscular to the descending branch of the thoracodorsal vessel. The nerve running with the vessel was dissected free and left in place. A tunnel was made between the donor site and defect and the flap was interpolated into the defect and secured. The donor site was closed in a layered fashion over a 19 Blake drain with 2-0 Vicryl, 3-0 V-loc, and Prineo tape. The mastectomy skin was closed temporarily with staples and covered with Ioban. The patient was then repositioned supine and re-prepped and draped. The flap was inset taking care not to place too much tension on the pedicle. The areas of skin paddle on the flap that were buried under the mastectomy skin were marked and de-epithelialized. The incisions were closed with 3-0 Vicryl, 3-0 V-loc, and Prineo tape. The patient was placed in a mammary support bra and taken to the recovery room in stable condition. Please note that all counts were correct. The patient tolerated the procedure well.

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Modified CV Flap for Nipple Reconstruction

41

Kriya Gishen and Wrood Kassira

Indications

1. Congenital athelia.
2. Athelia status post mastectomy and breast reconstruction.

Essential Steps

Preoperative Markings

1. Mark patient in standing position.
2. Measure contralateral nipple-areolar complex position if present and transpose measurements and markings to opposite breast mound to identify precise location of nipple reconstruction.
3. If neither nipple-areolar-complex is present, nipple position is marked at the maximum projection of the breast mound along the breast meridian which may correspond to approximately 19–21 cm from the sternal notch or mid clavicular line, 9–11 cm from the midpoint of the sternum and 8 cm from the inframammary fold, with final position agreed upon by both surgeon and patient.
4. A CV is designed with two V flaps and one circular C-flap. The width of the V-flaps correlate to nipple projection (1.0–1.5 cm). Each V-flap approximately measures 2 cm in length. The diameter of the C-flap determines the diameter of the new nipple (1.0–1.5 cm). The base of the C that remains connected to both V-flaps measures 1 cm creating a total flap length of approximately 5 cm.

Intraoperative Details

1. Place in supine position on operating table.
2. Under general anesthesia with endotracheal intubation or local anesthesia per patient preference.
3. Prep and drape surgical site in standard surgical sterile manner with Chlora-Prep.
4. Infiltrate marked incision with local anesthetic consisting of 50:50 mixtures of 0.25 % Marcaine and 1 % lidocaine with epinephrine 1:100,000 using 25-gauge needle.
5. Using 15 blade, incise along markings leaving at least a 1 cm length between V-flaps intact to preserve flap blood supply.
6. Raise flaps composed of dermis and subcutaneous tissue.
7. With flap held perpendicular to skin surface, rotate V-flaps so that 1.5 cm ends are aligned to form a cylinder.

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8. Lower the C-flap parallel to skin surface as the cap of the cylinder.
9. Using 3-0 Monocryl place deep dermal sutures to close base from which flap was raised.
10. Inset nipple reconstruction using 5-0 fast gut simple interrupted sutures.
11. Close dermis of harvest site incisions with 5-0 fast gut running suture.
12. Dress with bacitracin and Xeroform.
13. Cover with sterile plastic cap fashioned from one eye of sterile goggles, covered with Tegaderm and punctured with holes to allow for ventilation.

Postoperative Care

1. Control pain.
2. Keep area covered for 1 week. Showering permitted but avoid direct water pressure to surgical site.
3. Office follow-up in 1 week.

Note These Variations

If skin overlying the implant-based reconstruction is very thin, consider performing nipple reconstruction in the operating room in case of implant exposure or injury.

Possible Complications

Bleeding, infection, scaring, hematoma, seroma, poor cosmesis, asymmetry, need for reoperation, implant exposure. Most likely expected result is loss of nipple projection and this is variable.

Operative Dictation

Diagnosis: Absence of Right/Left/Bilateral nipple(s) status post mastectomy with breast reconstruction OR congenital absence of Right/Left/Bilateral nipple(s).

Procedure: Nipple reconstruction with CV flap.

Indication

This is a _____ with athelia secondary to _____. This patient presents with lack of Right/left/bilateral nipple-areolar-complex(es). The surgery is indicated to allow nipple and areolar reconstruction with proper nipple placement on the breast mound, projection, size, shape and symmetry. Patient understands the benefits, risks and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was marked and taken to the operating room and placed in supine position on the operating table. Time-out was performed among operating room staff with patient's name, medical number and operative site confirmed. General Anesthesia with endotracheal intubation, Monitor Anesthesia Care or Local Anesthesia can be instituted per patient and surgeon preference. Preoperative antibiotics were given. Time out was taken. The area of incision was infiltrated with 0.25% Marcaine and 1% lidocaine plus 1:100,000 epinephrine. The patient was prepped and draped in standard sterile surgical manner.

The skin was incised using a 15 blade along the marked edges of the flap, taking care to preserve a 1 cm flap base for adequate blood supply. The flap was then raised including the dermis and subcutaneous tissue. Using small skin hook, the flap was held perpendicular to the breast surface and the rectangular V-flaps were rotated so that the 1.5 cm wide distal edges of the two flaps aligned and a cylinder was formed. Using 3-0 Monocryl, deep dermal sutures were placed to secure the newly formed nipple cylinder to the base from which the flap was raised. 5-0 fast-gut simple interrupted sutures were then placed where the V-flaps align. The C-flap was subsequently lowered to form a cap of the cylindrical nipple. Again, 5-0 fast-gut was utilized in a simple interrupted fashion to inset the C-flap. The dermis of the harvest site incisions was then closed with 5-0 fast-gut running sutures.

The newly reconstructed nipple was then covered with a generous amount of bacitracin and loosely wrapped with Xeroform. Sterile goggles can be cut in half to form plastic nipple covers. The nipple cover should be punctured with several small holes to allow for ventilation before being secured in place over the nipple by Tegaderm. Tegaderm may then be carefully punctured where covering underlying vent holes. Care should be taken to ensure that the nipple cover is not compressing the nipple. Needle, instrument, and sponge count were correct. There were no complications.

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Breast Augmentation with Autologous Fat Grafting

42

Arij El Khatib and Salim C. Saba

Introduction

Popular interest in fat as an autologous filler for primary breast augmentation has been around since Ilouz demonstrated the feasibility of suction-assisted lipectomy in the early 1980s. Bircoll in 1985 presented the first paper on fat grafting for breast augmentation at the California Society of Plastic Surgeons [1]. Unfortunately, this was met with harsh criticism by the plastic surgery community. It led to a strong position statement by the American Society of Plastic Surgeons citing that calcifications and scarring compromise cancer detection [2].

Largely unaffected by the ASPS position statement, European plastic surgeons continued to utilize and refine their techniques. In 2006, Baker presented his results of 20 patients showing no resultant interference with mammographic interpretation [3]. Not long after, Khoury presented a prospective series of more than 40 patients (mean follow-up of 30 months) demonstrating both the efficacy and safety of fat grafting [4]. Since then, a number of studies have corroborated these findings [5–7].

Challenges involved with fat grafting for breast augmentation relate directly to large-volume graft survival in a relatively limited recipient space [8]. Success also depends on multiple variables that include (1) quality of the harvested fat, (2) grafting methods, and (3) quality of the recipient bed. Despite this, many recent studies have demonstrated reproducibility of fat grafting for a variety of aesthetic and reconstructive indications [9–12].

Given the recent safety issues associated with breast implants, e.g., anaplastic large cell lymphoma, a growing public interest in natural filler alternatives has grown. Breast augmentation with fat grafting is gaining more widespread support. More plastic surgeons are offering it to their patients as a reasonable alternative to implants, for moderate augmentation techniques.

Indications

1. Correction of post-reconstruction residual defects
2. Primary/secondary breast augmentation for hypomastia
3. Total breast reconstruction after mastectomy or implant removal

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4. Correction of post-lumpectomy defects
5. Correction of congenital breast anomalies, e.g., tuberous breast, Poland syndrome, and pectus excavatum
6. Camouflaging implant edges in thin patients and those with capsular contracture

Contraindications

1. Patients desiring significant volume changes in one session, i.e., more than one cup size increase
2. Thin patients with low body mass index or inadequate donor sites
3. Patients actively undergoing chemotherapy or radiation therapy for breast cancer
4. Patients with unrealistic expectations

Possible Complications

1. Bruising, swelling, and discomfort in donor and recipient sites (common and early)
2. Fat necrosis resulting in oil cysts, lumps, or calcifications (late)
3. Inadequate breast volume or correction due to resorption
4. Contour deformities in the donor site
5. Scarring of the incision sites
6. Infection (rare)

Essential Steps

Preoperative Details

1. Preoperative pictures are taken with the patient's hands at the sides, on the hips, and above the head. This helps to better define contour irregularities, particularly in post-reconstruction and/or lumpectomy/mastectomy patients.
2. Mark the infra-mammary fold in addition to the peripheral borders of the breast.
3. Different colors may be used to mark areas needing significant volume versus areas that simply need feathering.
4. Five-millimeter stab incision markings may be made at the skin-areola junction allowing access to the entire breast from a central location.
5. Five-millimeter stab incision markings may also be placed peripherally at irregular intervals to access specific areas of contour irregularity.
6. Donor sites are marked with special consideration given to preexisting asymmetries with care taken not to accentuate these postoperatively.
7. For augmentation, only modest size increases can be obtained.
8. The upper limit of injected fat per session is usually about 300 cm^3. Fat necrosis may result due to an inability of an inadequate recipient bed to support additional adipocytes.
9. Preoperative breast size and soft tissue compliance are additional variables that affect grafting volumes in a single session.
10. Fat resorption to a moderate degree (about 50 %) can be expected to occur and cannot be assessed before a 3–4-month postoperative interval. Thus, additional fat grafting sessions should not be scheduled prior to 3 months.

Intraoperative Details

1. General anesthesia.
2. Local anesthesia with or without sedation may be used for smaller harvest and donor areas.
3. Prep and drape the chest and harvesting area, keeping preoperative markings.
4. Infiltrate Klein's solution into the donor area. Utilize a wet/super-wet technique.
5. Utilize 2.7-mm-diameter cannula with at least nine side holes to minimize negative pressure while optimizing harvest efficiency.
6. Set negative pressure at about 1/3 atm (250 mmHg) to minimize trauma to adipocytes.
7. An aspirator vacuum source may be used for large-volume aspiration. Handheld syringe

aspiration can be utilized for low-volume aspiration.

8. Fat processing may be done in a fashion that minimizes air exposure and desiccation of adipocytes, i.e., closed systems utilizing IV tubing with two-way valves connected on one end to the aspiration cannula and on the other end to IV bags.
9. Low g-force centrifugation and "double decanting" may be utilized to purify the fat and minimize trauma to adipocytes (described in conjunction with the BRAVA technique).
10. For augmentation, one of three techniques may be used: Coleman method, reverse liposuction, and mapping technique. The standard Coleman method utilizes manually operated small syringes for aspiration and injection. Unpredictable pressure gradients and long grafting times in excess of 4 h is not uncommon.
11. The reverse liposuction technique utilizes a vacuum pressure for harvesting and employs the minimally traumatic, double-decanting method to concentrate adipocytes.
12. Reverse liposuction technique places insertion sites at the IMF and lateral breast fold and avoids the more visible décolletage part as an entry site.
13. Fat is grafted in a fanning pattern at varying depths from the fascial plane to the subdermal plane (direct parenchymal injection is avoided).
14. The lateral, axillary injection sites are utilized to inject submuscularly for added projection.
15. Injection rate utilizing a 14-gauge, single side hole cannula should be approximately 1 cm^3 per 2–4 s.
16. Injection of fat with a 60-cm^3 syringe also minimizes breast augmentation times to less than 2 h while minimizing injection pressure.

Postoperative Care

1. Standard postoperative pain control.
2. Compression garments may be used on donor sites.
3. Reston foam placed along the IMF and cotton fluffs covering insertion sites on both breasts.
4. Dressings may be removed on postoperative day 5.
5. Surgical brassiere may be used for up to 3 weeks postoperatively.

Operative Dictation

Diagnosis: hypomastia
Procedure: breast augmentation with autologous fat grafting

Indication

This is a _____ year old woman presenting with long-standing hypomastia of bilateral breasts without any other abnormalities. The patient wants a modest augmentation from an A cup to a large B cup-sized breast. However, she does not want breast implants rather opting for a more "natural" approach. As the patient has excess fat deposits in the abdomen and hips, these are agreed upon as donor sites. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed. She also understands the possible need for additional fat grafting sessions due to an unpredictable degree of fat resorption postoperatively.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in the supine position. Time-out was performed among operating room staff. One gram of cefazolin was given intravenously 30 min prior to making first incision. The patient was induced and endotracheally intubated. Prepping and draping of the chest and abdomen were done widely and in standard fashion.

Stab incisions were made in an asymmetric fashion to allow for infiltration of Klein's solution (50 mL of 1 % Xylocaine and 1 mg epinephrine in 1 L of normal saline solution) into harvesting area(s). A wet technique was utilized

whereby each abdominal quadrant was infiltrated with about 150–200 cm^3 of Klein's solution. Once all donor areas were infiltrated, 5 min were allowed to pass to in order to optimize the vasoconstrictive effects of the wetting solution.

Vacuum suction at −250 mmHg was utilized through a 2.7-mm-diameter suction cannula with nine side holes collecting into a 1200-mL canister. Each zone was suctioned thoroughly with bloody aspirate acting as the end point. Care was taken to avoid losing negative pressure through the cannula, lest a violent gush of air, which desiccated and ruptured the adipocytes, was introduced through the tubing.

Upon completion of the harvest, stab incisions were closed with a simple 4-0 Vicryl Rapide suture, and the lipoaspirate in the collection canister was allowed to stand for 10 min to allow for non-traumatic gravitational decanting. The buoyant fat layer was then slowly and carefully aspirated into 60-cm^3 luer lock syringes. These were then collected in a large sterile basin and allowed to undergo gravitational decanting. This minimally traumatic "double-decanting" technique allowed for gentle concentration of the adipocytes. The heavier serosanguinous fraction was then expelled, keeping only the harvested fat in the syringes.

A 14-gauge, single hole cannula was fitted onto the 60-cm^3 syringe. Stab incisions, 6–8 in all, were made along the inferior mammary fold (IMF) and the later axillary fold. The cannula was introduced just superficial to the muscle to create a tunnel. Injection of the fat took place at a rate of about 1 cm^3 every 2–4 s upon slow withdrawal of the cannula. This pattern followed a fan shape and covers multiple depth levels up until the subdermal fat layer. The entire breast was grafted in such a fashion to ensure even distribution of small amounts of fat at varying depths.

A maximal injection volume of 300 cm^3 was reached on each breast before terminating the procedure. Incisions were closed with a simple 4-0 Vicryl Rapide. Reston foam was applied along the IMF and the lateral breast fold and a snug surgical brassiere was applied prior to reversing the patient.

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Ultrasound-Assisted Liposuction for Gynecomastia

43

Rebecca C. Novo and Onelio Garcia Jr.

Indications

1. Gynecomastia or pseudo-gynecomastia with minimal skin excess and normal inframammary fold (grade I)

Essential Steps

Preoperative Markings

1. In the upright position, mark the suprasternal notch, midline, and inframammary fold.
2. Concentric topographically marked breast tissue to be targeted, centered on the maximal projection.

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Intraoperative Details

1. Placed in supine position.
2. General anesthesia or monitor anesthesia care.
3. Administration of tumescence solution was performed with: 1 L 0.9 normal saline or lactated Ringer and 1 amp (1 mL of epinephrine (1:100,000)); approximate volume 3:1 to anticipated volume of aspirate removal.
4. Mark one or two access points per side to be operated (these should be lateral and inferior to the breast tissue and/or within the IMF).
5. Bair hugger applied to the lower body and warmed IVF used throughout the operation.
6. UAL performed in a fanlike distribution from two access points, ensuring disruption of IMF.
7. One minute UAL performed per 100 mL anticipated aspirate.
8. Traditional liposuction performed to remove lipoaspirate.

Postoperative Care

1. Control blood pressure and pain.
2. Body compression garment applied over Topi-Foam dressing and worn continuously for 6 weeks.
3. Patient may remove dressing and shower at 48 h.

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Possible Complications

1. Seroma, hematoma, infections, and hypertrophic or keloid scars
2. Asymmetry
3. Contour abnormalities
4. Skin burns

Operative Dictation

Diagnosis: gynecomastia
Procedure: ultrasound-assisted liposuction of the bilateral breast tissue

Indication

This is a _____ year old male with a significant bilateral breast enlargement, who desires a more masculine appearance. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Preoperative antibiotics were administered, sequential compressive devices placed on bilateral lower extremities, and a warming blanket was placed on the lower body. General endotracheal anesthesia was induced without difficulty. The patient's arms were wrapped on padded arm boards and abducted just less than 90°. A time-out among the surgeons, anesthesia, and operating room staff was performed. Chest hair was clipped, and the skin was prepped and draped in the typical sterile fashion. The preoperative surgical markings were reinforced. Two stab incisions were made bilaterally as access points. These were made lateral and inferiorly to be concealed in the IMF and the lateral border of the breasts. Through these access points, tumescence was instilled at 400 mL/min to a total volume of _____ mL per side.

Ultrasound energy was then applied using a solid two or three ring probe. The amplitude was set at 80–90 %. Intraoperative skin protection was used consisting of a plastic port placed through the skin incision, a wet towel placed on the skin, and continuous probe movements to avoid skin burns. Fanlike passes were made from both access points targeting the concentric topography of the breast tissue, and additional focus was placed on disrupting the inframammary fold. The treatment continued until there was loss of tissue resistance and blood in aspirate, as well as secondary endpoints of total ultrasound time of _____ min and volume reductions were reached. Ultrasound was followed by fat evacuation and contouring using a Mercedes 4 liposuction cannula for a total volume of _____ mL of lipoaspirate. The stab incisions were closed with 5-0 Vicryl absorbable sutures and Steri-Strips. All instrument, sponge, and needle count were correct. The wound was dressed with non-occlusive dressing, and the garment was applied with instructions to wear continuously for 7 days and worn consistently other than bathing for 6 weeks.

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Subcutaneous Mastectomy and Free Nipple Graft for Gynecomastia

44

Rebecca C. Novo, Ryan Reusche, and Onelio Garcia Jr.

Indications

Breast biopsy is indicated when malignancy is suspected:

1. Pain and discomfort
2. Unilateral or bilateral grade II or grade III gynecomastia (per modified McKinney and Simon, Hoffman and Kohn scales):
   (a) Persists more than 3–4 months after pathological causes ruled out
   (b) Persists after 3–4 months of unsuccessful medical treatment for pathological gynecomastia
3. Unilateral or bilateral grade IV gynecomastia (per modified McKinney and Simon, Hoffman and Kohn scales)
   (a) Persists more than 6 months after pathological causes ruled out
   (b) Persists after 6 months of unsuccessful medical treatment for pathological gynecomastia
4. Pseudo-gynecomastia following massive weight loss with excess skin and laxity
5. Female to male transgender confirmation surgery

Essential Steps

Preoperative Markings

In standing position, the patient is asked to place the hands on the hips and flex pectoralis major. The lateral border is palpated and marked. The new nipple location is frequently marked at the intersection between the fourth–fifth rib and the lateral border of the pectoralis.

Measurements include:

1. Suprasternal notch to nipple
2. Inter-nipple distance
3. Midclavicular point to nipple
4. Nipple to sternal notch (~20 cm)
5. Nipple to IMF (should be 4–5 cm)

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Markings include:

1. Sternal notch
2. Midline
3. Inframammary crease
4. Breast meridian
5. Rib numbers
6. Lateral border of the pectoralis
7. Twenty-eight millimeter nipple-areolar complex template
8. New nipple location as described above

Intraoperative Details

1. Patient placed in supine position, arms untucked and abducted.
2. Under general anesthesia with endotracheal intubation.
3. Cleanse the skin, prep, and drape in sterile operative fashion.
4. Infiltrate marked areolar and inframammary incision with local anesthetic plus 1:100,000 epinephrine.
5. Harvest the nipple as a full-thickness graft.
6. Raise flap through inframammary incision in the subcutaneous plane.
7. Excise the breast tissue, ensuring 1–1.5 cm thickness of the subcutaneous tissue on the skin flap.
8. Trim excess skin as needed, working upper flap medially to avoid dog-ear deformity.
9. Place a drain and close wounds with running subcutaneous absorbable sutures.
10. *CRITICAL STEP* Utilizing previously taken measurements draw markings for nipple placement.
11. Nipples applied as full-thickness graft with tie-over bolster dressing with mild compression.

Postoperative Care

1. Control blood pressure and pain.
2. The bolster dressing on the nipple is removed on the seventh day. (Superficial layers of the nipple may slough when removing the bolster. A superficial eschar on the nipple may last 2–4 weeks.)
3. Avoid smoking, caffeine, alcohol, and heavy lifting until follow-up appointment.

Follow-Up Care

Drainage tubes are removed when the output is less than 30 mL/day for 2 days.

Note These Variations

1. An endoscopic technique has also been described, best utilized for those with low-grade gynecomastia.
2. Liposuction (UAL or SAL) has been described for mostly fatty breasts or as an adjunct to mastectomy.

Possible Complications

1. Risk of nipple malposition or asymmetry
2. Risk of hematoma, seroma, hypertrophic or keloid scar, infection, asymmetry, concavity, and nipple areolar complex pigment changes
3. Risk of loss of or decreased nipple sensation

Operative Dictation

Diagnosis: gynecomastia (define laterality)
Procedure: subcutaneous mastectomy and free nipple graft

Indication

This is a _____ male with _____ grade gynecomastia. This patient is presenting with pain and discomfort of the bilateral chest due to hypertrophic breast tissue present for the past ____ years. The surgery is indicated to reduce chest discomfort and provide pathologic evaluation of the removed breast tissue. The patient also desires a more typical male anatomic form.

The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, measurements were performed preoperatively with the patient in the upright position. The patient was then taken to the operating room and placed in supine position. Preoperative antibiotics were administered. Anti-embolic compression device were placed on bilateral lower extremities. A time-out was held including the surgeon, anesthesia, and operating room teams. General anesthesia was induced without complications. The patient's arms were abducted at approximately 90° and secured to the arm boards. The measurement and incision lines were reinforced around the areolar and inframammary regions. The operative area was infiltrated with 1 % lidocaine plus 1:1000 epinephrine. The patient was prepped and draped in standard sterile fashion.

The nipple-areolar complex was marked with a 28 mm cookie cutter template, and using a #15 blade and traction/counter-traction, this was excised full thickness. The nipple was saved on the back table for later replacement in a warm saline-soaked gauze. Hemostasis was achieved using cautery as needed. With a #15 blade, an incision was subsequently made along the inframammary crease. Using dissecting scissors and cautery, a flap was raised in the subcutaneous plane superficial to the breast parenchyma. The breast tissue was excised en bloc and sent to pathology for analysis labeled as left and right breast parenchyma. Irrigation with warm saline was performed, and complete hemostasis was achieved with the use of cautery. By performing a pinch test for tensionless closure, markings were drawn for removal of the excess skin. The marking edges were then stapled together and the patient placed in upright position to assess symmetry. Once achieved, the patient was placed in supine position, staples were removed, and excess skin excised along markings. A medium-sized closed suction drain was placed laterally through a separate stab wound. Attention was directed to work the upper skin flap medially to minimize dog-ear deformity. The deep dermis was approximated with 3-0 Monocryl interrupted subcuticular sutures.

The site of nipple placement was established with the previous measurements: at the intersection of the lateral border of the pectoralis and the fifth rib. Nipple location was marked using a 20 mm template, and the patient again placed upright to confirm symmetry. Using a #10 blade and facelift scissors, the marked nipple recipient sites were fully de-epithelized. Hemostasis was fully achieved in areas of de-epithelization with electrocautery. The previously harvested nipple-areola was inspected to ensure that all subcutaneous tissue was trimmed. The nipple-areolar complex was then applied as a full-thickness graft. The nipple-areola was sutured into the de-epithelialized bed with interrupted 4-0 chromic sutures.

A tie-over bolster made of cotton balls wrapped with Xeroform was secured with 4-0 nylon sutures placed around the periphery of each areola. Surgical glue was placed along the inframammary incision. Each drain was secured with a 3-0 nylon suture and Tegaderm was placed over each drain site bilaterally. The drains were placed to the bulb suction. The patient tolerated the procedure well. All instrument, sponge, and needle counts were correct.

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Part III

Burn

Z-Plasty for Scar Contracture

45

Samuel Golpanian, Ariel Wolf, and Wrood Kassira

Indications

1. Release scar contracture
2. Improve skin contour
3. Relieve skin tension
4. Close tissue defects

Essential Steps

Preoperative Markings

1. Identify the orientation of the relaxed skin tension lines or the desired orientation of the new scar. The new central limb will be represented by a line connecting the distal tips of the two lateral limbs. This line should either lie along the relaxed lines of skin tension or along the division between two aesthetic subunits.
2. Diagonal lines are drawn at a 60° angle to the original scar (the diagonal lines should be the same length as the scar).
3. Flaps are rearranged mentally or, if needed, the pattern can be cut on a piece of paper or marked on the drape as a model prior to making the incisions.

Intraoperative Details

1. Surgical site is prepped with an antibacterial solution, such as povidone-iodine (Betadine), and sterile drapes are applied.
2. Two arms are drawn at each end of the linear scar, inscribing an angle of 60° to the scar. The side arms are exactly equal in length to the central scar and should have the same angle.
3. Local (1 % lidocaine with/without epinephrine) or regional anesthesia is administered.
4. Using a #15 blade, make or complete the central limb incision.
5. For a scar revision or lesion excision, excise the linear scar or lesion in a narrow ellipse along its longitudinal axis.
6. Make the incisions on the previously marked skin to create the lateral limbs of the "Z."

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7. Bevel the incisions away from the narrow angles of the "Z" to maximize flap tip thickness and vascularity.
8. Elevate skin flaps using fine skin hooks.
9. The flap plane is created below the subdermal vascular plexus and just into the subcutaneous fat.
10. Include some subcutaneous fat as the dissection approaches the base of the flap to maintain a strong blood supply.
11. Undermine the skin where the flap is attached to create additional flap mobility.
12. Achieve hemostasis.
13. Avoid handling the tissue with forceps to prevent damage to the tissue.
14. Use fine skin hooks to rotate the triangular flaps and cross them over one another.
15. Place a suture at each of the flap tips to secure them in place.
16. Complete the remainder of the wound closure with interrupted subdermal 3-0 or 4-0 absorbable sutures and close the skin with interrupted 3-0 or 4-0 non-absorbable sutures.
17. Place Steri-Strips, as needed, a non-adherent dressing, and a protective occlusive dressing.

Postoperative Care

1. Pain reliever(s).
2. Wound care.
3. Antibiotic ointment.
4. Sutures should be removed at days 3–5 for the face and days 10–14 for the trunk or extremities.
5. If the wound is on the face, the patient should be instructed to sleep with the head elevated the first two nights following the procedure and avoid sleeping on the affected side.
6. If the Z-plasty is performed to release a joint contracture, the joint should be splinted in extension for at least one week.

Theoretical Central Limb Gain Length with Various Angles [1]

Angle between central and lateral limbs (°)	Potential gain in length (%)
30	25
45	50
60	75
75	100
90	120

Note These Variations

Z-plasties can be performed in parallel or series:

1. Z-plasties in parallel result in greater longitudinal lengthening; however, this is at the expense of transverse shortening and requires more adjacent tissue to be available.
2. Z-plasties in series require less adjacent tissue but offer less longitudinal lengthening. Multiple Z-plasties in series also offer better cosmetic results compared to a single large Z-plasty.

Possible Complications

1. Flap necrosis
2. Hematoma formation
3. Wound infection
4. Wound dehiscence
5. "Trapdoor" deformity

Operative Dictation

Diagnosis: wound contracture of [anatomic location] secondary to [cause of defect]
Procedure: Z-plasty for scar contracture

Indication

This is a [age and gender] with severe scar contraction [anatomic location] secondary to [cause of defect] who wants to improve its function and appearance. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After informed consent was obtained, the patient was taken to the operating room and identified by name, medical record number, and procedure to be performed. The patient was placed in the supine position and time-out was performed with all operating room staff present. General endotracheal anesthesia was induced and appropriate preoperative antibiotics were given.

The [anatomic location] was selected and this area was infiltrated with 1% lidocaine with 1:100,000 epinephrine. The wound scar was excised along its longitudinal axis with a #15 blade in order to create the central limb incision. Lateral limbs of the "Z" were created next. Skin flaps were then elevated and a flap plane was created below the subdermal vascular plexus. A small amount of subcutaneous fat was included in order to maintain a strong blood supply to the area and to avoid unnecessary damage to the nutrient vessels. Fine skin hooks were used to rotate the triangular flaps and cross them over one another. Sutures were then placed at each flap tip to secure them in place. Interrupted subdermal 4-0 absorbable sutures were used to close the remainder of the wound, and interrupted 4-0 non-absorbable sutures were used to close the skin. Steri-Strips, a non-adherent dressing, and a protective occlusive dressing were then placed over the area. The patient tolerated the procedure well and was transferred to the recovery room in stable condition.

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Burn Escharotomy

46

Reem Karami, Ghassan Abu-Sittah, and Amir Ibrahim

Indications

1. Full-thickness circumferential burns of the extremity with impending or established vascular compromise
2. Full-thickness circumferential burns of the thorax preventing adequate chest excursion with impending or established respiratory compromise

Possible Complications

1. Inadvertent fasciotomy
2. Injury to the underlying tissue, including neurovascular structures
3. Extensive blood loss
4. Infection and bacteremia

Essential Steps

Preoperative Markings

Upper Extremity

1. Mark the incisions in the longitudinal mid-axial line between the extensor and flexor surfaces, avoiding the flexor creases at the joints.
2. Medially the incision should be anterior to the medial epicondyle, to avoid ulnar nerve injury, and can be extended to the base of the first finger.
3. Laterally the incision can be extended to reach the proximal phalanx of the thumb.

Lower Extremity

1. Mark the incisions in the longitudinal mid-axial line between the extensor and flexor surfaces.
2. Medially the incision is extended behind the medial malleolus to avoid injury to the long saphenous vein and saphenous nerve.
3. Laterally the incision is made in the mid-lateral line to avoid common peroneal nerve injury.

Chest

1. A longitudinal incision is made on both sides along the midaxillary line reaching the costal margin or the upper abdomen depending on the extent of the burn.

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2. The two longitudinal incisions are connected by two transverse incisions; the first is below the clavicles across the upper chest and the second across the upper abdomen.

Note that all incisions should be extended 1 cm proximal and distal to the burnt tissue into the healthy tissue.

Intraoperative Details

1. Place the patient in supine position.
2. Anesthesia is usually not required since the burn is not sensate. Conscious sedation can be done.
3. Cleanse the affected area with chlorhexidine or nonalcoholic Betadine skin prep.
4. Apply sterile drapes.
5. Make the incisions according to the preoperative markings using a scalpel or cutting diathermy.
6. Ensure that the incisions are full thickness into the subcutaneous fat.
7. Run your finger along the incision to detect any residual restrictive areas.
8. Apply alginate dressing or Vaseline gauze.

Postoperative Care

1. Elevation of the affected extremity
2. Close monitoring of circulation in case of an affected limb or breathing in case of an affected chest
3. Dressing changes

Operative Dictation

Diagnosis: burn eschar
Procedure: burn escharotomy

Indications

This is an X-year-old male/female presenting after sustaining a circumferentially burn injury to an extremity with an impending vascular compromise or to the chest with respiratory compromise.

Description of the Procedure

After obtaining an informed consent, the patient is taken to the operating room. He is placed in supine position. A proper time-out is performed. Conscious sedation or general anesthesia is instituted. The patient is prepped and draped in a standard sterile surgical fashion.

Marking of the incisions was done. Eschar edges are infiltrated with 1% lidocaine plus 1:100,000 epinephrine. Using a scalpel or electrocautery, the eschar is incised according to the preoperative markings. Dissection is deepened into the subcutaneous tissues and fat until complete release is achieved.

Upper or Lower Extremity

Complete release is achieved by medial and lateral mid-axial incisions where blunt dissection using dissecting scissors is used in the proximity of nerves, vessels, or tendons. Assessment and securing adequate circulation at the end of the procedure must be achieved otherwise a more deep fasciotomy will be needed.

Trunk (Chest and Abdomen)

Adequate release is achieved by complete release in multiple checkrein incisions that are deepened into the subcutaneous fat and sometimes into Scarpa's fascia. Assessment and securing adequate respiratory and circulatory function must

be checked with the anesthesiologist to guarantee no residual abdominal compartment syndrome is still present that otherwise might necessitate laparotomy.

Proper hemostasis was achieved with the use of the coagulation diathermy. Doppler signals were documented. Non-adherent antimicrobial dressing is applied followed by sterile gauze and bandages.

Suggested Reading

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Tangential Excision and Split-Thickness Skin Graft

47

Imad L. Kaddoura and Amir Ibrahim

Indications

1. Very deep partial skin loss (deep dermal wounds) where if the residual dermis is not grafted, it will slough and separate like a third-degree burn
2. Whole skin dermis which does not involve fat (third-degree burns)
3. Questionable depth burns with anatomically thick skin for diagnostic and therapeutic causes, i.e., deltoid, back regions, etc.

Possible Complications

1. Excision of large surface areas leading to excessive bleeding > 10%
2. Inadequate excision resulting in residual eschar and high bacterial colorization
3. Over-excision of viable dermis converting the burn wound into full fledged third-degree burn

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Essential Steps

Preoperative Planning

1. Timing: The best time is between the second and fifth day post burn after which the burn softens making excision more difficult with increased microorganisms in the slough.
2. Adequate preoperative fluid resuscitation.
3. Decision on the functional area that takes precedence, i.e., face, hands, etc.
4. Decision on the extent (surface area) to be debrided, i.e., 5–10 % keeping in mind that blood loss could range between half a unit to one unit for each 1 % debrided.
5. Decide on immediate split-thickness skin harvesting area and marking it.
6. Preoperative transfusion if necessary.
7. Prepare the number of blood units that will be needed intraoperatively.
8. Preoperative wound cultures.

Intraoperative Details

1. Favorable positioning for excision and harvesting.
2. General anesthesia/deep sedation or regional anesthesia when possible and/or indicated.
3. Pluck or shave when indicated (scalp).

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4. Infiltrate donor regions "in limited procedures" with local anesthetic (usually lidocaine 1 %) plus 1:100,000 epinephrine.
5. Fine-tuning of the different instruments to be used, i.e., Humpy®, Goulian®, etc., or their modifications, i.e., Braithwaite, Watson, or Cobbett.
6. Prepare hemostatic solution need be; the commonly used solution is 1 L NaCl 0.9 % mixed with 1 mg of epinephrine ± thrombin.

Postoperative Care

1. Avoid exposure and thus dryness of excised dermis.
2. Some surgeons like to inspect their grafts for any hematomas and/or sloughed grafts, thus minimizing graft failure and healing time; however, if the surgeon is confident about hemostasis and fixation of the grafts, then the dressing change should be performed on the third or fourth day and thereafter daily. All staples (nonabsorbable) are often removed by 5–7 days post grafting.
3. Inspect recipient and donor dressings in the PACU (post anesthesia care unit) for any excessive bleeding.
4. Check the patient's hemodynamics (vital signs).
5. Check urine output hourly.
6. Repeat hematocrit, kidney function tests, blood gas, lactate, and electrolytes immediately after surgery or thereafter depending on the severity and the extent of the burn and surgery.
7. Control pain and blood pressure.

Operative Dictation

Diagnosis: % deep second- and third-degree burns

Procedure: tangential excision and split-thickness skin graft

Indication

This is an X-year-old male/female presenting after sustaining questionable third-degree burns and/or very deep partial skin loss (deep dermal wounds). If the residual dermis is not grafted, it will slough and separate like a third-degree burn. If these wounds are left untreated for secondary intention healing that more require more than 3 weeks, complications will most probably develop. These include infection, sepsis, scarring, and chronic wound. Risks and benefits of the excision and skin grafting are discussed with the patient, family or guardian.

Description of the Procedure

After obtaining an informed consent, the patient was taken to the operating room. A proper time out was performed. Monitor anesthesia care was instituted. The patient was positioned in the appropriate and planned position; careful attention was directed toward appropriate padding of pressure zones. Preoperative antibiotics were given (depending on previous cultures). Any residual hair was cleansed, plucked, and/or shaved to expose the proposed donor site. The donor and recipient sites were prepped and draped in standard sterile surgical fashion.

The guarded skin graft knife (the Humpy knife or one of its modifications, i.e., Braithwaite, Watson, Cobbett, or Goulian) was calibrated to a little finer scale needed for taking than a skin graft of the same thickness. Excision was started in the most dependable areas to avoid spillage of blood and fluids down and obscure the operative field. Using the guarded skin knife at an angle of 30–45°, tangential excision with a back and forth movements under constant pressure was performed. Surgery was initiated in the center of the burn where it was probably deepest and directed toward the periphery of the analgesic area. All yellow-brown dermis left behind was repeatedly excised until a graftable layer of residual

dermis was evidenced by punctuate bleeding or underlying fat where the subdermal veins were not thrombosed. "Zone of hyperemia" was avoided as it would epithelialize spontaneously. Excessive bleeding was avoided and controlled by elevation of a limb, topical epinephrine soaked pads, compression bandages, and careful coagulation.

Prior to excision, a pneumatic tourniquet was used following elevation and placement of an Esmarch tourniquet and pressure set at 250-mm mercury for the upper limb and 300 mm for the lower one. However, the disadvantage of performing excision under tourniquet was that bleeding from the dermis was not readily seen when the zone of stasis was reached. However, its pink color was easier to identify. Black, thrombosed, subdermal veins were an absolute contraindication to grafting. Tangential excision was limited by the available donor sites of autografts.

After achieving adequate hemostasis, attention was directed to harvesting the skin grafts from the donor areas that were previously prepared. Antiseptic solutions were wiped off the skin with NaCl 0.9 % soaked pads. Split-thickness skin grafts were harvested relatively thin but not to the extent that the edges were ragged. The excised area was measured twice and therefore the necessary amount of skin graft was harvested accordingly. The powered dermatome was prepared and checked carefully. The thickness of the skin graft to be harvested was set on the dermatome with fine-tuning variations from the medium thickness of 0.010 of an inch. The width of the dermatome guard was chosen between 1, 2, 3, and 4 in. Mineral oil was applied on the skin surface where skin grafts were to be harvested. Whether air power, battery, or electrically driven dermatome was used, it was double checked before using it. The harvesting was performed by turning on the dermatome before applying it to the skin surface and then using a constant moderate pressure it was applied on the harvesting area with an angle of 30–45° where a steady forward movement was performed for the whole planned area to be harvested.

Skin grafts were carefully held. They were applied as sheets or meshed at different ratios according to the area to be grafted. Meshing could vary from 1:1 to 1:9. The higher the ratio, the bigger the seams that required longer time to heal and created more scarring. Attention was given to place the outer skin grafts on the rugged surface of the plastic mesh to avoid the "spaghetti" skin result.

Whether meshed or sheets, careful attention was drawn to apply the dermis down in contact with the wound surface and the epidermis dermis up. The dermis was usually a shiny moist surface and skin edges tend to curl toward it. Skin grafts were applied to the previously excised areas and placed edge to edge with minimal gaps in between two skin grafts or between a skin graft and normal skin. Although pressure was not essential for "take," avoidance of rotational forces by fixing the edges and central portions by absorbable sutures and/or staples were usually necessary. The grafted areas were then covered with some form of vaselinated dressing or gauze cotton soaked in mineral oil.

Multilayer different dressing was applied to avoid shear forces that might displace the skin graft. A splint was applied if necessary to immobilize the limb joints.

The patient was awakened and moved carefully to her/his prewarmed unit.

Full-Thickness Skin Graft

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Samuel Golpanian and Wrood Kassira

Introduction

Skin grafting for coverage of skin and/or tissue defects, secondary to trauma, infections, and neoplasms, is still a widely performed procedure by reconstructive surgeons today. While split-thickness skin grafts include the epidermis and varying amounts of dermis, full-thickness skin grafts consist of the epidermis and the entire underlying dermis [1]. Full-thickness skin grafts are valuable for the reconstruction of certain soft tissue defects that require maintenance of functional and aesthetic integrity, such as the fingers or face [2, 3]. Donor sites may heal by primary closure or use of split-thickness skin grafts. Undeniably, full-thickness skin grafting bears its own risks of complications. The most significant involved the potential for graft contracture, poor graft survival, donor-site infections, and skin color mismatching [4]. Overall, the procedure is a meticulous task that requires important postoperative observation and care. Restoration of function and cosmesis is considered a successful outcome for full-thickness skin grafting procedures [4, 5].

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Indications

1. Restoration of an intact skin barrier previously lost secondary to burns, trauma, cancer resections, or infections.
2. Improvement of function and appearance of areas of skin loss.

Possible Complications

1. Graft loss
2. Graft contracture/deformity
3. Donor-site infection
4. Color/hair mismatch

Essential Steps

Preoperative Markings

1. Trace or measure the appropriate perimeter of the wound or recipient site. (The wound bed is often larger after the scar or contracture is

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excised; therefore, measure after excision of scar contracture.)
2. Mark the skin of the selected donor-site area to closely match the size and shape of the recipient-site defect.

Intra-operative Details

1. Place patient in supine position.
2. Induce general anesthesia or monitored anesthesia care.
3. Infiltrate donor site with local anesthetic plus 1:100,000 epinephrine.
4. Incise an ellipse of skin large enough to cover defect.
5. Primarily close donor site with absorbable suture and skin sealant.
6. Harvest skin graft with the full layer of dermis and some underlying fat.
7. Defat the skin graft while it is placed under tension.
8. Prepare the recipient site by using a sterile scrub brush or lap to scrub the wound to healthy bleeding tissue.
9. Cut several small slits in the graft to prevent fluid accumulation.
10. Place graft, dermis side down, over wound and suture in place with absorbable suture.
11. Create and apply moist wound dressing/Xeroform-type bolster and cover with dry gauze.

Postoperative Care

1. Control pain.
2. Keep original dressing in place for 5 days, checking recipient site each day.
3. After 5 days, apply antibiotic ointment and Xeroform or Telfa dressings 1–2 times daily to recipient site for the next several days.
4. Gently clean recipient site with saline during each dressing change.
5. Once graft appears to be healing (i.e., pink, adherent), remove dressings and apply moisturizer to the area.
6. Remove donor-site dressing after 24 h and apply antibiotic ointment with dry gauze for several days, leaving wound open to air.
7. Remove donor-site suture after 7–10 days.
8. Counsel patient to avoid sun exposure area and not to smoke.

Operative Dictation

Diagnosis: full-thickness skin loss of [anatomic location] secondary to [cause of defect]
Procedure: full-thickness skin graft

Indication

This is a [age and gender] with full-thickness skin loss of [anatomic location] due to [cause of defect] who wants to improve its appearance and function. The patient understands the benefits, risks, and alternatives associated with the procedure, including, but not limited to, poor wound healing, bleeding, infection, graft failure, poor cosmesis, pain, need for additional procedures, and wishes to proceed.

Description of the Procedure

After informed consent was obtained, the patient was taken to the operating room and identified by name, medical record number, and procedure to be performed. The patient was placed in the supine position. Time-out was performed with all the operating room staff present. General endotracheal anesthesia was induced and appropriate preoperative antibiotics were given. The donor site was shaved and the patient was prepped and draped in the usual sterile fashion.

The recipient-site wound was completely debrided down to the subcutaneous level and irritated to induce sufficient bleeding and achieve a healthy bed of tissue. Then, the [anatomic location] was selected as the donor site, and this area was infiltrated with 1 % lidocaine with 1:100,000 epinephrine. The size of the skin area to be

excised was considered large enough for adequate defect coverage. The skin graft was sharply excised full thickness to include the epidermis and dermis using a #15 scalpel. Hemostasis of the donor site was achieved using Bovie electrocautery. The skin was trimmed to fit the donor-site defect and small cuts with an #11 scalpel were made to prevent postoperative fluid accumulation. The skin graft was then placed in saline moist gauze.

After placing the skin graft over the recipient-site wound defect and flattening its contours, it was secured in place using 5-0 chromic sutures around the edges. A sterile bolster dressing using Xeroform-wrapped cotton balls was then applied to the transplanted skin graft. The donor-site defect was closed primarily using deep dermal 3-0 monocryl and running subcuticular 4-0 monocryl and dressed with skin sealant.

The patient tolerated the procedure well and was transferred to the recovery room in stable condition.

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Part IV

Craniofacial

Osseous Genioplasty

49

David E. Morris, Carlos Amir Esparza Monzavi, and Pravin K. Patel

Indications

Anatomic

1. Horizontal or vertical macrogenia
2. Horizontal or vertical microgenia
3. Chin asymmetry

Functional

1. Lip incompetence with mentalis strain

Essential Steps

Preoperative Markings

There are no applicable skin markings for an osseous genioplasty. Markings may be made at two points intraoperatively (see steps 4 and 7 below).

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Intraoperative Details

1. Nasotracheal general anesthesia. Eye protection with tarsorrhaphy sutures, clear adhesive eye shields, or corneal shields.
2. Infiltrate lower central vestibular mucosa and mentalis with lidocaine containing 1:100,000 epinephrine.
3. Place throat pack and brush teeth with chlorhexidine gluconate 0.12% (Peridex) oral rinse or dilute aqueous povidone-iodine (Betadine) solution.
4. Labial mucosa incision with an inverted "V" to spare the frenulum, from canine to canine using a guarded blunt tip Bovie. Divide the mentalis muscle leaving an adequate cuff of muscle attached to the bone for reattachment at the time of closure. The incision line may be marked with a marker or by gently scoring the mucosa with a Bovie. This is done so as to preserve a 6–8 mm mucosal cuff and a central "V" so as to preserve the frenulum.
5. Dissect subperiosteally from the incision to, but not extending over the inferior border of the mandible.
6. Identify the mental foramen bilaterally and, protecting the mental nerves, continue the dissection inferior and lateral to the exiting nerve, thereby creating a tunnel.
7. Use an oscillating saw to vertically score the chin in the midline and on either side of the midline. These will serve as guides to ensure

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symmetry in positioning the osteotomized segment.
8. Mark the planned horizontal osteotomy on the bone with a sterile pencil. Care is taken to stay inferior to the dental roots and at least 6 mm inferior to the mental foramina and extending as far posteriorly as possible.
9. The osteotomy is made using a reciprocating saw.
10. Mobilize the osteotomized symphyseal segment to its desired position using the vertical score marks as reference marks to achieve symmetry.
11. Internally fixate the mobile segment to the stable segment using plate(s) and bicortical screws.
12. Approximate the mentalis muscle on either side of the midline. Close the mucosal layer.
13. Place a microform tape skin dressing.

Note These Variations

Depending on treatment goal, the osteotomy design varies:

Sliding genioplasty, vertical reduction/elongation, narrowing/widening, centering/leveling for asymmetry, jumping, and double step

Possible Complications

1. Nerve injury (mental nerve and inferior alveolar nerve)
2. Injury to dentition
3. Infection
4. Failure to meet patient expectations and appearance
5. Residual asymmetry and under- or overcorrection
6. Fixation hardware palpability, pain, discomfort, temperature sensitivity
7. Prolonged recovery affecting school and work
8. Unpredictable or unanticipated events including death

Postoperative Care

1. Clear liquid diet is advised for 48 h, followed by full liquid diet for 48 h, and then by soft diet for the remainder of the week.
2. Oral antibiotics are used prophylactically.
3. Chlorhexidine mouth wash is used twice per day for 1 week.
4. Warm salt water mouth rinses are encouraged after each time the patient eats or drinks for the first week.
5. Cold compresses are used for the chin for 48 h following surgery.
6. The patient sleeps with the head of bed elevated or on extra pillows for the first week.
7. The microform tape skin dressing is removed on postoperative day 10.

Operative Dictation

Diagnosis: microgenia, macrogenia, and mandibular asymmetry
Procedure: osseous genioplasty

Indications

This patient was admitted for an osseous genioplasty with the goal of improving facial harmony and symmetry. Indications, risks, and alternatives and outcome of the details of the planned procedure were discussed with the patient in the clinic and reviewed in the preoperative holding area. The patient and family verbalized understanding of our discussion. They have no further questions and are comfortable with the decision to proceed with surgery.

Description of the Procedure

Preparation for the Surgery

After a formal "time-out" protocol, the patient was positioned supine on the operating table with attention to minimizing pressure areas and to

lower extremity risk to thromboembolism. General anesthesia was induced. Nasotracheal tube was then secured to the nasal septum and to the anterior scalp. Monitoring and intravenous access lines were established. Intravenous antibiotic and steroids were initiated (depending on the surgeon's protocol). The eyes were protected (tarsorrhaphy or clear eyelid shield). A throat pack was placed. The mouth was cleansed and teeth were brushed with chlorhexidine gluconate 0.12 % (Peridex) oral rinse or dilute povidone-iodine (Betadine) solution. The operative sites were infiltrated with 1 % lidocaine with 1:100,000 epinephrine for hemostasis. The face was then cleansed with a skin prep and draped in a sterile fashion.

Exposure

A lip retractor was placed. Using the nondominant hand to evert the lip and the index finger to palpate below the planned intraoral incision, a mucosal incision with an inverted V to spare the frenulum was made and carried through the mentalis muscle from canine to canine using a guarded blunt tip Bovie. Care was taken to retain a cuff of muscle on the symphyseal bone. A periosteal elevator was then used to develop the subperiosteal plane inferior to this cuff, but not over the inferior border of the mandible. Mental foramina with exiting nerves were identified bilaterally. Mental nerves were protected while carrying the exposure inferior to the nerve and as far lateral to the foramen as anatomically feasible along the posterior mandibular inferior border. The exposure of the mandibular symphysis and lateral mandibular body was limited to the planned osteotomy line so that the mobilized segment would remain vascularized.

Osteotomy

The planned osteotomy line was marked inferior to the dental roots and at least 6 mm inferior to the mental foramina. Using an oscillating saw, vertical lines were scored along the labial symphyseal surface including one at the midline for reference. Using a reciprocating saw the osteotomy was made along the marked line from one inferior mandibular border to the symphysis. The reciprocating saw was then redirected to the contralateral inferior mandibular border and the contralateral osteotomy was made and continued to the symphysis. The mandibular symphysis was then mobilized, leaving its posterior muscular attachments intact. Bipolar cautery was used for hemostasis to control any bleeding from the muscle.

Repositioning and Fixation

The symphysis was then repositioned so as to achieve the preoperatively set goals in terms of symmetry and proportion. It was then fixed with a titanium plate and bicortical screws.

Closure

The mentalis muscle was resuspended to the retained muscular cuff on either side of the midline. The labial mucosa was reapproximated with a resorbable suture. The throat pack was removed. The oropharynx and stomach were suctioned. A microform tape dressing was placed.

Emergence from Anesthesia

The patient was awakened and extubated and taken to the recovery room in stable condition.

Patient's Family Discussion

We then discussed with the patient's family the operative procedure and postoperative care. We went over diet, activities, pain management, oral care, medications, and the importance of postoperative appointments.

Note

For vertical reduction and leveling cases, two horizontal osteotomies are typically made. These are both marked, care being taken that the superior one is clear of tooth roots and at least 6 mm below the mental foramina. The inferior osteotomy is performed first followed by the superior osteotomy. The resulting wedge of bone can be used as a bone graft.

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LeFort I Osteotomy

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Carlos Amir Esparza Monzavi, David E. Morris, and Pravin K. Patel

Indications

Anatomic

1. Maxillary hypoplasia
2. Mandibular hyperplasia, relative
3. Maxillary–mandibular anomalous relationship to the cranial base
4. Dental: Class III, negative overjet (reverse overjet), open bite (apertognathia)

Functional

1. Difficulty with incising and mastication of food
2. Difficulty with nasal breathing
3. Difficulty with speech (articulation)

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Essential Steps

Preoperative Markings

There are no applicable preoperative skin markings to be done with a LeFort I osteotomy. Intraoperatively, there are markings that may be made at several junctures (the medial canthus as a reference for vertical repositioning, the mucosal incision, and the maxillary osteotomy line). These are described respectively in the section "Essential Steps" (steps 4, 6, and 10).

Intraoperative Details

1. Nasotracheal general anesthesia. Secure nasotracheal tube to the nasal septum and forehead. Eye protection (tarsorrhaphy sutures, clear adhesive eye shields). Place throat pack.
2. Interdental surgical hooks (if not placed by the orthodontist prior the surgery). Check occlusal splint to make sure that the splint independently fits the maxillary dentition and the mandibular dentition.
3. Infiltrate the operative areas of exposure with epinephrine-containing solution (1 % Xylocaine with 100,000 epinephrine solution): maxillary labial–buccal vestibule above the attached gingiva, anterior nasal

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spine, base of the nasal septum, submucosally along nasal floor and nasal sidewalls, retromolar region, and junction of the hard and soft palate. Pack bilateral nasal airways with cottonoids soaked with a vasoconstricting agent.

4. For vertical repositioning cases, mark the bilateral medial canthus with methylene blue; these marks will be used as a baseline reference in repositioning the maxilla so that the vertical midface height is adjusted to achieve the planned dental display. Use a caliper to measure vertical distance from this mark to the tip of central incisors or to the maxillary orthodontic arch wire.
5. The oral cavity is prepped with dilute Betadine solution or an antibiotic oral rinse (chlorhexidine gluconate).
6. Intraoral upper vestibular incision from bicuspid to the bicuspid region, modified centrally as an inverted V, leaving mucosal cuff for closure. This may be marked with a pen or by gently scoring the mucosa with a Bovie.
7. Subperiosteal dissection superiorly, identifying the infraorbital foramen, exposing the lateral zygomaticomaxillary buttress, body of the zygoma, and the anterior portion of the zygomatic arch.
8. Submucosal exposure of anterior nasal spine and bony piriform aperture.
9. Elevate the nasal mucosa from the lateral nasal sidewall inferior to the inferior turbinate, the nasal floor, and medially along the vomer septal cartilage junction.
10. Mark planned maxillary osteotomy with a pencil from the medial buttress to the lateral buttress tailored to the patient's deformity.
11. Separate the cartilaginous nasal septum and vomer from the maxillary crest with elevator and guarded osteotome. Palpate the guarded osteotome with a finger placed at the junction of the hard and soft palate to ensure that the separation is complete.
12. Complete horizontal maxillary osteotomy using a reciprocating saw proceeding from the medial buttress, across the anterior maxillary wall, and through the posterolateral maxillary wall.
13. Separate the pterygoid plate from the maxillary tuberosity using a curved osteotome.
14. Down-fracture osteotomized maxilla with digital pressure. If there is any difficulty with the down fracture, then "revisit" the osteotomy with the reciprocating saw and with an osteotome to complete the posterior nasal and maxillary wall.
15. Identify and ligate descending palatine neurovascular bundle if bleeding or disrupted.
16. Mobilize maxilla completely so that it can be placed passively into its planned position. This will require traction to be placed at the retromolar region and at the junction of the hard and soft palate.
17. Repair any nasal floor mucosal lacerations with a resorbable suture.
18. Extract third molars if needed.
19. Assess and remove any diseased maxillary sinus mucosa (polyps).
20. Multisegment the maxilla if it is needed.
21. Wire the oral surgical splint to maxillary arch and bring arches into maxillomandibular fixation (MMF) with dental orthodontic elastic bands.
22. Confirm the planned position by vertical measurement from marked reference point to the orthodontic arch wire using a caliper (an alternative is to use wires).
23. Remove any bony prominences of the mobilized maxillary segment and/or the superior stable segment that may cause premature contact, thereby impeding planned position.
24. Stabilize mobilized maxillary segment in the final position using titanium plates and screws.
25. Release MMF and check occlusion in centric relation. Remove splint (if one-piece LeFort I) and recheck occlusion.
26. Assess the osteotomy gap for bone graft.
27. Trim caudal septum if needed to prevent lateral buckling of cartilaginous septum.

28. Drill hole through anterior nasal spine and secure the anterior septum to the midline.
29. Alar base cinch suture.
30. Close the mucosal incision. Consider V-to-Y closure.
31. Remove throat pack. Suction stomach. Remove the eye protection. Extubate.
32. Place guiding dental elastics in the canine region.
33. Admit for monitoring (bleeding and airway).

Postoperative Care

1. The patient is hospitalized in a step down unit for the first night to monitor for bleeding and airway issues. On postoperative day 1, he is transferred to a general floor and remains inpatient until tolerating adequate oral intake and pain is controlled with enteral analgesics.
2. The patient is permitted to shower on postoperative day 1.
3. Prophylactic antibiotics are used for 1 week.
4. Head of bed is elevated for the first week.
5. The patient is given clear liquid diet immediately postoperatively and for the first 2 days, followed by full liquids for the subsequent 2 days, followed by soft diet for the next 3 weeks.
6. Chlorhexidine mouth rinses are used twice per day for 2 weeks.
7. Warm salt water mouth rinses are encouraged after each time the patient eats or drinks until he is brushing his teeth regularly.
8. Teeth brushing is encouraged as soon as the patient is comfortable doing so. A Waterpik at low setting may be used up until this time.
9. Guiding elastics are started either immediately postoperatively or at the patients first postoperative visit 1 week after surgery.
10. If a splint was used for a multisegment osteotomy, it is removed at 6 weeks postoperatively.
11. Contact sports are avoided for 6 weeks following surgery.

Possible Complications and Adverse or Unsatisfactory Outcome

1. Injury to dentition
2. Injury to sensory nerves that may be permanent
3. Avascular necrosis of maxillary segment
4. Malunion and nonunion
5. Relapse into an unacceptable position
6. Infection
7. Bleeding with a need for transfusion
8. Outcome that may require additional procedures
9. Failure to meet patient expectations, appearance, and function
10. Prolonged recovery affecting school and work
11. Nasal appearance and function
12. Smile, lip, and gum appearance and function
13. Maxillary sinusitis
14. Fixation hardware palpability, pain, discomfort, and temperature sensitivity
15. Unpredictable or unanticipated events including death and neurovascular compromise

Operative Dictation

Diagnosis: maxillary hypoplasia, hyperplasia, asymmetry, relative mandibular hyperplasia, and maxillary–mandibular anomalous relationship to the cranial base

Procedure:

1. LeFort I osteotomy (single-piece or multisegmental) with repositioning
2. Internal skeletal fixation (manufacturer)
3. Occlusal splint
4. Bone graft (autogenous/allograft)

Indications

Patient is presenting for a LeFort-type midfacial skeletal osteotomy and repositioning under general anesthesia. The indications and surgical goals related to restoration of normal anatomy

and function, operative details, intraoperative decisions, risks and complications (nerve, dentition, loss of tissue and bone, plate fixation), blood loss and need for blood transfusion, predictable and unpredictable changes in appearance and function, including unsatisfactory outcome, and need for further operative intervention and orthodontic treatment have been discussed. We discussed the hospitalization, postoperative recovery which can be prolonged, and the need for close postsurgical monitoring of the occlusion by the surgeon and the orthodontist. The patient verbalized understanding and a formal written consent was obtained.

Description of the Procedure

Preparation for the Surgery

After a formal "time-out" protocol, the patient was positioned supine on the operating table with attention to minimizing pressure areas and to lower extremity risk to thromboembolism. General anesthesia was induced. The nasotracheal tube was then secured to the nasal septum and to the anterior scalp. Monitoring and intravenous access lines were established. Intravenous antibiotic and steroids were initiated (depending on the surgeon's protocol). Eyes were protected (tarsorrhaphy or clear eye shields). A throat pack was placed. The mouth was cleansed and teeth were brushed with chlorhexidine gluconate 0.12% (Peridex) oral rinse or dilute povidone–iodine (Betadine)>solution. The operative sites were infiltrated with 1% Xylocaine with 1:100,000 epinephrine for hemostasis. The nasal cavity was packed with oxymetazoline-soaked cottonoids. The face was then cleansed. The skin was prepped and draped in a sterile fashion.

Surgical Planning and Splint Fabrication

The maxilla and mandibular dental stone models were mounted on an articulator and the occlusal position was determined. The cephalometric radiographs were analyzed and visual treatment objectives were performed. The model surgery was performed and an occlusal guide for surgery was fabricated.

Reference Marks

Prior to the incision, the vertical distance from the medial canthus to the maxillary orthodontic arch wire between the lateral incisor and the canine are measured bilaterally and recorded.

Incision and Exposure

A lip retractor was placed. An upper buccal vestibular incision from bicuspid to bicuspid was made, modifying this centrally as an inverted V to spare the frenulum. The anterior and lateral maxilla, piriform rim, and anterior zygoma were exposed in the subperiosteal plane. Anteriormost masseteric fibers were detached from the zygomatic body. The pterygopalatine region was exposed and packed with cottonoids soaked in 1:50,000 epinephrine solution. The nasal mucosa was elevated to expose the lateral nasal sidewall, nasal floor, and medial nasal vomer septal cartilage to the full length of the hard palate.

Osteotomy

The nasal septal disjunction is performed with an elevator anteriorly followed by a guarded osteotome posteriorly, with the posterior pharynx protected with a gauze pack and a finger placed at the junction of the hard/soft palate. The maxillary osteotomy was marked medially above the root apices and continued laterally at the level planned preoperatively in order to achieve anatomic goals. The osteotomy was made with a reciprocating saw. For a higher level LeFort I: The osteotomy was ramped superolaterally to include a portion of the zygoma, and then posteriorly, the osteotomy was carried back down the pterygomaxillary junction using a narrow thin osteotome. The pterygomaxillary separation was performed with a curved osteotome, and then the osteotomy was completed with a straight osteotome with it directed inferiorly at selective sites of resistance. The maxilla was downfractured with finger pressure alone. Once downfractured, the remaining portion of the mucosal

flap of the nasal floor was elevated. The maxilla was then fully mobilized with the use of retromolar and retropalatal retractors. The nasal floor mucosa was repaired with chromic suture. Hemostasis was assured, carefully examining the descending palatine vessels. Bleeding vessels were controlled with bipolar cautery and hemo-clips.

Dental Extractions

With the maxilla down-fractured, the maxillary third molars (#1, #16) were extracted after identifying the location.

Maxillary Sinus

With the maxilla down-fractured, the maxillary sinus mucosa was assessed. Diseased sinus mucosa and polyps were removed.

Multisegmented Maxilla

With the maxilla down-fractured and mobilized, the maxilla was multisegmented. The interdental osteotomies were initiated with a narrow diameter fissure burr followed by a thin interdental osteotome. The hard palatal mucosa was infiltrated with a saline solution and then segmented using a thin reciprocating saw and an osteotome with a finger placed on the palatal mucosa for protection. The segments were then gently mobilized with a palatal spreader.

Repositioning and Fixation

The prefabricated occlusal surgical splint was wired to the maxillary dental arch using 30 gauge wire. The mobilized maxillary segment was placed into maxillary–mandibular fixation (MMF) indexed by the splint using tight dental elastics. With the mandibular condyles seated within the glenoid fossa, the maxillary–mandibular complex was ranged and placed into its desired position. This was based on presurgical clinical and radiographic planning using the vertical reference marks at the medial canthus. To facilitate this, areas of premature bony contact were eliminated so that the maxilla was passively positioned. The maxillary segment was then fixated into position with titanium plates and screws at the medial and posterolateral buttresses with the condyles seated in the glenoid fossa. The MMF was released and the occlusion was assessed by passively ranging the mandible. This was done initially with the occlusal splint in place and then rechecked with the splint removed so as to eliminate artificial interferences from the splint. (The splint was then resecured to the maxillary arch wire to maintain occlusal stability.)

Closure

The operative site was irrigated with half strength hydrogen peroxide and normal saline and hemostasis was assured. The caudal septal edge was trimmed as needed to prevent buckling. The septum was centered and secured using a predrilled hole through the anterior nasal spine with a transfixation suture. An alar base cinch suture was placed. A V–Y upper lip closure was performed, approximating the orbicularis muscle and the associated mucosa. The remainder of the incision was approximated with resorbable suture. The previously placed throat pack was removed. The oropharynx and stomach were suctioned. The protective eye shields were removed and the pupils were found to be equal and constricted, appropriate for the level of anesthesia.

Emergence from Anesthesia

The patient was awakened and extubated. The oropharynx was suctioned. Light guiding dental elastics was placed at the canine region with the patient having the ability to open their mouth for postoperative comfort.

Patient Family Discussion

We then discussed with the patient's family the operative procedure, intraoperative decisions, hospitalization, and postoperative care. We discussed that our immediate concerns are to monitor bleeding and airway. We discussed our criteria for discharge to home. We went over diet, activities, pain management, oral care, medications, and the importance of postoperative appointments.

The above operative template will need to be modified accordingly for patients with facial cleft.

Suggested Reading

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Bilateral Sagittal Split Osteotomy (BSSO) of the Mandibular Ramus

51

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Indications

Anatomic

1. Mandibular hyperplasia, hypoplasia, and asymmetry
2. Maxillary–mandibular anomalous relationship to the cranial base
3. Dental: Class III, Class II, negative overjet (reverse overjet), and excessive overjet

Functional

1. Difficulty with incising and mastication of food
2. Difficulty with airway (obstructive sleep apnea)
3. Difficulty with speech (articulation)

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Essential Steps

Preoperative Markings

There are no applicable preoperative skin markings to be done with a bilateral sagittal split mandibular osteotomy (BSSO) osteotomy. Intraoperatively, the mucosal incision may be marked (see step 5).

Intraoperative Details

1. Nasotracheal general anesthesia. Secure nasotracheal tube to the nasal septum and forehead. Eye protection (tarsorrhaphy sutures, clear adhesive eye shields). Place throat pack.
2. Interdental surgical hooks (if not placed by the orthodontist prior the surgery). Check occlusal splint to make sure that the splint independently fits the maxillary dentition and the mandibular dentition.
3. Infiltrate the operative areas of exposure with epinephrine-containing solution (1% Xylocaine with 100,000 epinephrine solution): mandibular retromolar region, angle, ascending ramus, and lingual ramus.
4. Simultaneously keep the mouth propped open, the tongue retracted, and a wide cheek retractor placed in the oral cavity.

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5. Bilateral lower buccal vestibular incisions are made lateral to the attached gingiva in the first molar region, extending proximally. A 6–8-mm mucosal cuff is left so as to facilitate closure. The incision may be marked with a pen or gently scored with a Bovie.
6. Expose the lateral surface of the posterior body, angle, and ascending ramus in the subperiosteal plane. Minimize the exposure necessary along the buccal–lateral aspect of the ascending ramus.
7. Strip masseteric muscle fibers from the angle region.
8. Place a channel retractor at the angle to support the mandible.
9. Expose the anterior ramus border toward the coronoid process using a "notched" elevator and strip the anterior attachments of the temporalis muscle with an electrocautery.
10. Clamp of the coronoid process with a Kocher clamp retractor.
11. Expose the medial aspect of the ramus along its depth reflecting the soft tissue from the sigmoid notch toward the entrance of the inferior alveolar nerve.
12. A medial ramus retractor is placed to protect the inferior alveolar nerve.
13. Horizontal corticotomy of the medial ramus superior to the mandibular foramen along the entire width of the ramus using initially a side cutting Lindemann burr or a reciprocating saw if the anatomy is appropriate.
14. Continue the corticotomy inferiorly with a reciprocating saw, following the medial aspect of the external oblique ridge to the region between the first and second molar.
15. Perform distal (vertical) corticotomy from this point to the inferior border of the mandibular body using either the saw or the Lindemann burr. Perform a back cut with the saw where the vertical corticotomy meets the inferior mandibular border. The medial and lateral aspect of the inferior border must be sectioned for a several millimeters to facilitate the osteotomy with an osteotome.
16. Using a series of osteotomes, complete the sagittal split, working systematically from the distal (vertical) to the proximal (horizontal) corticotomy. The correct plane is along the inner cortical surface of the proximal segment.
17. Separate the sectioned proximal and distal segments with a ramal spreader. Note the position of the inferior alveolar nerve, which should remain with the distal segment.
18. Separate any residual medial pterygoid muscle fibers and stylomandibular ligament attachments from the medial aspect of the proximal segment. This is especially important with mandibular setback procedures to facilitate posterior repositioning of the distal segment.
19. Complete the contralateral osteotomy as in previous steps.
20. Wire the prefabricated oral surgical splint to the maxillary arch using 30-gauge wire. Bring the maxillary and mandibular arches into maxillomandibular fixation (MMF) using tight elastics with the splint.
21. Place bilateral fixation between the proximal and distal segments with either bicortical screws through a transbuccal approach or plates or monocortical screws through an intraoral approach.
22. Release the MMF to ensure that the lower dental arch passively comes into the occlusal splint.
23. Remove the splint and ensure again that occlusion is acceptable.
24. Approximate the muscle with periosteal edge along the length of the incision.
25. Close the mucosa with resorbable sutures. If transbuccal approach is used for fixation, close skin incisions with fast-absorbing gut suture.

Postoperative Care

1. The patient is hospitalized in a step down unit for the first night to monitor for bleeding and airway issues. On postoperative day 1, he is transferred to a general floor and remains inpatient until tolerating adequate oral intake and pain is controlled with enteral analgesics.

2. The patient is permitted to shower on postoperative day 1.
3. Prophylactic antibiotics are used for 1 week.
4. If transbuccal trocar incisions were made, these are treated with topical antibiotics for 3 days.
5. The head of bed is elevated for the first week.
6. The patient is given clear liquid diet immediately postoperatively and for the first 2 days, followed by full liquids for the subsequent 2 days, and then by soft diet for the next 3 weeks.
7. Chlorhexidine mouth rinses are used twice per day for 2 weeks.
8. Warm salt water mouth rinses are encouraged after each time the patient eats or drinks until he is brushing his teeth regularly.
9. Teeth brushing is encouraged as soon as the patient is comfortable doing so. A Waterpik at low setting may be used up until this time.
10. Guiding elastics are started either immediately postoperatively or at the patients' first postoperative visit 1 week after surgery.
11. Contact sports are avoided for 6 weeks following surgery.

Possible Complications and Adverse or Unsatisfactory Outcome

1. Injury to dentition
2. Injury to sensory nerves that may be permanent
3. Avascular necrosis of mandibular proximal segment
4. Malunion and nonunion
5. Unfavorable split and unanticipated mandibular fracture
6. Relapse into an unacceptable position
7. Infection
8. Bleeding with a need for transfusion
9. Possible need for unanticipated revisional procedure(s)
10. Failure to meet patient expectations, appearance, and function
11. Prolonged recovery affecting school and work
12. Unacceptable change in cervicomental contour
13. Unacceptable change in smile, lip appearance, and function
14. Fixation hardware palpability, pain, discomfort, and temperature sensitivity
15. Unpredictable or unanticipated events including death and neurovascular compromise

Operative Dictation

Diagnosis: mandibular hyperplasia, hypoplasia, and asymmetry

Procedure:

1. Bilateral mandibular sagittal split osteotomy with repositioning
2. Internal skeletal fixation (manufacturer)
3. Occlusal splint

Indications

This patient presents for a bilateral sagittal split osteotomy and repositioning of the mandible under general anesthesia. Indications and surgical goals related to restoration of normal anatomy and function, operative details, intraoperative decisions, risks and complications (nerve, dentition, loss of tissue and bone, plate fixation), blood loss and need for blood transfusion, predictable and unpredictable changes in appearance and function, outcome including and unsatisfactory outcome, and need for further operative intervention and orthodontic treatment have been discussed. We have discussed that with this procedure, there is a significant loss of function with the inferior alveolar nerve affecting sensation, initially with all patients. It is followed by gradual recovery in some but not all patients. Some degree of permanent sensory should be expected. We discuss the hospitalization, postoperative recovery which can be prolonged, and the need for close postsurgical monitoring of the occlusion by the surgeon and the orthodontist.

The patient verbalizes understanding and a formal written consent is obtained.

Description of the Procedure

Preparation for the Surgery

After a formal "time-out" protocol, the patient was positioned supine on the operating table with attention to minimizing pressure areas and to lower extremity risk to thromboembolism. General anesthesia was induced, and the nasotracheal tube was then secured to the nasal septum and to the anterior scalp. Monitoring and intravenous access lines were established. Intravenous antibiotic and steroids were initiated (depending on the surgeon's protocol). Eyes were protected (tarsorrhaphy or clear eyelid shield). A throat pack was placed. The mouth was cleansed and teeth were brushed with chlorhexidine gluconate 0.12 % (Peridex) oral rinse or dilute povidone–iodine (Betadine) solution. The operative sites were infiltrated with 1 % Xylocaine with 1:100,000 epinephrine for hemostasis. The face was then cleansed with a skin prepping solution and draped in a sterile fashion.

Surgical Planning and Splint Fabrication

(Performed preoperatively) The maxillary and mandibular dental stone models were mounted on an articulator and the occlusal position was determined. The cephalometric radiographs were analyzed and visual treatment objectives were performed. The model surgery was performed and an occlusal guide for surgery was fabricated.

Exposure

A lip retractor was placed, followed by a mouth prop placed on the contralateral side. The tongue was retracted medially exposing the operative site. Preserving an adequate mucosal cuff for closure, a lower vestibular incision was made extending from the posterior mandibular body, angle, and extending vertically along the ramus. The buccal or lateral surface of the posterior mandibular body, angle, and ascending ramus was exposed in the subperiosteal plane. The inferior and posterior borders of the mandible were elevated to accommodate a channel retractor. The anterior border of the ramus was exposed in an inferior to superior fashion with a notched elevator. The temporalis muscle fibers were stripped using an electrocautery exposing the coronoid process. The coronoid process was clamped with a Kocher clamp and retracted to facilitate exposure. The medial aspect of the ramus was exposed from the anterior border to the posterior border and then from superior to inferior reflecting the soft tissue from the sigmoid notch toward the entrance of the inferior alveolar nerve. A medial ramus retractor was placed to protect the nerve.

Osteotomy

A horizontal corticotomy was made through the medial cortical plate above the lingula using a Lindemann side-cutting burr. The corticotomy was then continued using a thin reciprocating saw from the horizontal corticotomy inferiorly following the medial aspect of the external oblique ridge. This was then continued and completed as a vertical corticotomy extending to the inferior border at the region of the first and second molar. A back cut was made at the inferior mandibular border using the reciprocating saw to section both the buccal and lingual cortices. Starting at the vertical osteotomy and working proximally, osteotomes were directed along the inner buccal cortex to systematically complete the osteotomy. A ramus spreader was then used to complete the splitting of the ramus into proximal and distal segments. With the segments mobilized, the inferior alveolar nerve was visualized to accompany the distal segment and no obvious transection of the nerve was noted. The medial pterygoid muscle attachments were then stripped from the medial aspect of the proximal segment. With one side completed, a similar procedure was then carried out on the contralateral side.

Repositioning and Fixation

The distal mandibular segment dental arch was then fully mobilized from the proximal condylar segments. A prefabricated surgical splint was then fixed to the maxillary arch with 30-gauge

wire. The distal mandibular segment was positioned with the teeth occluding in the splint and the arches placed into maxillary–mandibular fixation (MMF) with the occlusal splint and tight elastics, establishing the final occlusion. (With mandibular setback, excess ramal buccal bone was resected with a reciprocating saw. The bone was preserved for later bone grafting as needed.) With the condyles seated, the proximal and distal segments were brought together with plates and monocortical screws through the intraoral exposure or as an alternate positional bicortical screws were placed through a transbuccal approach. The MMF was released. The occlusion with the mandibular dentition passively came into the splint with the condyles seated within the glenoid fossa. The splint was removed and again the occlusion closely matched the planned final occlusion with the mandible in centric relation.

Emergence from Anesthesia

The patient was awakened and extubated. The oropharynx was suctioned. Light guiding dental elastics were placed at the canine region with the patient having the ability to open their mouth for postoperative comfort.

Patient Family Discussion

We then discussed with the patient's family the operative procedure, intraoperative decisions, hospitalization, and postoperative care. We discussed that our immediate concerns are to monitor bleeding and airway. We discussed our criteria for discharge to home. We went over diet, activities, pain management, oral care, medications, and the importance of postoperative appointments.

Suggested Reading

Obwegeser HL. Mandibular growth anomalies. Berlin: Springer; 2001.

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Unilateral Complete Cleft Lip Repair with Primary Semi-open Rhinoplasty

52

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Introduction

The multidisciplinary approach is essential to the satisfactory treatment of cleft patients [1]. This includes surgeons, orthodontists, speech pathologists, pedodontists, prosthodontists, otolaryngologists, social workers, psychologists, as well as a photographer. All of these contribute to the care of cleft patients from infancy to adulthood. The techniques presented here are based on the experience of the members of the Chang Gung Craniofacial Center over a period of 30 years in a Chinese population. They have also been tested in other racially diverse centers. The improved outcomes result from an integrated approach with presurgical management, surgical refinements, and postsurgical maintenance.

Indication

Unilateral complete cleft lip of primary palate.

Essential Steps

Preoperative Markings

1. Mark the non-cleft side peak of Cupid's bow (CPHR), center point of Cupid's bow (LS), peak of Cupid's bow on the cleft margin of the non-cleft side (CPHL), commissure (CHR, CHL), red line [2], peak of Cupid's bow on the cleft side (CPHL′) [3], right and left base of ala (SBAR, SBAL) in sequence.
2. Measure the vertical height (VR, VL) and the horizontal length (HR, HL) to adjust the peak of Cupid's bow on the cleft side (CPHL′) [3, 4].
3. Mark the incision lines: the rotation flap, C-flap, advancement flap, and CM- and L-flap.

Intraoperative Details [5]

1. Under general anesthesia, the patient is placed in supine position with the face prepared and draped.
2. Infiltrate the nose and the upper lip mucosa with local anesthetics: 1% Xylocaine with 1:200,000 epinephrine.

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3. Incise the rotation flap: The curvilinear line of Mohler's incision [6] extending upward into the base of columella followed by a back cut on the non-cleft side philtrum.
4. The orbicularis muscle is separated 2–3 mm from the skin, not crossing the midline at the subdermal plane.
5. Downward traction on the free border of the lip with a skin hook will determine if the rotation is adequate or not.
6. The C-flap incision line is made from point CPHL along the skin and mucosa junction. The incision line is extended 5 mm or more upwardly at the junction of the columellar skin and septal mucosa. The mucosa of the C-flap is raised as the CM-flap based on the alveolar margin.
7. Using a tenotomy scissors, medial crura of the lower lateral cartilage (LLC) on the cleft side is dissected free.
8. The incision line of the advancement flap starts from the point CPHL′. A white skin roll (WSR) triangular flap is designed above CPHL′ according to the width on the non-cleft side. The incision line is extended upward along the skin and vermilion/mucosa junction to the split point of nasolabial groove. The L-flap is designed and raised beneath the incision based on the alveolar margin on the cleft side [7].
9. The incision line is then continued along the skin-mucosal junction on the pyriform until the inferior edge of the inferior turbinate. An inferior turbinate flap (T-flap) can be raised to lengthen the mucosa if needed in wide cleft.
10. The T-flap is elevated in a retrograde fashion based on the vestibular skin.
11. The attachments of the lower lateral cartilage (LLC) to the alar base and upper lateral cartilage (ULC) are released, allowing easy mobilization of the LLC and the lateral segment.
12. Supraperiosteal muscle dissection until visualizing the infraorbital nerve fibers on the cleft side is performed.
13. The orbicularis peripheralis muscle is separated from the skin along the incised edge to a line drawn from the alar base to the base of the philtral column (CPHL′). The Angular artery is used as a landmark for the muscle dissection around the alar base.
14. The orbicularis marginalis flap (OM-flap) is incised along the free border of the lip to include the orbicularis marginalis muscle, the vermillion medial to point CPHL′, and the corresponding mucosa posteriorly.
15. The T-flap based on vestibular skin is rotated 90° to fill in the defect on pyriform rim. Its superior edge is sutured to the pyriform edge.
16. The L-flap is transposed medially behind the columella and sutured with interrupted 5-0 polyglactin suture to the mucoperichondrium of the previous incision to reconstruct the nasal floor.
17. Laterally, the inferior edge of the T-flap is sutured to the superior edge of the L-flap with interrupted 5–0 polyglactin suture.
18. The CM-flap is transposed laterally below the L-flap. It is attached to the maxilla and sutured to the inferior border of the L-flap to create the buccal sulcus.
19. The vestibular skin with attached ala is advanced over the mucosal bridge to the uppermost point of the previous incision behind the columella.
20. The upper free edge of the vestibular skin flap and bridging T- and L-flaps are closed with interrupted 5-0 polyglactin suture.
21. Medial tip of the C-flap is rotated into the collumellar base defect created by the Mohler's incision.
22. A stay suture of 5-0 polydioxanone is applied over the orbicularis marginalis muscles to align the lips position.
23. The upper orbicularis peripheralis muscle tip of the advancement flap [8] is anchored with strong suture (polydioxanone 4-0) to the caudal edge of the nasal septum.
24. The orbicularis muscle is approximated by overlapping fashion with vertical mattress sutures. The muscle approximation is tighter than the skin.
25. The Noordhoff's vermillion flap is marked and incised on the OM flap, while the OM flap is held under tension.

26. The vermilion on the non-cleft side is incised above or along the red line and the vermilion flap is carefully inserted. The excessive tissue is carefully trimmed to approximate the free border of the lip.
27. Lateral tip of the C-flap is carefully trimmed to close the nasal sill. The nostril width on the cleft side is slightly overcorrected to make it narrower than the non-cleft side.
28. The tip of the advancement flap is sutured to the most lateral point on the junction of the C-flap and the rotation flap.
29. Final skin closure on the lip with 7-0 polyglactin or nylon suture.
30. A rim incision on the non-cleft side nostril and the Tajima reverse-U incision [9] on the cleft side are made. The reverse-U incision is made about 1–2 mm higher than the alar rim on non-cleft side [10].
31. The interdomal fibrofatty tissue on nasal tip is released from both LLCs.
32. Repositioning of LLCs with mattress suture with more median advancement on the cleft side. The excess skin below the reversed U incision is trimmed.
33. Closure of the nostril incisions with 4-0 polyglactin suture.
34. Creation of alar-facial groove with alar transfixion sutures [11].

Postoperative Care [12]

1. Remove any respiratory secretion.
2. Keep the baby warm and prop up approximately 45–60°.
3. Feed the baby with the same milk bottle that was used preoperatively. Large-holed nipple such as a cross-shaped or Y-shaped nipple is preferred.
4. Wound care after each feeding. Apply antibiotics ointment or wet saline dressing on the wound until removal of sutures.
5. The stitches are removed 5–7 days after operation.
6. Postoperative scar care: using a silicone nasal conformer for 6–8 months duration. Lip strap with adhesive tape, silicone sheet, and silicone gel are used for scar compression [13].

Note These Variations

If the anterior palate is repaired with vomer flap at the same time, the T flap is not necessary. The L-mucosal flap can be sutured to the septal extension of the vomer flap to close the nasal floor

Possible Complications

1. Stitch abscess
2. Compromised skin circulation
3. Wound dehiscence
4. Asymmetry
5. Unfavorable scar

Operative Dictation

Diagnosis: unilateral complete cleft lip and palate

Procedure: unilateral cheiloplasty and primary semi-open rhinoplasty.

Indication

The ___ M/O baby weight ___ kg is a case of ___ complete cleft of primary palate. The alveolar cleft will be narrowed down to ___ mm before operation by a period of nasoalveolar molding.

Description of the Procedure

In the operating room, the baby was placed supine. Adequate general anesthesia was achieved with endotracheal intubation. The face was prepared and draped as usual fashion. A moistened throat pack was inserted into the oral cavity. Prophylactic intravenous antibiotic was administrated prior to the procedure.

The landmarks of the lip including the three points of the Cupid's bow on the medial segment, midpoint, the proposed peak of Cupid's bow on the lateral segment, the red line, and the commissures were marked out and tattooed with methylene blue. The nose and the upper lip mucosa were infiltrated with 1% Xylocaine with

1:200,000 epinephrine. The incision line of the rotation flap was marked in a Mohler's fashion from the lateral peak of the Cupid's bow into the columella with a back cut toward the philtral column of the non-cleft side. The rotation flap was incised with a #67 Beaver blade, and the flap was rotated down by releasing all the abnormal insertion of the orbicularis oris muscle to the columella base. Downward traction on the free edge of the lip with a skin hook determined the adequacy of the rotation. Attention was then drawn to C-flap, which was created by incising along the skin and mucosa junction. At the deepest point of this junction, the incision line was extended upward into the membranous septum to separate the skin and the mucosa behind the columella for several millimeters. The orbicularis muscle within the rotation flap was separated 2–3 mm from the skin edge, not crossing the midline in the subdermal plane. Using a tenotomy scissors, the medial crura of the lower lateral cartilage on the cleft side was dissected free.

The landmarks and incision line of the advancement flap (lateral segment) were marked out. These included the proposed peak of the Cupid's bow with a white skin roll triangular flap above this point. The incision was made along the cleft edge to the split point of nasolabial groove. The L-mucosal flap (L-flap) based on the cleft alveolar margin beneath the skin incision was developed. Supraperiosteal muscle dissection until visualizing the infraorbital nerve fibers on the cleft side was performed. At the nasolabial groove, the mucosal incision was extended upward to develop an inferior turbinate flap. The incision was converted into an intercartilaginous incision to separate the lower lateral cartilage from the upper lateral cartilage and releasing the abnormal muscle insertion to the alar base. The orbicularis peripheralis muscle was separated from the skin along the incised edge to a line drawn from the alar base to the base of the philtral column (CPHL′). The angular artery was used as a landmark for the muscle dissection around the alar base. Further muscle mobilization was required until the lateral segment could be advanced medially to oppose the medial segment without much tension. The submucosal dissection was limited to 2 mm, while the dissection on the skin side was much extensive to separate any abnormal muscle insertion from the skin. The orbicularis marginalis flap (OM-flap) was incised along the free border of the lip to include the orbicularis marginalis muscle, the vermillion medial to point CPHL′, and the corresponding mucosa posteriorly.

The lower lateral cartilage was fixed at a higher position along the intercartilaginous incision with 5-0 polyglactin suture. The defect along the piriform rim after advancing the lower lateral cartilage was replaced with the transposed inferior turbinate flap (T-flap). The two mucosal flaps (T- and L-flap) were sutured together bringing across the cleft, medially sutured to the septal incision to reconstruct the nasal floor paying special attention on the nostril width. The CM-mucosal flap (CM-flap) was brought across the cleft and sutured below the L-flap to reconstruct the sulcus. Attention was drawn to the columella where the medial tip of the C-flap was rotated into the collumellar base defect created by the Mohler's incision. A stay suture of 5-0 polydioxanone was applied over the orbicularis marginalis muscles to align the lips position. The upper muscle tip on the advancement flap was anchored to the nasal septum with 4-0 polydioxanone suture. Further muscle approximation of the advancement flap was overlapped over the muscle of the rotation flap with vertical mattress sutures. This was to reconstruct the orbicularis ring and the philtral ridge. The Cupid's bow was leveled with a small incision on the nasal floor area of the advancement flap to match its length to the rotation flap. Lateral C-flap tip was interdigitated into the incision on the nasal floor in a Z-plasty fashion, thus eliminating the horizontal incision of the advancement flap. A Noordhoff's vermilion flap was created on the lateral lip and interdigitated into the medial lip to level the red line. The white skin roll flap was carefully inserted to the medial lip with a small incision just above the point of the Cupid's bow. Simple closure of the mucosa and skin was performed with 5-0 and 7-0 polyglactin suture respectively.

Attention was then drawn to the nose. A rim incision was made on the non-cleft side nostril, whereas the Tajima reverse-U incision on the

cleft side. The reverse-U incision was made about 1–2 mm higher than the alar rim on non-cleft side. The lower lateral cartilages were mobilized from the skin envelope of the nose by sharp dissection. Then the lower lateral cartilages were approximated with mattress sutures with more medial advancement on the cleft side. The excess skin below the reversed U incision was carefully trimmed, and incision wounds were closed with 5-0 polyglactin suture. Through and through mattress sutures with 5-0 polydioxanone sutures were placed along the alar facial groove of the cleft side to obliterate the dead space between the skin and the cartilage besides giving extra support to the cartilage.

The baby had undergone the entire procedure well and recovered from general anesthesia in a stable condition. The estimated blood loss was approximately 5 cm^3.

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Bilateral Complete Cleft Lip Repair and Primary Semi-open Rhinoplasty

53

Ting-Chen Lu, Un-Chang See, Philip Kuo-Ting Chen, and M. Samuel Noordhoff

Introduction

The reconstruction of a symmetrical bilateral cleft lip and a natural looking nose with adequate columella length is a difficult challenge. The integrated multidisciplinary approach with presurgical nasoaveolar molding, modification of surgical techniques, and postoperative scar management and maintenance of the reconstructed nasal shape can give a more consistent better result [1–4]. Better understandings of the primary pathology and refined surgical technique have resulted in a decrease of severity in secondary deformities and the classic stigmata of the repaired cleft. The key surgical principles and steps are presented in this chapter [5].

Indication

Bilateral complete cleft lip and palate.

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Essential Steps

Preoperative Markings

1. Mark the anatomical points over the prolabium and lateral lips. The width between bilateral peak of Cupid's bow (CPHL and CPHR) is 4 mm. Narrow the marks on the columellar base to 3 mm [6–10].
2. Mark the bilateral forked flaps and prolabium mucosal flap (PM-flap) on the prolabium.
3. Mark the red line, commissure, proposed peak of the Cupid's bow on lateral lips. The anatomical point should be the point where the vermilion first becomes widest and the point is usually 3–4 mm lateral to the converging junction of the red line and white skin roll. It is usually 13–15 mm from the commissure.
4. Mark the white skin roll-free border flap and L-mucosal flap (L-flap) on the lateral lip.

Intraoperative Details [5]

1. Under general anesthesia, the patient is placed in supine position with the face prepared and draped.
2. Infiltrate the lateral lip mucosa, inferior turbinate, and prolabium with local anesthetic plus 1:200,000 epinephrine.

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3. The prolabial straight line incisions are made with a #11 scalpel.
4. The prolabial flap, forked flaps, and columella are raised together and advanced cephalic to a new position [10, 11].
5. The central part of the prolabial mucosa flap (PM-flap) is designed as an inferiorly based flap used to line the raw surface on the lower third of the premaxilla and deepen the sulcus.
6. The incisions on the lateral segments are made from the proposed peak of Cupid's bow along the cleft edge, leaving a 1 mm width of white skin roll (WSR) to develop a WSR-free border flap.
7. Bilateral L-mucosal flap about 5 mm wide based on the alveolar ridge of the cleft margin is raised.
8. Supraperiosteal muscle dissection until visualizing the infraorbital nerve fibers on the lateral segment is performed.
9. The orbicularis peripheralis muscle is separated from the skin along the incised edge and the alar base to a line drawn from the alar base to the base of the philtral column (CPHL′). The angular artery is used as a landmark for the muscle dissection around the alar base. An inferior turbinate flap (T-flap) is developed based on the vestibular mucosa. The ligamentous attachments of the lower lateral cartilage to the pyriform rim are released.
10. The nasal floor is reconstructed with the L-flap and inferior turbinate flap (T-flap) if the cleft is wide.
11. Bilateral lateral wings of the PM-flap are sutured below the L-flap to create the sulcus. The alar base skin is advanced medially to the columella to prevent flaring of the ala. The vestibular skin margin is sutured to the superior margin of the L-flap for a complete nasal floor closure.
12. Further muscle mobilization is required until both edges could be approximated at the midline without tension.
13. The lower 2/3 of the orbicularis muscles and mucosa are approximated in one layer with vertical mattress sutures over the midline, while the upper 1/3 is with simple sutures. The upper border of the muscle is anchored to the nasal septum.
14. Cupid's bow is reconstructed with the white skin roll-free border flaps which are brought together below the prolabium [12–14].
15. Skin closure with 7-0 nylon or polyglactin suture.
16. The nose is reconstructed with Tajima reverse-U incisions on both alar rims, and the lower lateral cartilages (LLCs) are dissected under direct vision to release all the tip fibrofatty tissue from the LLCs [15, 16].
17. The separated LLCs are approximated by mattress sutures.
18. The excessive tissue on the lower edge of the Tajima incisions is trimmed off.
19. Additional alar-transfixion sutures are placed in the ala-facial groove.
20. The forked flap is sutured backward toward the nasal septum to tighten and restore the columellar-lip angle.

Postoperative Care

1. Remove any respiratory secretion.
2. Keep the baby warm and prop up approximately 45–60°.
3. Feed the baby with the same milk bottle that was used preoperatively. Large-holed nipple such as a cross-shaped or Y-shaped nipple is preferred.
4. Wound care after each feeding. Apply antibiotics ointment or wet saline dressing on the wound until removal of sutures.
5. The stitches are removed 5–7 days after operation. A silicone nasal conformer is used for 6–8 months after operation. Lip tapping, silicone sheet, and silicone gel are used for scar care [17].

Possible Complications

1. Stitch abscess
2. Compromised skin circulation
3. Wound dehiscence
4. Asymmetry
5. Unfavorable scar

Operative Dictation

Diagnosis: bilateral complete cleft lip and palate
Procedure: bilateral cheiloplasty

Indication

The ___ M/O baby weight ___ kg is a case of bilateral complete cleft lip of primary palate. The patient has had presurgical nasoalveolar molding. The alveolar gaps are ___ mm on both sides.

Description of the Procedure

In the operating room, the baby was placed in supine position. Adequate general anesthesia was achieved with endotracheal intubation. The face was prepared and draped as usual fashion. A moistened throat pack was inserted into the oral cavity. Prophylactic intravenous antibiotic was administered prior to the procedure. The landmarks of the lip were marked out on the prolabium and both lateral segments. The Cupid's bow measured 4 mm in width and the central segment is narrowed to 3 mm at columellar base. The proposed peak of the Cupid's bow on the lateral lip was measured 13–15 mm from the commissure. The lateral segments were infiltrated with 1 % Xylocaine with 1:200,000 epinephrine solution.

The prolabium was stabilized with a double skin hook retracting the columella upward, while a small single skin hook to counter tract the prolabial mucosa. Using a #11 scalpel, the central segment and two forked flaps were developed. Lateral incisions were extended behind the columella into the membranous septum. The central segment, forked flap, and columella were raised together and advanced cephalic to a new position. This will allow muscle approximation beneath the prolabial skin. The dissected columella was sutured to membranous septum at a higher position. The PM-flap (vermilion and mucosa part of the prolabium) was divided into a central inferiorly based flap and two lateral wings. The central part was used to deepen the sulcus on premaxilla, while the two lateral wings were used to create the sulcus. At the lateral segment, the L-mucosal flap was raised along the cleft edge. Supraperiosteal muscle dissection until visualizing the infraorbital nerve fibers was performed. The orbicularis peripheralis muscle was separated from the skin along the incised edge to a line drawn from the alar base to the base of the philtral column (CPHL′). The angular artery was used as a landmark for the muscle dissection around the alar base. The incision was extended upward to include an inferior turbinate flap. The ligamentous attachments of the lower lateral cartilage to the pyriform rim were released. The white skin roll-free border flap included with the vermilion and full thickness free border of the lip were prepared for Cupid's bow reconstruction later. Further muscle mobilization was required until both edges could be approximated at the midline without tension.

The bilateral T-flaps were used to fill in the defects on the pyriform area after advancing the lower lateral cartilages. (The T-flap was not necessary in case of narrow cleft.) The T- and L-flaps were sutured together bringing across the cleft and medially sutured to the septal incision for the nasal floor reconstruction, paying special attention to the nostril width. The excessive tissue on the nasal floor was trimmed away. Bilateral lateral wings of the PM-mucosal flap were sutured below the L-flap to create the sulcus. Attention was then drawn to lateral lip. Lower 2/3 of the orbicularis muscles and mucosa were approximated in one layer with 4-0 polyglactin (Vicryl) vertical mattress sutures over the midline, while the upper 1/3 is with simple sutures. The upper border of the muscle was anchored to the nasal septum. The skin flap of the central segment was aligned to the lateral lips. The full thickness white skin roll, vermilion, and free border flap were brought together below the central segment to reconstruct the central lip. The forked flaps were sutured backward toward the nasal septum to tighten and restore the columellar-lip angle. Excessive orbicularis muscle was preserved for augmentation of the lip tubercle.

Attention was then drawn to the nose. Tajima reverse-U incisions were made over both alar

rims. The lower lateral cartilages (LLCs) were skeletonized from the nasal skin envelope and dissected free from the interdomal fibrofatty tissue under direct vision. The lower lateral cartilages were repositioned with 5-0 polydioxanone mattress suture. The excessive skin below the Tajima incisions was trimmed away. The incision was closed with 5-0 polyglactin suture. To provide further support, through-and-through sutures using 5-0 polydioxanone were placed at the medial crura. Additional alar-transfixion sutures were placed in the ala-facial groove to obliterate the dead space as well as provide further LLC support. The baby has undergone the entire procedure well and recovered from anesthesia in a stable condition.

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Two-Flap Palatoplasty

54

Stephanie M. Cohen and Mimis Cohen

Indications

1. Achieve reconstruction of the anatomical defect.
2. Create a functional apparatus for the production and development of normal speech.
3. Correction of abnormal positioning of the palatal muscles.

Essential Steps

Preoperative Markings

1. Lateral incisions are marked from the most anterior edge of the cleft bilaterally through the imaginary line between palatal tissue and gum to about 1 cm within the soft palate.
2. Medial margin incisions are also marked from the most anterior edge of the cleft to the hemi-uvula, bilaterally.

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Intraoperative Details

1. Place in the supine Trendelenburg position.
2. General anesthesia with an oral Rae endotracheal tube.
3. Cleanse face.
4. Place Dingman mouth gag for exposure and securing of the endotracheal tube.
5. Infiltrate proposed incision lines with 0.5 % lidocaine plus 1:200,000 epinephrine for vasoconstriction and hydro-dissection of the palatal mucoperiosteal flaps.
6. Place a 2-0 silk suture in each hemi-uvula for traction and secure in the spring of the mouth gag.
7. Incise the proposed lateral incision and start elevation of the palatal mucoperiosteal flap from anterior to posterior under the periosteum with a dental scaler.
8. Incise the medial border of the flap, leaving a 2–3 mm calf to facilitate closure of the nasal lining.
9. Identify the greater palatine neurovascular bundles and protect bundle.
10. Complete release of abnormal attachments of the muscles of the soft palate, primarily the levator veli palatini and tensor veli palatini from the posterior edge of the bony palate.
11. Dissection and release of the lateral aspect of the palatal flap in the soft palate (Ernst space).

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12. Complete dissection of the palatal muscles including the palatoglossus and palatopharyngeous muscles from the nasal lining from the posterior edge of the hard palate to the uvula.
13. Complete nasal lining dissection in the hard palate to facilitate medial mobilization and tension-free closure.
14. Repeat some steps on the opposite site.
15. Meticulous hemostasis.
16. Closure of nasal mucosa from the uvula to the anterior edge of the cleft with interrupted 4-0 polyglactin (Vicryl) sutures.
17. Closure of myomucosal flaps starting from the uvula and advancing anteriorly with horizontal mattress 4-0 polyglactin (Vicryl) sutures.
18. Closure of palatal mucoperiosteal flaps to the anterior edge of the cleft with mattress 4-0 polyglactin sutures.
19. Approximation of the flaps to the gum lateral as much as possible to minimize open space.
20. Suctioning of gastric contents and the oral cavity.

Postoperative Care

1. Overnight observation in pediatric step-down unit for airway monitoring.
2. Immediate unrestricted bottle feeding as soon as patient is completely awake.
3. Maintain IV until adequate oral intake.
4. Pain medications as needed.

Possible Complications

1. Bleeding (specifically intraoperative)
2. Airway obstruction in the immediate postoperative period
3. Wound dehiscence (development of palatal fistula)
4. Possible impact on midface growth

Operative Dictation

Diagnosis: cleft palate, unilateral complete

Procedure: palatal repair with two-flap palatoplasty technique

Indication

This is a _____ born with a complete cleft lip and palate. The lip was repaired several months ago. Patient presents now for repair of palate. Benefits, risks, and alternatives associated with the procedure were discussed with the patient's parents in detail including possible results and complications. Informed consent was obtained.

Description of the Procedure

Patient and family were greeted in the preoperative area. History and physical and laboratory test were reviewed for accuracy. Informed consent was verified. The patient was brought to the operating room and placed in the supine position. Time out was performed among the operating room staff. General anesthesia was introduced and patient was intubated with an oral Rae tube. Tube was secured in place with a 1000 drape and a mesentery to relieve pressure on the chin. The table was positioned in Trendelenburg position for better exposure. The patient was prepped and draped in the usual sterile fashion. A Dingman mouth gag was positioned to provide exposure and secure the endotracheal tube. The palate was infiltrated with 0.5% lidocaine plus 1:200,000 epinephrine for vasoconstriction and hydro-dissection of the palatal flaps. A 2-0 silk suture was placed on either side of the hemi-uvulas for traction and secured in the spring of the mouth gag. Incisions were made with a #15 scalpel laterally at the junction between the hard palate mucosa and the gum on the alveolar ridge. Incision was made from posterior to anterior, starting 1cm posterior to the hard palate to the edge of the anterior edge of the cleft.

Using a dental scaler, mucoperiosteal flap was elevated off the surfaces of the bony palate. Medial incision was carried from the edge of the cleft to the hemi-uvula. The mucoperiosteal flap was dissected carefully until the greater palatine neurovascular bundles were visualized. At this point, the

abnormal attachment of the muscles of the soft palate were dissected free from the posterior border of the palatal bone with attention to avoid tearing of the nasal mucosa. Ernst space was dissected and the dissection continued in the soft palate. The nasal lining was carefully dissected free from the palatal muscles all the way to the uvula. With the use of single hooks for traction, the areas of the dissection were inspected one more time to make sure that the palatal flaps were completely free and easily approaching the midline. The nasal mucosa was then dissected free from the bony palate from posterior to anterior. The same procedure was performed in the opposite site.

Meticulous hemostasis was completed. The repair was started by approximating the nasal lining in the area of the uvula with 4-0 polyglactin (Vicryl) sutures. The closure of the nasal lining was completed to the anterior edge of the cleft. This closure was achieved without tension and without the need to use a vomer flap. The oral myomucosal flaps were then closed with 4-0 Vicryl interrupted sutures in a horizontal mattress fashion with the forward bite incorporating both the mucosal and muscular layers and the back bite only incorporating mucosa. The mucoperiosteal flaps were then approximated in the midline with 4-0 Vicryl interrupted horizontal mattress sutures, thus completing the repair.

Relaxing lateral incisions were approximated as much as possible to minimize the open areas in the palate. Gentle pressure was applied to the palate for 5 min for hemostasis. The stomach, esophagus, and oropharynx were suctioned with a soft orogastric tube. The Dingman mouth gag was removed and the patient was extubated.

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Double-Opposing Z-Plasty Palatoplasty

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Stephanie M. Cohen, David E. Morris, and Mimis Cohen

Indications

1. Reconstruction of the soft palate in patients born with clefts of the secondary palate, with or without cleft of the primary palate:
   (a) Achieve closure of the anatomical defect.
   (b) Correction of abnormal positioning of the palatal muscles.
   (c) Create a functional apparatus to facilitate anatomic speech development.

Note: patient-specific or optional information is indicated within "⟨ ⟩."

Essential Steps

Preoperative Markings

1. The planned flap incision lines are marked on the palatal surface just prior to incision.

Intraoperative Details

1. Supine position, slight Trendelenburg.
2. General anesthesia with an oral Rae endotracheal tube.
3. Cleanse face.
4. Place Dingman retractor for exposure.
5. Infiltrate palate with local anesthesia plus 1:100,000 epinephrine for hemostasis and hydro-dissection of mucosa.
6. Creation of posteriorly based oral myomucosal flap and, deep to this, anteriorly based nasal mucosal flap on one hemipalate. Creation of anteriorly based oral mucosal flap and, deep to this, posteriorly based nasal myomucosal flap on the contralateral hemipalate.
7. Transposition and inset of the four flaps.
8. ⟨For patients in whom the cleft extends anterior to the hard palate/soft palate junction, concomitant reconstruction of the anterior component of the cleft defect⟩.

Postoperative Care

1. Overnight observation in pediatric step-down unit for airway monitoring.
2. ⟨Removal of tongue suture ⟨(if placed)⟩ on POD #1⟩.
3. ⟨Use of bilateral elbow immobilizers for first postoperative week⟩.

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4. Initially age-appropriate liquid diet.
5. No straws or bottles that require suction for oral intake of liquids.

Possible Complications

1. Airway obstruction in the immediate postoperative period.
2. Wound dehiscence (subsequent development of palatal fistula).
3. Intraoperative bleeding.

Operative Dictation

Diagnosis: cleft palate, ⟨unilateral/bilateral/secondary palate with/without primary palate, with/without cleft lip⟩

Procedure: palatoplasty—double-opposing Z-plasty

Indication

This patient was born with a cleft palate and presents for palatal reconstruction. The indications, risks, and alternatives of the planned procedure were discussed with the patient's parents both in the clinic and on the day of surgery, and informed consent was obtained.

Description of the Procedure

The patient was placed supine on the operating room table where she underwent general endotracheal anesthesia with an oral Rae tube that was secured in the midline. Time-out was performed among the operating room staff. Preoperative antibiotics were administered. A Dingman retractor was placed and tidal volumes verified after placement of the retractor. Care was taken to pad all potential pressure points. The table was positioned in slight Trendelenburg position for the purpose of exposure. The face and oral cavity were prepped and draped in the usual sterile fashion using a dilute aqueous Betadine solution. The planned areas of dissection were infiltrated with 0.5 % lidocaine with 1:100,000 epinephrine. With a marking pen, the oral mucosal/nasal mucosal junction was marked bilaterally, as were planned opposing Z-plasty flaps. These were situated just behind the hard/soft palate junction. Incisions were made bilaterally along the nasal mucosal/oral mucosal junction from the tip of the uvula, extending anteriorly to just behind the hard/soft palate junction.

Attention was turned to the left-sided flaps. Using tenotomy scissors, the oral mucosa with muscular layer was dissected away from the underlying nasal mucosa. The previously marked left-sided posteriorly based triangular flap containing oral mucosa/muscle was incised and lifted from the underlying nasal layer. Care was taken to fully transect the levator musculature from its posterior hard palatal attachments. Dissection was continued laterally, sweeping the muscular bulk posteriorly with the flap. Next the underlying anteriorly based nasal mucosal triangular flap was incised.

Attention was turned to the right side. The anteriorly based oral mucosal triangular flap was incised and elevated with scissors from the underlying muscular/nasal mucosal layer. Deep to this, the posteriorly based muscular/nasal mucosal flap was incised in a medial to lateral direction to the extent that enabled tension-free inset of the left-sided nasal mucosal flap. Muscular dissection was however carried laterally well beyond the flap incision. This permitted maximal retropositioning of the levator muscle bulk.

<For clefts extending anteriorly into or through the hard palate, insert dictation of how the anterior component of the reconstruction was performed. For example, bilateral incisions along the oral mucosal/nasal mucosal junction were continued anteriorly to just behind the alveolar ridge. Then it was extended laterally just inside of the bilateral alveolar ridges. Palatal flaps were elevated, as was a Vomer flap and the anterior portion of the reconstruction completed in the manner of a two-flap palatoplasty>.

Hemostasis was achieved with electrocautery. The left and right uvular tips were sutured together with 4-0 Vicryl. The left and right deep layer flaps were transposed and inset using interrupted 3-0 and 4-0 Vicryl sutures. The opposing overlying left and right superficial layer flaps were then transposed and inset in the same fashion.

The stomach was suctioned with an orogastric tube. The Dingman retractor was removed. A 2-0 silk tongue suture was loosely placed and taped to the cheek with Steri-Strips. The patient was extubated and taken to the post-anesthesia care unit in stable condition.

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Superiorly Based Pharyngeal Flap

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Stephanie M. Cohen, David E. Morris, and Mimis Cohen

Indications

1. Correction of velopharyngeal dysfunction associated with cleft palate or with other conditions in which there is incomplete closure of the velopharyngeal mechanism
2. Presurgical clinical speech assessment and instrumental examination (nasopharyngoscopy or video fluoroscopy) findings demonstrating pharyngeal flap to be anatomically the most appropriate procedure based on the patient's closure pattern

Note: patient-specific or optional information is indicated within "< >."

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Essential Steps

Preoperative Markings

No formal preoperative markings are indicated.

Intraoperative Details

1. Supine position, slight Trendelenburg.
2. General anesthesia with an oral RAE endotracheal tube.
3. Cleanse face.
4. Place Dingman retractor for exposure.
5. Infiltrate palate with 0.5% lidocaine plus 1:100,000 epinephrine for hemostasis and hydrodissection of mucosa.
6. Midline incision made in soft palate with lateral retraction of hemipalatal flaps.
7. Nasal mucosal flap dissected from each hemipalate.
8. Pharyngeal flap raised off of prevertebral fascia, starting inferiorly.
9. <Catheters, nasopharyngeal airway> placed transnasally to control sizing of lateral ports.
10. Pharyngeal flap sutured to the soft nasal surface of the soft palate.
11. Additional lateral sutures placed between pharyngeal flap edge and hemipalatal edge <with catheters, nasopharyngeal airway in place> for port sizing.

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12. Inset nasal mucosal triangular flaps to cover raw surface of pharyngeal flap.
13. Oral mucosa of previous soft palate incision closed over the pharyngeal flap.

Postoperative Care

1. Overnight observation in pediatric step-down unit for airway monitoring
2. Liquid diet postoperatively using cup or spoon (no straws)

Possible Complications

1. Airway obstruction; immediate postoperative
2. Wound dehiscence causing palatal fistula and/or flap separation from palate
3. Hyponasality
4. Failure to correct velopharyngeal dysfunction/persistant hypernasality
5. Obstructive sleep apnea
6. Intraoperative bleeding

Operative Dictation

Diagnosis: velopharyngeal dysfunction, cleft palate <with or without cleft lip>.
Procedure: superiorly based pharyngeal flap.

Indication

This patient was born with a cleft palate. Despite previous palatal reconstruction, the patient has developed abnormal speech patterns associated with velopharyngeal dysfunction. This was anatomic in nature and cannot be corrected with speech therapy alone. Based on thorough clinical and instrumental evaluation, it was recommended that he/she undergo pharyngeal flap procedure in an effort to improve speech. Indications, risks, and alternatives of the planned procedure were discussed with the <patient and> family and informed consent was obtained.

Description of the Procedure

The patient was positioned supine on the operating room table and underwent general anesthesia with endotracheal intubation using an oral RAE tube. It was secured in the midline and a Dingman retractor was placed. A shoulder roll was placed to hyperextend the neck. <Preoperative antibiotics were given.> Time-out was performed among the operating room staff. The table was positioned in slight Trendelenburg for better exposure. The face and oral cavity were prepped and draped in the usual sterile fashion. The soft palate and posterior pharyngeal were infiltrated with 0.5 % lidocaine with 1:100,000 epinephrine. A 4-0 Vicryl suture was placed in the uvula and placed on the Dingman mouth guard for retraction. The soft palate was divided in the midline in a full-thickness fashion from the hard/soft palate junction to the uvula with a #11 scalpel. Each hemipalate was retracted laterally with a traction suture placed through the divided uvula. A laterally based triangular nasal mucosal flap was elevated from the deep surface of each hemipalate.

After the posterior pharyngeal wall was inspected and palpated, and no sign of medially displaced internal carotid arteries verified, the planned superiorly based pharyngeal flap was marked with its base placed at the level of the hard palate. The lateral incisions were made down to the level of prevertebral fascia. This was followed by the inferior incision. The flap was then elevated off of the prevertebral fascia from inferiorly to superiorly to the level of the axis vertebra. The donor site was closed with running interlocking hemostatic 3-0 Vicryl suture. In doing so, the posterior pharyngeal wall edges were tacked down to the prevertebral fascia. The distal edge of the raised pharyngeal flap was sutured to the posterior edge of the divided soft palate with interrupted 3-0 Vicryl sutures. A 14-French red rubber catheter <or nasopharyngeal airway> was placed transnasally, passing it through each port. Additional sutures of 4-0 Vicryl were placed bilaterally between the pharyngeal flap edge and the

divided hemipalatal edge in order to tailor the port size around the catheter. Hemostasis was achieved with electrocautery. The previously raised nasal mucosal flaps were sutured together in the midline with 4-0 Vicryl suture so as to cover the raw surface of the pharyngeal flap. They were also sutured to the mucosal of the flap to avoid leaving any rough surface. The uvular traction sutures were removed. The previously divided soft palate was closed with interrupted 3-0 Vicryl suture over the newly constructed pharyngeal flap. The stomach was suctioned with an orogastric tube. The Dingman retractor was removed. The patient was extubated and taken to the postanesthesia care unit.

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Sphincter Pharyngoplasty

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Stephanie M. Cohen and Mimis Cohen

Indications

1. Correction of velopharyngeal dysfunction.
2. Correct/improve hypernasality during speech.

Initial Steps

1. Complete speech evaluation and documentation of VPD.
2. Preoperative nasopharyngoscopy to fully appreciate the anatomy, size of gap, and pattern of velopharyngeal closure.
3. If hypertrophic tonsils/adenoids are present, remove ahead of time. (Instruct ENT colleague to avoid any injury to the tonsillar pillars during tonsillectomy.)

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Selection of Procedure

Sphincter pharyngoplasty is selected versus other procedures, based on the anatomy of the velopharynx, endoscopic findings, and surgeon's experience.

Essential Steps

Preoperative Markings

No formal preoperative markings are indicated.

Intraoperative Details

1. Procedure is performed in a supine position under general anesthesia with an oral RAE tube secured in the midline of the lower lip.
2. A small roll is placed under the shoulders to assist in neck overextension.
3. Place the bed in Trendelenburg position.
4. Standard prep and drape.
5. Place Dingman mouth guard for exposure and to secure endotracheal tube.
6. Observe the anatomy of the area prior to injection and make final operative plan.
7. Place a 3-0 silk suture in the uvula to better expose the posterior pharyngeal wall and secure in the spring of the Dingman.

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8. Mark the areas of incisions of the posterior tonsillar pillars and the posterior pharyngeal wall (transverse incision to correspond to the cephalic end of the proposed flaps).
9. Infiltrate the posterior tonsillar pillars and the posterior pharyngeal wall with lidocaine and 1:200,000 epinephrine for hemostasis.
10. Create myomucosal flaps from the posterior tonsillar pillars.
11. Incise the posterior pharyngeal wall transversely at the level of the axis, to allow inset.
12. Overlap the tonsillar pillar flaps in the posterior pharyngeal wall and suture in place, leaving a gap of approximately 1 cm.
13. Close the donor sites.

Postoperative Care

1. Overnight observation in pediatric step-down unit for airway monitoring.
2. Maintain IV fluids till appropriate oral intake is confirmed.
3. Unrestricted liquid and soft diet when fully awake.
4. No antibiotics.
5. Pain medications as needed.

Possible Complications

1. Airway obstruction in the immediate postoperative period
2. Bleeding
3. Wound dehiscence
4. Incomplete correction of VPD
5. Hyponasality
6. Obstructive sleep apnea—long term

Operative Dictation

Diagnosis: velopharyngeal dysfunction
Procedure: sphincter pharyngoplasty

Indication

This is a _____-year-old patient born with cleft palate which was repaired in the past and now presents with residual hypernasal speech which has not improved with speech therapy. The patient underwent nasopharyngoscopy, which demonstrated a "bow tie" gap in the velopharynx during speech. Benefits, risks, and alternatives associated with the procedure are discussed with the patient's parents in detail, including the need for postoperative speech therapy. Informed consent is obtained.

Description of the Procedure

Patient and family were greeted in the preoperative area. History and physical were reviewed for accuracy and informed consent was verified. The patient was brought to the operating room and placed in the supine position. Time-out was performed among the operating room staff. General anesthesia was introduced and patient was intubated with an oral RAE tube. Tube was secured in place with a 1000 drape and a mesentery to relieve pressure on the chin. The table was positioned in slight Trendelenburg for better exposure. A small role was placed under the shoulders to extend the neck and further facilitate exposure. The patient was prepped and draped in the usual sterile fashion. A Dingman mouth guard was placed to provide exposure and secure the endotracheal tube in the midline. A 2-0 silk suture was passed through the uvula and secured in the spring of the Dingman. This allowed for traction of the uvula and better visualization of the oro-/nasopharynx. The areas of incisions in the posterior tonsillar pillars and the posterior pharyngeal wall were marked and then infiltrated with 0.5% lidocaine with 1:200,000 epinephrine for hemostasis.

Using a #15 scalpel, we incised the mucosa of the posterior tonsillar pillar anteriorly, posteriorly, and inferiorly and elevated a myomucosal flap, making sure to incorporate the palatopharyngeus

muscle fibers in the flap. The dissection and mobilization of the flap was carried to the superior margin of the pillar. Meticulous hemostasis was carried and the donor site was closed with a running 4-0 polyglactin (Vicryl) suture. The same procedure was performed on the opposite site. We then proceeded with the transverse incision of the posterior pharyngeal wall, connecting the more cephalic incisions of the posterior tonsillar pillar flaps. This incision was carried though the mucosa and the muscle to the prevertebral fascia, at the level of the axis. After meticulous hemostasis, we initiated insetting the flaps to the posterior pharyngeal wall. Interrupted 4-0 polyglactin (Vicryl) sutures were used for all steps of flap insetting. The superior mucosa of the left flap was first sutured to the mucosa of the superior aspect of the incision of the posterior pharyngeal wall. Next, we sutured the inferior mucosa of the left flap to the superior mucosa of the right flap to overlap the two flaps. During this step, we checked the size of the newly created velopharyngeal orifice and found it big enough to allow introduction of the small finger of the surgeon. Finally, we attached the inferior mucosa of the right flap to the inferior mucosa of the posterior pharyngeal wall. All sutures included mucosa, submucosa, and muscle fibers on each bite. The surgical area was inspected for any opening in the suture line. Gentle pressure was applied to the pharyngeal wall for a few minutes for hemostasis. The stomach was then suctioned with a soft orogastric tube. The Dingman mouth guard was removed and the patient was extubated and transferred to the recovery room.

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Microtia Reconstruction

58

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Indications

1. Anotia (unilateral or bilateral)
2. Complete ear hypoplasia (microtia)
3. Hypoplasia of the middle third of the auricle
4. Traumatic loss of upper two-thirds of the auricle
5. Acquired defects of upper two-thirds of auricle from cancer resections
6. Patients old enough to comply with postoperative instructions and in whom normal ear growth is within 7 mm of full vertical height (at least 6–7 years old)
7. Patients with at least 60 cm of chest circumference (this size predicts adequate cartilage for framework construction)

Contraindications

1. Associated medical conditions that preclude ear reconstruction
2. Syndromic patients with cognitive impairment
3. Patients younger than 7 years of age who are unlikely to be compliant

Relative Contraindications

1. Prior surgical scars over the proposed site of ear reconstruction
2. Previous burns in the mastoid region
3. Previous skin grafts in the mastoid region

Possible Complications

1. Loss of definition of the reconstructed ear
2. Skin flap necrosis (secondary to infection or hematoma)
3. Cartilage graft loss (secondary to infection)
4. Cartilage resorption
5. Donor site infection leading to scarring and deformity

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6. Pneumothorax and rib pain (immediate postoperative)
7. Chest wall deformity

Essential Steps

Surgical Planning

1. Several surgical techniques have been described in the literature; the surgeon should choose a method suitable for his/her skills and experience.
2. Reconstruction with autologous cartilage framework remains the standard for microtia repair despite potential donor site morbidity.
3. Assessment of hearing impairment is the key. Hearing aids should be applied shortly after birth in order to optimize normal speech.
4. Planned middle ear reconstruction or bone-anchored hearing aid placement should occur after auricle reconstruction so as to avoid violating the skin envelope which will subsequently be used to cover the cartilage framework.
5. Harvest of perichondrium with the rib preserves the potential for growth in the constructed ear framework; however growth may exceed contralateral (normal) ear growth and leave a noticeable chest wall deformity. Precise sizing of the ear framework avoids these issues.
6. A piece of banked cartilage (1 × 1.5 cm) is retained superior to the construct.
7. Careful attention must be paid to blood supply of the periauricular tissue, lobule, and skin flaps.
8. Either a preprinted pattern or an x-ray film tracing of the normal contralateral ear may be used to replicate an outline for the reconstructed ear. Because the details of the ear can only be seen on profile view, it is not critical to match shape exactly, as long as size and position are carefully matched.
9. Positioning of the reconstructed ear should be based on normal contralateral ear coordinates:
   (a) Axis of the reconstructed ear should parallel the nasal profile.
   (b) Constructed and contralateral helical roots should be the same distance from the ipsilateral lateral canthi.
   (c) Constructed lobule should be at the same level as the contralateral lobule.

   These measurements are more difficult to achieve in patients with associated hemifacial microsomia because the ear vestige is depressed and closer to the eye.
10. In bilateral microtia patients with a very low hairline, slightly smaller ears should be reconstructed to minimize problems with hirsute helices. In unilateral cases, symmetry should not be compromised to avoid hair growth, and the hairline may be managed by covering the superior pole with a temporoparietal fascia flap and skin graft or by postoperative laser or electrolysis for hair removal.
11. Symmetry is more easily obtained in bilateral microtia cases.
12. Pressure dressings should not be applied after placing the framework to avoid compromising the skin envelope.
13. Plication sutures for securing the skin envelope to the framework should be used with caution to avoid skin necrosis.

Brent Technique

Intraoperative Details

Stages are separated by at least 4 months to allow for adequate healing and resolution of edema.

First Stage (Constructing Cartilage Framework)

1. Rib cartilage is obtained from the contralateral chest.
2. Cartilaginous portion of the 6th–8th ribs is used for the block reconstruction of the auricle, preserving the synchondrosis.

3. Cartilage from the ninth floating rib is used to create the helix. Thinning the convex surface allows for warping in a favorable direction (along the superior rim of the cartilage).
4. Ear silhouette is carved with the use of scalpel blades and woodcarving chisels. Avoid power tools as they compromise chondrocyte survival.
5. Perichondrium is preserved on the external surface of the construct.
6. Dissection of the cutaneous pocket proceeds by making an incision along the posterior margin of the auricular vestige and dissecting 1–2 cm beyond the planned borders of the auricle framework.
7. The deformed cartilaginous vestige is excised and discarded at this stage or at the second stage.
8. Hemostasis and cartilage graft adherence are ensured by using a closed-system suction drain.
9. Bacitracin and Xeroform (or petroleum gauze) are used to cover the skin over the constructed ear contours.
10. Closed-suction drains ×2 are placed and emptied every 8 h for the first 24 h and then every 12 h till removal after 5–6 days.

Second Stage (Rotating the Lobule into Position)

1. Eventual lobule position is de-epithelialized.
2. Displaced lobule is repositioned by making a Z-plasty incision.

Third Stage (Posterior Auricular Sulcus)

1. The cartilage framework is raised from the mastoid fascia.
2. Banked cartilage from the first stage is placed posterior to the released framework under a fascial flap, providing projection to the reconstructed ear.
3. A split-thickness skin graft from the non-hair-bearing region of the groin is placed posterior to the framework, creating the retroauricular sulcus.

Fourth Stage (Conchal Definition and Tragal Construction)

1. Conchal definition is created by harvesting a chondrocutaneous composite graft from the anterolateral conchal surface of the contralateral ear.
2. Soft tissue is excavated below the tragal flap prior to inset of the composite graft, giving the illusion of an auricular meatus.

Operative Dictation

Diagnosis: Left microtia
Procedure: Repair of left microtia using Brent technique

Indication

This is a 7-year-old boy, who presents to clinic with concerns about a small, misshapen left ear. By history and exam, the patient has an isolated microtia. A CT scan with thin cuts through the temporal bone determines normal middle ear anatomy with canal atresia.

Discussion with the family focuses on repair of microtia using the Brent technique. Each of the four stages is separated by 4 months.

Description of the Procedure

Common to All Four Stages:

Prior to all procedures, informed consent was obtained following a complete explanation of the procedure to be performed, with documentation that the family and patient understood what has been communicated to them. Parental consent was obtained. Prior to surgery, a time-out was performed, confirming the patient's identity, side of the procedure, and actual procedure to be performed. Preoperative intravenous antibiotic was given within 1 h of incision. The affected area was prepped and draped in sterile fashion. One percent lidocaine with 1:100,000 epinephrine was used to achieve local anesthesia.

First Stage

The patient was placed in the supine position. His head and contralateral chest were prepped and draped sterilely. Sterilized x-ray film was marked and cut to the shape of the contralateral normal ear, and anatomic landmarks were detailed with a permanent marker. The template was reversed for marking the position of the reconstructed ear on the left mastoid skin. The marking was aligned using the contralateral ear's relationship to the nose, lateral canthus, and lobule position.

After marking the skin, the left mastoid area was infiltrated with local anesthesia. Injection was also performed at the contralateral costal margin (see below). Ten minutes were allowed to elapse. An incision was made at the posterior inferior border of the vestigial ear. Using fine tenotomy scissors, a subcutaneous pocket was created that was 1.5 cm larger than the skin markings to accommodate tight skin adherence to the framework. All bleeding points were cauterized. The pocket was then packed with normal saline-moistened gauze.

Attention was then turned to the contralateral chest, where the sixth, seventh, and eighth rib cartilage, corresponding to the synchondrosis, was approached through an oblique incision at the costal margin. A #15 scalpel was used to make the 3-cm incision; electrocautery was used to dissect through subcutaneous tissue reaching the fascia of the rectus abdominis muscle. A transverse incision was made in the fascia, followed by longitudinal splitting of the rectus muscle, exposing the anterior surface of the synchondrosis. During the ensuing dissection, the perichondrium was kept intact. The previously created x-ray film template was used to mark the anterior surface of the synchondrosis, with the superior portion positioned on rib cartilage from 6 and 7 and the inferior lobular portion on rib 8. Following this, dissection with a blunt periosteal elevator was performed beneath the synchondrosis. Gauze can be used to assist with this blunt dissection. Following complete dissection under the cartilage to be harvested with the gauze still in place, protecting the underlying pleura, a #15 scalpel was used to make the cartilage cuts. A metal ribbon was positioned under the knife. The cartilage was removed as a single piece. The floating portion of the ninth rib was harvested in the same manner.

Prior to closure, the dissection area was filled with normal saline and two Valsalvas of 45 mmHg were delivered by the anesthesiology team. No bubbling occurred, indicating absence of injury to the pleura, and closure was commenced. Closure of the dissected pocket was performed with 4-0 PDS for interrupted re-approximation of the muscle, followed by similar suture closure of the fascia. The deep dermis was re-approximated using 4-0 Monocryl, and a 5-0 Monocryl was used for subcuticular skin closure.

(If a tear has occurred in the underlying pleura during dissection, a red rubber catheter was placed through the pleural tear and secured with a figure-of-8 suture (4-0 Vicryl) around the catheter to close the pleura. Subsequent layers of tissue were closed as previously described).

The final skin sutures were placed around the red rubber catheter, and final securing of the subcuticular stitch was coordinated with the anesthesiologist. During a Valsalva, the feeding tube was removed, and the final stitch of the skin completed. A postoperative chest x-ray was performed in the recovery room.

The framework was then carved to form the shape of the ear. The synchondrosis was used to create the superior crus, the antihelix, as well as the margin of the conchal bowl. These details were exaggerated to compensate for overlying skin thickness. The floating rib was then carved on the side away from the framework, to allow bending along the framework margin. 4-0 clear Nylon was then used to secure the helical rim to the framework. Suture knots were tied on the underside of the framework. Care was taken to adequately create the root of the helix in a deeper plane that dipped toward the conchal bowl.

Banked cartilage (1.5 × 2 cm) was placed at the superior extent of the dissected skin pocket, keeping it separate from the framework. The framework was then placed within the previously created pocket, with one suction drain placed around the periphery of the framework and the second under the framework, positioned at the open area between the crus. Ear position was

compared to the contralateral normal side. During skin closure, the two tubes were placed to wall suction. The skin was closed with 5-0 Monocryl for deep dermal closure, followed by 5-0 plain gut running baseball stitch to close the skin. The suction circuit was closed for both systems and changed from wall suction to the tubes; the suction system was reopened. During these changes, the contour of the skin draping the framework did not change. Rolled Xeroform was placed within the contours of the reconstruction, followed by dry gauze and a cup ear protector—with the goal of avoiding pressure on the reconstructed ear.

Postoperative Care

1. The closed-suction drains are maintained for 6 days.
2. Protective cup dressing should be left in place during this time for the first week.
3. Postoperative antibiotic should be continued till the drains are removed.
4. The protective cup is worn at night for a month.
5. No swimming for a month.
6. No contact sports for 3 months.

Second Stage

The lobule region was infiltrated with local anesthetic to minimize bleeding. A z-plasty incision was made along the lateral border of the misshapen remnant cartilage and abnormally positioned lobule, then extending along the inferior border of the previously placed cartilage framework. This incision helped to expose residual cartilage and remove excess skin. The z-plasty allowed seamless repositioning of the vertically positioned lobule along the inferior border of the framework. The medial attachment of the repositioned lobule retained attachment to maintain blood supply. Skin closure was performed with 5-0 Monocryl for deep dermal closure and 5-0 plain to close the skin. A gauze dressing with an ear protector was applied.

Postoperative Care

1. Dressings with the protective ear cup should be worn for a week.
2. Only perioperative antibiotics given.

Third Stage

A circumferential skin incision 5 mm posterior to the framework rim, from the helical root to the lobule, was used to elevate the framework with skin cover. Dissection was carried beneath the framework leaving a capsule covering the cartilage. The degree of dissection was a balance between the need for release and projection and the need to maintain blood supply to the reconstruction. Circumferential dissection was then performed under the scalp tissue in order to advance normal skin into the retroauricular region. The excess skin formed a central dog-ear at the posterior hairline that was excised and closed with 3-0 PDS or 3-0 Vicryl for deep dermal closure followed by interrupted 4-0 Prolene to close the skin. This decreased the amount of skin graft required to cover the retroauricular raw region. The banked cartilage from the first stage was then placed deep in the retroauricular sulcus under a facial flap for ear projection. The remaining postauricular defect was covered with full-thickness skin graft from the inguinal non-hair-bearing area. The donor site was closed primarily with 4-0 Monocryl for deep dermal re-approximation and 4-0 Monocryl for subcuticular skin closure. A compressive dressing was placed over the skin graft and the ear was covered with an ear protector.

Postoperative Care

1. Dressings should be left in place for 7 days to ensure skin graft take.
2. Gentle cleaning of the skin graft with q-tip and hydrogen peroxide daily after removal of the dressing.
3. Bacitracin is applied to the healing skin graft for several days after removal of the dressing.
4. Only perioperative antibiotics given.

Fourth Stage

A J-shaped incision was fashioned along the posterior tragal margin and an anteriorly based cutaneous flap was elevated. Exposed subcutaneous tissues were resected to create the depth of the conchal bowl. Contralateral ear concha was marked and a chondrocutaneous composite graft was harvested and the donor site was closed primarily. The composite graft was then used to

build the neo-tragus by covering the posterior wall of the neo-tragus sandwiching the cartilage against the underlying raw surface. The remaining defect of skin at the conchal bowel was then covered by a full-thickness skin graft harvested from the retroauricular sulcus of the contralateral ear. 5-0 plain sutures were used to fix the grafts and close the skin. A compressive dressing was placed over the grafts.

Postoperative Care

1. Dressings should be left in place for 7 days to ensure skin graft take.
2. Only perioperative antibiotics administered.

Nagata Technique

Intraoperative Details

Stages are separated by at least 6 months to allow for reconstitution of blood supply.

First-Stage Reconstruction (Constructing Cartilage Framework)

1. Rib cartilage is obtained from the right chest but may be obtained from either side.
2. The sixth and seventh costal cartilages are typically used to create the base frame, antihelix, tragus, lobule, and conceal bowl, with the helical rim carved from the eighth costal cartilages. The fifth costal cartilage is harvested and banked subcutaneously to use at the second-stage elevation. However, individual anatomy may necessitate using the seventh cartilage for the helix or other alterations.
3. The synchondrosis between ribs is usually not strong in small children, and it is best to take this apart during harvest to preserve the perichondrium in the chest.
4. The ear framework is carved with the use of scalpel blades and gouges. The pieces are fixed together with 5-0 surgical steel wire twisted on the posterior surface. A small incision in the anterior cartilage will allow the wire to be tightened until it is beneath the surface of the cartilage.
5. Aim to preserve perichondrium in the chest to prevent later deformity. Excess cartilage shavings are replaced within the preserved perichondrial tunnels and serve to repopulate the cartilage.
6. Chest wall pain is controlled by use of a postoperative pump with bupivacaine, which remains in place for 5 days.
7. Dissection of the cutaneous pocket should proceed carefully using primarily blunt dissection over the retroauricular scalp and sharp dissection over the cartilage vestige.
8. The deformed cartilaginous vestige is excised and discarded.
9. Hemostasis and cartilage graft adherence are ensured by using a closed-system suction drain and sewn-on Xeroform bolsters.
10. Suction drains remain for 1 week and are emptied every hour for the first 8 h, then every 2 h for 8 h, and then every 4 h for the remainder of the hospital stay (typically 2 nights). The parents change the drain tubes TID.

Second-Stage Reconstruction (Ear Elevation)

1. The banked cartilage graft is excised and carved into a small c-shaped strut, wider superiorly and laterally, to fit behind the framework. 4-0 nylon is used to hold layers of cartilage together.
2. The ear is elevated, preserving the posterior capsule. A turnover flap may be created just posterior to the lobule to resurface the back of the lobule, especially in girls who desire ear piercing. This helps preserve the inferior retroauricular space. The retroauricular and neck skin can then be advanced to eliminate the resulting defect.
3. The retroauricular skin is elevated and a fascial flap is turned over to cover the cartilage strut.
4. Split-thickness skin graft is harvested from the temporal scalp, just above the ear. This has the advantage of a hidden and less painful donor site and a better color match. The hair superior and anterior to the area to be harvested is preserved, so that in patients with long hair, the

donor site can be covered as the hair regrows. In patients with a history of hypertrophic scarring, or patients who may wish to wear their hair shaven, the scalp donor site is contraindicated, and a hip or thigh donor site may be used. Use of full-thickness groin skin can result in pubic hair growth behind the ear once the patient reaches puberty.

5. A small z-plasty may be performed to align the lateral edge of the lobule and the helical tail.

Operative Dictation

Diagnosis: Right microtia

Procedure: Repair of right microtia following a modification of the Nagata technique

Indication

This is a 7-year-old girl, who presents to the clinic with right microtia, a well-preserved hairline, and facial symmetry.

Description of the Procedure

Common to Both Stages:

The patient was taken to the operating room and placed on the table in the supine position. After satisfactory induction of general anesthesia, a time-out was held by all participants, and the preoperative cefazolin (for skin flora) and either ciprofloxacin or gentamicin (for pseudomonas) were administered. The scalp, ear, and chest were prepped and draped in the usual sterile fashion. The head was turned toward the nonoperated ear, which was protected with a foam donut. A shoulder roll was placed to extend the neck on the side of the operated ear.

First Stage

A 58-mm pattern (sized to match the contralateral ear) had been printed on projector paper. The position of the facial features (eyebrow, eye, lateral ala, oral commissure) relative to the normal left ear was marked with a permanent marker on the transparency paper, and the plastic then transposed over to the right side. By lining up the facial features, it was possible to mark the desired position of the right ear, which was tattooed with methylene blue.

An incision was made over the right sixth interspace. Cautery was used to dissect through subcutaneous tissue until the fascia was identified. The edge of the rectus muscle was separated from the oblique muscles vertically to avoid splitting any muscle. This exposed the costal cartilages. The 5th–8th costal cartilages were resected in subperichondrial fashion as follows: An incision was made with cautery through the periosteum just lateral to the costochondral junction. A freer elevator was placed under the periosteum and passed medially, staying in the same plane, to elevate the perichondrium. The perichondrium was split with a 15-blade, cutting directly on the freer to avoid damaging the cartilage. The freer was then advanced, taking care to stay within the original plane and not to allow the instrument to damage the cartilage; this process was repeated up to the sternal junction. The freer was carefully used to elevate the perichondrium on the superior and inferior margins of the cartilage and to gently separate the synchondrosis. It was then placed at the costochondral junction and careful pressure used to disarticulate the cartilage from the bone. The cartilage was then grasped with a sponge and gently dissected from the posterior perichondrium. At the sternum, the freer was used to cut the cartilage and place it in a bacitracin bath. To facilitate harvest of additional cartilage, once the first had been removed, a piercing towel clamp was placed through the anterior portion of the rib and used to elevate the ribcage into the field. The small incision was moved around to provide visibility using just a single retractor. Once all four cartilages were removed, the chest was filled with saline and a Valsalva maneuver performed to confirm that there were no air leaks. Hemostasis was assured with cautery and the chest packed with moist gauze.

On the back table, a 58-mm preprinted pattern was sterilized by soaking in betadine. This was used to create a three-dimensional framework, consisting of a base frame with carved scaphoid and triangular fossa (formed from the sixth and

seventh cartilages), a lobule, a two-layer tragus, an antihelix with superior and inferior crura (all also from the sixth and seventh cartilages), a helical rim carved from the eighth costal cartilage, and a conchal strut, from the fifth cartilage. The bulk of the fifth cartilage and all shavings were preserved in the bacitracin bath. The cartilage pieces were shaped with a #15 scalpel and further refined with cutting gouges. They were affixed to each other with fine 5-0 steel wire passed through 25-gauge needles and twisted posteriorly. A small incision was then made on the anterior surface of the cartilage and the wire was given 1–2 additional twists to tighten it below the surface. Wire sutures were placed every 3–5 mm to provide strength to the construct. Additional carving was performed to obscure the joints between cartilage pieces. Methylene blue was used to mark cuts and areas to be carved away. The framework was made to match the size of the opposite ear, so that it will be 3–4 mm larger with the skin draped over it, and allow for normal contralateral ear growth to match the size of the constructed ear.

Following completion of the reconstructed ear, the operation proceeded with two teams. Anesthesia personnel were alerted to deepen sedation in case the patient has lightened during the back table carving. The perichondrial tunnels in the chest were closed from medial to lateral with running 3-0 Vicryl, recreating a perichondrial sleeve and tucking the free end of the bone well into the perichondrium/periosteum. One or two small gaps were left in the running sutures, and the retained cartilage pieces and shavings were poked through these gaps to fill the perichondrial tunnels with these pieces. The large remnant of cartilage 5 was retained. Two small catheters were then placed percutaneously into the submuscular space for postoperative pain relief. The muscle was re-approximated with 3-0 Vicryl, and the superficial fascia was also closed with 3-0 Vicryl. The large piece of cartilage 5 was placed above the Scarpa's fascia and the skin closed with 4-0 Monocryl deep dermal and 4-0 Monocryl subcuticular sutures. The wound was dressed with cyanoacrylate glue, and Steri-strips were applied lengthwise. The catheters were secured with a small drop of cyanoacrylate glue and coiled under a clear plastic dressing. At the end of the case, the catheters were primed with 5 cm^3 of 0.25 % Marcaine each and attached to a pain ball containing 550 cm^3 of 0.25 % Marcaine, to deliver 2 cm^3/h each of local anesthetic over the next 5 days.

The ear was marked for Nagata skin flaps, consisting of a w-shaped flap of the posterior lobule and retroauricular skin that lined up with the marked lateral border of the ear and had a well-defined subcutaneous pedicle in the planned location of the conchal bowl. The incisions were made with a 15-C scalpel, and the earlobe carefully was split into anterior and posterior flaps, leaving the posterior flap as thin as the retroauricular skin and most of the fat on the anterior lobule. The retroauricular skin was then bluntly elevated with tenotomy scissors, taking care to extend the dissection well beyond the marked position of the ear to create a sizable pocket. The skin was elevated at the subcutaneous level to create a very thin, supple skin pocket. The incision at the superior lobule was made to begin the earlobe rotation, but the extension into the intertragal notch was left until the framework was in place, to allow exact positioning. Careful blunt and sharp dissection was then used to excise the microtic cartilage from under the skin, taking special care not to leave any behind or buttonhole the skin. The pocket was then copiously irrigated. A small closed-suction drain connected to vacuum tubes was then placed through a retroauricular stab incision and secured with 4-0 Prolene. The ear carving was carefully rotated into place, holding the pocket open with one or more Ragnell retractors and passing the tragus and lobule superiorly around the pedicle. A pocket anterior to the attachment of the lobule was made for the tragus to fit into, taking care to preserve vascularity to the lobule. Once the framework was in place, the remaining cut for the lobule rotation was precisely made, and the lobule rotated to meet the retroauricular incision. The skin was closed with 5-0 Vicryl in the dermis, sewing the w-flap to itself to create a cup shape for the conchal bowl and trimming excess skin over the helical root for an exact fit. The superficial layer was closed with 6-0 fast-absorbing gut. Suction was applied to the drain, and good definition of the ear detail was appreciated.

The incision lines were covered with bacitracin. Xeroform was rolled into small bolsters and tucked both anterior and posterior to the tragus, into the triangular and scaphoid fossae, and then around the outside of the ear and sutured through the ear framework to each other to provide gentle pressure on these depressed areas. The ear was covered with a protective cup.

Postoperative Care

1. No contact sports for 3 months.
2. Admit for an average of 2 nights, longer if pain catheters are not used.
3. Xeroform bolsters should be elevated and wiggled daily to prevent pressure necrosis. The bolsters are removed at 2 weeks. Antibiotics are continued until the bolsters are out.
4. The purpose of the drain is to help the skin conform to the cartilage. Very little liquid will drain. It still needs to be changed frequently to maintain suction. We recommend q1h ×8 then q2h ×8, then q4h while in the hospital and TID at home. The drain and the pain catheters are removed at 1 week.

Second Stage

The hair was placed in braids or ponytails to expose the supra-auricular scalp, and the hair was clipped from a 15×6 cm area of temporal scalp, preserving 1–2 cm of hair at the anterior hairline.

The prior chest scar was excised and cautery dissection used to expose the banked rib cartilage. The capsule on one end of the cartilage was opened and bluntly elevated. The cartilage was then grasped with gauze and pulled from its attachments and then placed in saline for later use.

Bleeding was controlled with cautery and the wound closed in layers with 4-0 Monocryl. The wound was dressed with cyanoacrylate glue and Steri-strips.

A semicircular 2×2 cm turnover flap was designed in the non-hair-bearing skin just inferolateral to the lobule, to allow full-thickness resurfacing of the lobule. The ear was then elevated by sharply lifting this flap, and then proceeding around the ear, following the hairline, or cutting just along the framework where the hair encroached on the reconstructed ear. The ear was elevated preserving the lateral and posterior capsule for blood supply, until it was projecting slightly more than desired. Bleeding was controlled with cautery. A wire suture was exposed during the ear elevation, and this was grasped with a needle driver and pulled through the cartilage to remove it. The other wire sutures remained well covered with capsule.

Rib cartilage was carved into a bilayer strut, wider superiorly and laterally, to fit snugly behind the ear. The two pieces were held together with 4-0 Nylon. The strut was placed behind the ear and also fixed with 4-0 Nylon.

The retroauricular skin was elevated at a suprafascial level, and a 4×2 cm fascial turnover flap was elevated with cautery and turned over the cartilage, securing it with buried 5-0 Vicryl. Bleeding was controlled with cautery. The neck skin inferior to the ear was also elevated so that it can be advanced to meet the retroauricular space, eliminating the donor site for the lobular turnover flap. The flap was turned behind the lobule, thinning the posterior tissue and cartilage as needed to allow it to fit snugly and resurface the back of the earlobe, and then closed with 3-0 Vicryl. A small closed-suction drain that connected to vacuum tubes was placed under the elevated scalp through a retroauricular stab incision and secured with 4-0 Prolene. The periauricular skin was advanced and sutured with 3-0 Vicryl while preserving a normal retroauricular hairline.

The top of the lobule was not perfectly aligned with the helical tail, and a small (0.5×0.5 cm) z-plasty was designed, elevated, and transposed to correct this defect. The flaps were sutured with 6-0 fast-absorbing gut.

The shaved scalp was tumesced with 1:1,000,000 epinephrine solution. The defect behind the ear was measured and found to be 8×4 cm, and a split-thickness skin graft of 12:100,000 in. thickness was harvested with a dermatome. A wet sponge was used in removing hair fragments. The graft was sutured to the posterior ear with 5-0 fast-absorbing gut sutures and run with 6-0 fast-absorbing gut sutures, trimming excess skin with sharp scissors. Several pie-crust incisions were made, and the graft was quilted to the retroauricular sulcus with 5-0 fast-absorbing gut.

The scalp donor site was dressed with Xeroform, Telfa, and 4×4 gauze dressing. The ear was dressed with bacitracin and Xeroform bolster behind the ear, fluff gauze, and a head wrap.

Postoperative Care

1. No contact sports for 3 months postoperatively.
2. May be performed as an outpatient or 23-h stay.
3. Drain is changed TID and may be cut and left to drain into the dressing after 3 days.
4. The dressing is removed at 1 week, and daily Xeroform/bacitracin dressings are applied to the skin graft until completely healed.
5. Antibiotics are continued until the dressing is removed.

Acknowledgments Dr. Ann Schwentker performs the Nagata technique and believes this technique provides the best results in ear reconstruction.

Otoplasty

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Daniel A. Hatef, Jesse D. Meaike,
and Larry H. Hollier

Introduction

The incidence of a prominent ear deformity approaches 5 %, with an unfurled antihelix and a deep conchal bowl accounting for the most common variations [1]. Individuals with prominent ears, especially children, are sometimes exposed to significant psychological distress [2]. Thus, otoplasty can be performed to surgically contour the protruding ears to a less prominent, more natural position. Otoplasty involves exposing the auricular cartilage and mastoid fascia, placing sutures to recreate the antihelical fold, and setting the auricle back in its desired anatomic location. Complications include both short-term (e.g., infection, hematoma, necrosis) and long-term (e.g., asymmetry, inadequate correction) problems. The most common complication is patient dissatisfaction [1].

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Indication

1. Prominent ear deformity [3]

Essential Steps

Preoperative Markings

1. Postauricular incision

Intraoperative Details

1. Place the patient in supine position; pad all pressure points, tuck the arms, and place sequential compression devices on the lower extremities.
2. General endotracheal anesthesia induced by anesthesia team.
3. Mark postauricular incision as a small ellipse.
4. Infiltrate the incision line and postauricular tissues with 1 % lidocaine with epinephrine.
5. Prep and drape the face, bilateral ears, and surrounding periauricular areas.
6. Incise at the postauricular incision line down to the posterior surface of the auricular cartilage.
7. Dissect out this plane to expose the entire posterior surface of the auricular cartilage.

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Elevate posteriorly to expose the mastoid fascia.
8. Fold the ear to recreate a natural-appearing antihelical fold.
9. Insert 1.5 in. 25 gauge needles through the anterior surface of the ear to mark where the permanent sutures will be placed.
10. Place three Mustarde sutures at the marked locations using permanent, double-armed supramid.
11. Place a Furnas suture from the posterior auricular cartilage to the mastoid fascia, again using permanent suture.
12. Incise the excess skin down to the lobule and repair it with simple interrupted 5-0 plain gut.
13. Dress and cover the incision with fabricated conforming pressure dressing.

Postoperative Care

1. Pack the incision with cotton or straps soaked with antibiotic-containing preparation or disinfecting agent [3].
2. Change the dressing twice during the first week, with the first change occurring on postoperative day 1 or 2 [3].
3. Remove sutures and replace dressing with a headband 1 week post-op [3].

Possible Complications

1. Hematoma
2. Infection
3. Skin and cartilage necrosis [1]
4. Recurrent deformity [1]
5. Inadequate correction
6. Asymmetry
7. Patient dissatisfaction [1]

Operative Dictation

Diagnosis: Prominent ears
Procedure: Otoplasty

Indication

Patient is a _____ presenting with protruding ears. The patient complains of dissatisfaction with their appearance and social stigmatization and desires correction. The patient and family express understanding of the risks, benefits, and alternatives to the procedure and wish to proceed. After their questions are answered, informed consent is obtained.

Description of the Procedure

The patient was met in the preoperative holding area and marked. The patient was then brought to the operating room and placed in supine position on the operating room table, and the arms were tucked. All pressure points were padded, sequential compression devices were placed, and the patient was grounded. A time out was performed. General anesthesia was induced after oral intubation. A postauricular incision was marked out as a small ellipse for skin excision, and the incision and postauricular tissues were infiltrated with 5 cm^3 of 1 % lidocaine with epinephrine. The face and bilateral ears and surrounding periauricular areas were prepped and draped in typical sterile fashion.

Local anesthesia was administered. Adequate time for vasoconstriction was allowed. The incision was made with a #15 scalpel down to the posterior surface of the auricular cartilage. This plane was dissected out, spreading with scissors to expose the entire posterior surface. The posterior flap was elevated in similar fashion to expose the mastoid fascia to prepare for the placement of a Furnas suture. Vigilant hemostasis was obtained with the Bovie cautery on low setting and then the wound was irrigated. The ear was folded to recreate an antihelical fold. One and a half inch 25 gauge needles were dipped in methylene blue and inserted through the anterior surface of the ear to mark where the permanent sutures were to be placed. Three Mustarde sutures were then placed using double-armed 4-0 supramid in a Byrd mattress fashion and placed on hemostats. These were then tied down, doing the middle suture last in order to avoid the telephone ear

deformity. Using a double-armed 4-0 supramid, a Furnas suture was then placed from the posterior auricular cartilage to the mastoid fascia. The excess skin was excised down to the lobule. Skin was repaired with simple interrupted 5-0 plain gut. The incision was dressed with xeroform and bacitracin, and 4×4 gauze was placed over the ear. This was then covered with an eye protector and taped into place. All counts were correct, and the patient was extubated and transported to recovery without issue.

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Open Reduction and Internal Fixation of Orbital Floor

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Richard Siy, Jesse D. Meaike, and Larry H. Hollier

Introduction

The upper border of the maxillary sinus comprises the orbital floor, and this thin bone is susceptible to damage from trauma. Indications for surgical intervention include a fracture involving more than ½ of the orbital floor, diplopia extending beyond 7–10 days, extraocular muscle entrapment, and oculocardiac reflex, among others [1, 2]. It is generally accepted that repair can be delayed up to 2 weeks unless alarming features are noted (e.g., non-resolving oculocardiac reflex), in which case emergent intervention is indicated [2]. The transconjunctival preseptal approach has been demonstrated to be an effective approach to gain access to the orbital floor [3]. After the orbital floor is exposed, the limits of the fracture are identified, the entrapped tissue is reduced, and an implant is placed (if necessary). Postoperatively, the patient is positioned upright and monitored with pupil and vision checks [1, 4]. Possible complications include incomplete correction of preoperative enophthalmos or diplopia, eyelid malposition, and optic nerve injury [4].

Indications

1. Fracture involving more than ½ of the orbital floor or >1 cm^2 [1]
2. Enophthalmos >2 mm that is cosmetically unacceptable [1]
3. Diplopia extending beyond 7–10 days [2]
4. Oculocardiac reflex with bradycardia and cardiovascular instability [2]
5. Extraocular muscle entrapment [2]
6. Significant hypoglobus [2]

Essential Steps

Preoperative Markings

1. N/A

Intraoperative Details

1. Place the patient in supine position, pad all pressure points, and place sequential compression devices on the lower extremities.
2. General endotracheal anesthesia induced by anesthesia team.

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3. Prep and drape the face.
4. Irrigate the eyes with balanced saline solution, tape the uninvolved eye closed, and insert a corneal protector over the involved eye.
5. Place a Frost stitch through the gray line of the lower lid for traction.
6. Evert the lower eyelid over a cotton-tipped applicator and infiltrate the incision line with 1:100,000 epinephrine solution.
7. *If access to the lateral orbit is indicated, perform a lateral canthotomy*.
8. Incise the conjunctiva immediately along the inferior edge of the tarsus starting laterally and extending as far medially as necessary [5].
9. Sharply dissect through the orbital septum.
10. Bluntly dissect in the preseptal plane to the infraorbital rim periosteum.
11. Incise the periosteum at the inferior orbital rim and expose the fracture with a periosteal elevator [1].
12. Reduce the herniated tissue to fully visualize fracture defect [4].
13. Position the desired implant into the orbital cavity ensuring that it rests behind the infraorbital rim anteriorly and on an intact bony ledge posteriorly [6].
14. Perform a forced duction test to rule out entrapment [1].
15. Reapproximate the periosteum at the inferior orbital rim with absorbable sutures [1].
16. *Close the conjunctiva and lower lid retractors medial to lateral with buried, running 6-0 chromic sutures* [5].
17. *If a lateral canthotomy was required, perform an inferior canthopexy*.
18. Remove the corneal protector and irrigate both eyes.
19. Assess pupil symmetry.
20. Remove the Frost stitch.
21. Place antibiotic drops in the operated eye.

Postoperative Care

1. Elevate head of bed to improve pain and edema [1].
2. Observe patient overnight in an extended recovery unit and monitor with pupil and vision checks [4].
3. Advise patient to avoid nose-blowing, bending, and heavy lifting [4].

Possible Complications

1. Enopthalmos or exophthalmos [4]
2. Hypoglobus or hyperglobus [4]
3. Eyelid malposition [4]
4. Optic nerve injury or visual disturbance [4]
5. Retrobulbar hemorrhage
6. Corneal abrasion/injury [5]
7. Extraocular muscle damage [5]
8. Persistent diplopia
9. Infection [1]
10. Implant extrusion [1]
11. Lymphedema [1]
12. Infraorbital nerve dysfunction [1]

Operative Dictation

Diagnosis: Orbital floor fracture
Procedure: Open treatment of orbital floor fracture with implant

Indication

Patient is a _____ presenting with orbital floor fracture after trauma. A preoperative ophthalmologic evaluation is performed to rule out globe injury and establish a baseline visual exam prior to proceeding to the operating theater. The patient expresses understanding of the risks, benefits, and alternatives to the procedure and wishes to proceed.

Description of the Procedure

After informed consent and patient identity were verified in the preoperative area, the patient was taken to the operating room and placed in the supine position. All pressure points were carefully padded and sequential compression devices were placed on the lower extremities prior to induction. Prophylactic antibiotics were administered. General endotracheal anesthesia

was then induced by the anesthesia team. The face was prepped and draped in the usual sterile fashion with ophthalmic betadine solution. The eyes were irrigated with balanced saline solution. The uninvolved eye was taped closed with Steristrips. A corneal protector, liberally lubricated with ophthalmic ointment, was placed over the involved eye.

A Frost stitch was first placed through the gray line of the lower lid for traction. The lower eyelid was then everted over a cotton-tipped applicator and the conjunctival incision line infiltrated with 1:100,000 epinephrine solution for hydrodissection and hemostasis. (*If necessary for access to the lateral orbit, a lateral canthotomy may be performed. A fine scissor is used to incise the lateral palpebral fissure cutting through the skin, orbicularis muscle, septum, canthal tendon, and conjunctiva. Traction is then applied to the lower lid to allow for visualization of the inferior limb of the lateral canthus, which is also sharply divided.*) The incision was then made with needle-tipped electrocautery and sharp dissection carried through the orbital septum. Using a moistened cotton-tipped applicator, blunt dissection was then carried in the preseptal plane, gently separating the overlying orbicularis oculi muscle, down to the infraorbital rim periosteum. The periosteum was then incised transversely with electrocautery providing access to the underlying bone. A periosteal elevator was then used to free the overlying periosteum from the underlying bone, introducing a malleable retractor to prevent herniation of orbital contents into the operative field. The entire extent of the fracture was then visualized. An elevator was used to estimate the anterior-posterior length of the defects and a template of the proposed implant created with plastic trimmed from a basin. The template was then placed overlying the defect, with care taken to account for the superomedial slant of the orbital floor. Once appropriate coverage of the defect was confirmed without excessive AP length with the template, the implant was brought onto the field and trimmed to size. It was then positioned into the defect, again taking care to ensure appropriate positioning on the posterior ledge before securing it to the orbital rim with a single screw. A forced duction test was then performed to ensure no entrapment was caused. The periosteum was then re-approximated where possible with a 4-0 polyglactin suture. *The conjunctiva and lower lid retractors were closed with a buried, running 6-0 chromic suture*. (*If a lateral canthotomy was performed, a canthopexy must then be performed using 4-0 polyglactin, taking care to take a bite of tarsus or remnant lateral canthus and secure it to the superior limb of the lateral canthus at the orbital tubercle, 3–4 mm posterior to the orbital margin. The skin may then be closed per surgeon preference.*) The corneal protector was removed and both eyes were again irrigated. Pupil symmetry was assessed. The Frost stitch was removed and antibiotic drops placed in the operated eye.

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Open Reduction and Internal Fixation of Zygomaticomaxillary Complex Fracture

61

Richard Siy, Jesse D. Meaike, and Larry H. Hollier

Introduction

The zygomaticomaxillary complex (ZMC) articulates with the facial skeleton at four locations. These include the zygomaticofrontal (ZF) suture, zygomaticotemporal (ZT) suture, zygomaticomaxillary buttress (ZMB), and zygomaticosphenoid (ZS) suture. ZMC fractures are one of the three most common types of facial fractures, and facial trauma can disrupt one or multiple of these articulations [1]. Because of its importance in facial structure and function, proper reduction and fixation of the ZMC, when indicated, is paramount. Indications for surgical intervention include displacement of the malar complex resulting in functional or cosmetic deformity. Nondisplaced fractures do not typically require surgical intervention. Potential complications include malar malposition, enophthalmos, visual disturbances, and persistent infraorbital nerve paresthesias [2, 3].

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Indications

1. Displacement of malar complex resulting in cosmetic deformity [2]
2. Impingement of coronoid process [3]
3. Operative orbital floor fracture [3]
4. Orbital apex syndrome

Essential Steps

Preoperative Markings

1. N/A

Intraoperative Details

1. Place the patient in supine position, pad all pressure points, and place sequential compression devices on the lower extremities.
2. General endotracheal anesthesia induced by the anesthesia team.
3. Infiltrate the maxillary gingivobuccal sulcus incision, the superolateral orbital rim incisions, and the area of dissection over the maxilla and zygoma with 1 % lidocaine with 1:100,000 epinephrine.
4. Brush and rinse the tongue and teeth.
5. Prep and drape the face.
6. Irrigate the eyes with balanced saline solution.

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7. Tape the uninvolved eye closed and insert a corneal protector over the involved eye.
8. Incise 3–5 mm superior to gingivomucosal junction and continue laterally to approximately the first molar leaving a 3–5 mm cuff of gingival tissue [4].
9. Continue the incision directly down to and through the underlying periosteum and expose the maxilla with a periosteal elevator.
10. Incise directly over the ZF suture 8–10 mm above the lateral canthus as per the lateral portion of an upper blepharoplasty incision [5].
11. Elevate the periosteum overlying the zygomaticosphenoid suture to visualize this articulation.
12. Access the infraorbital rim and orbital floor via the transconjunctival approach [2].
13. Insert a Carroll-Girard screw percutaneously into the zygoma body and reduce the ZMC at all buttresses.
14. Perform a forced duction test and evaluate for extraocular entrapment.
15. Plate across the ZF suture [6].
16. Reduce and plate the infraorbital rim with a small plate placed more superiorly than anteriorly to avoid palpability [2].
17. Place a 2 mm L-shaped plate along the ZMB, positioning the leg of L-plate on the most lateral portion of the lateral maxillary buttress where bone is fairly thick and the foot of L-plate avoiding the dental roots [6].
18. Confirm appropriate reduction at all visualized buttresses and place the final screws at the zygomaticofrontal suture.
19. Evaluate the orbital floor and reconstruct if necessary.
20. Perform a forced duction test to rule out ocular entrapment.
21. Irrigate and close the upper lid incision.
22. Resuspend the midface.
23. Remove the Carroll-Girard screw and close the access incision.
24. Irrigate and close the maxillary vestibular approach.
25. Remove the corneal protectors and irrigate the eye with balanced saline solution.
26. Evaluate the pupils for symmetry.
27. Apply bacitracin ointment to all skin incisions.

Postoperative Care

1. Elevate the head of the patient's bed [4].
2. Document visual acuity and optic nerve function compared to preoperative baseline [4].
3. Start patient on soft diet and chlorhexidine gluconate for oral hygiene [4].
4. Obtain postoperative CT scans to assess the state of the reduction (*optional*) [2].
5. Remove nonabsorbable sutures in 4–7 days [4].

Possible Complications

1. Malar eminence flattening and asymmetry [7]
2. Widening of the face [7]
3. Trismus [7]
4. Malunion [7]
5. Enophthalmos/exophthalmos [7]
6. Lid malposition [4]
7. Visual disturbances (i.e., postoperative diplopia) [2]
8. Retrobulbar hematoma [4]
9. Persistent sensory disturbances of the infraorbital nerve distribution [2]
10. Hardware complications: infection, cold intolerance, palpability, plate exposure [2]

Operative Dictation

Diagnosis: Zygomaticomaxillary complex fracture
Procedure: Open treatment of zygomaticomaxillary complex fracture

Indication

Patient is a _____ presenting with zygomaticomaxillary complex fracture after trauma. A preoperative ophthalmologic evaluation is performed to rule out globe injury and establish a baseline exam prior to proceeding to the operating theater.

The patient expresses understanding of the risks, benefits, and alternatives to the procedure and wishes to proceed.

Description of the Procedure

After informed consent and patient identity was verified in the preoperative area, the patient was taken to the operating room and placed in the supine position. All pressure points were carefully padded, and sequential compression devices were placed on the lower extremities prior to induction. Prophylactic antibiotics were administered. General endotracheal anesthesia was then induced by the anesthesia team. The maxillary gingivobuccal sulcus incision, area of dissection over the maxilla and zygoma, and superolateral orbital rim incisions were infiltrated with 1 % lidocaine with 1:100,000 epinephrine. The teeth and tongue were brushed and rinsed with chlorhexidine mouthwash. The face was prepped and draped in the usual sterile fashion with ophthalmic Betadine solution.

The eyes were then irrigated with balanced saline solution and the uninvolved eye taped closed. A corneal protector, liberally lubricated with ophthalmic ointment, was placed over the involved eye. (*Although good anatomic reduction can often be achieved with the anterior approach described, plate fixation of the zygomatic arch may require a coronal or preauricular approach.*)

Attention was first turned to the intraoral exposure. With the upper lip retracted superiorly, an incision was made with needlepoint electrocautery 3–5 mm superior to the gingivomucosal junction, taking care to leave a cuff of tissue for closure while remaining inferior to the pyriform aperture by palpation of the anterior nasal spine. The incision was carried laterally to approximately the first molar to allow for exposure. The incision was then taken directly down to and through the underlying periosteum. An elevator was then used to free the overlying periosteum of the maxilla to allow visualization of the medial and lateral buttresses, taking care to avoid injury to the infraorbital nerve at its exit from the foramen. (*If present, a depressed arch may be reduced with a blunt elevator introduced through this incision. In rare cases of minimal displacement and comminution, a blunt instrument may be placed posterior to the body of the zygoma through this incision and used to reduce it on intact periosteal hinges without fixation.*) The dissected cavity was then packed with epinephrine solution-soaked pledgets and attention turned to the orbital rim.

A #15 scalpel was used to incise over the zygomaticofrontal suture as per the lateral portion of an upper blepharoplasty incision. Dissection was carried down to the suture with needlepoint electrocautery. The periosteum overlying the zygomaticosphenoid suture was raised with a periosteal elevator to allow for evaluation of this broad articulation. A transconjunctival approach was then used to visualize the inferior orbital rim and orbital floor. (*See ORIF of orbital floor fracture*.) A Carroll-Girard screw was then placed percutaneously into the body of the zygoma to allow for disimpaction, with evaluation at all exposed buttresses for appropriate reduction. (*Paralysis may be requested from the anesthesia team to prevent pull of the masseter from impeding reduction.*) A forced duction test was performed to ensure no extraocular entrapment occurred with reduction. The height of the zygoma was first established with placement of a five-hole 1.2 mm plate with one screw on each side of the fracture line along the frontozygomatic suture to allow for rotation at other sites. Attention was then turned to the infraorbital rim, which was reduced and plated with a five-hole 1.2 mm plate as well, confirming reduction at the zygomaticosphenoid suture before applying screws to the zygomatic segment. The epinephrine-soaked pledgets were then removed and a 2.0 mm L-plate shaped to conform to the lateral buttress, taking care to avoid screw holes overlying dental roots or the thin bone overlying the maxillary sinus. (*A 2.0 mm plate may also be placed at the medial buttress along the pyriform aperture if needed. Primary bone grafting at this buttress may be indicated if there is significant comminution, as this buttress best resists pull of the masseter.*) With appropriate reduction and fixation

confirmed at all visualized buttresses, the final screws were placed at the zygomaticofrontal suture for a total of two screws on each side. With the zygoma reduced, the orbital floor was then evaluated. (*In the majority of cases, the orbital floor will require reconstruction. See ORIF of orbital floor fracture.*) The upper lid incision was then irrigated and closed with the periosteum, orbicularis, and skin in separate layers. The subconjunctival incision was then irrigated and the midface resuspended to the infraorbital rim plate with 4-O polyglactin sutures before closure. The Carroll-Girard screw was removed and the access incision closed with 5-O plain gut. Finally, the maxillary vestibular approach was irrigated and closed with interrupted 3-O polyglactin suture. (*If bilateral incisions were made, an alar cinch stitch may be placed with long-lasting absorbable suture. Similarly, an anterior V-Y advancement of the central portion of the incision may be placed with 2–3 interrupted absorbable sutures placed to prevent flattening of the labial tubercle.*)

The corneal protectors were removed and the eye irrigated with balanced saline solution. A forced duction test was again performed to rule out ocular entrapment. The pupils were evaluated for symmetry. Bacitracin ointment was applied to all skin incision. An orogastric tube was passed and the stomach contents suctioned to reduce postoperative nausea.

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Zygomatic Arch Reduction (Gillies Approach)

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Richard Siy, Jesse D. Meaike, and Larry H. Hollier

Introduction

The zygomatic arch is formed by the articulation of the temporal process of the zygoma and the zygomatic process of the temporal bone. It serves as an attachment point for the masseter and plays a significant role in maintaining facial contour. Isolated arch fractures are often the result of a direct lateral force to the arch that drives the fragments of the zygomatic arch medially [1]. Isolated zygomatic arch fractures yielding significant contour deformity or trismus are managed surgically [2]. In the Gillies approach, a temporal incision is made anterior and superior to the root of the helix and carried through to a plane just deep to the superficial layer of the deep temporal fascia. An elevator is inserted through this incision, navigated to a location medial to the zygomatic arch, and used to reduce the zygomatic arch to its anatomic position. The main complication of this procedure is facial asymmetry or contour deformity.

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Indications

1. Isolated zygomatic arch fractures with significant contour deformity or trismus [2]
2. Isolated, noncomminuted, depressed zygomatic arch fractures [3]

Essential Steps

Preoperative Markings

1. Identify and mark the superficial temporal artery and hairline.
2. Mark the transverse temporal incision (2 cm in length) 2.5 cm anterior and superior to the ear root within the hairline [2].
3. Mark the frontal branch of the facial nerve (optional).

Intraoperative Details

1. Place patient in supine position.
2. General anesthesia or monitored anesthesia care with local anesthesia.
3. Incise the skin at the marked temporal location using caution to avoid the superficial temporal artery [4].
4. Continue the incision through the subcutaneous tissue, superficial temporal fascia, and

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superficial layer of the deep temporal fascia into a plane immediately superficial to the temporal fat pad [2].
5. Insert the elevator through the incision into this plane and advance it until it is medial to the depressed portion of the zygomatic arch [4].
6. Apply an outward force to the elevator to reduce the fracture without using the squamous portion of the temporal bone and the overlying tissue as a fulcrum [5].
7. Close the temporal fascia with absorbable suture material and the subcutaneous tissue and skin according to surgeon preference [5].

Postoperative Care

1. Elevate the head of to decrease swelling [2].
2. Document facial nerve function, particularly brow elevation.
3. Remove nonabsorbable facial sutures 4–7 days postoperation [2].

Possible Complications

1. Zygoma asymmetry [6]
2. Facial nerve injury
3. Hematoma

Operative Dictation

Diagnosis: Zygomatic arch fracture
Procedure: Closed reduction of zygomatic arch fracture using Gillies approach

Indication

Patient is a _____ presenting with zygomatic arch fracture after trauma. The patient expresses understanding of the risks, benefits, and alternatives to the procedure and wishes to proceed.

Description of the Procedure

After informed consent was obtained and patient identity verified in the preoperative area, the patient was taken to the operating room and placed in the supine position. All pressure points were carefully padded and sequential compression devices placed on the lower extremities prior to induction. Prophylactic antibiotics were administered. General endotracheal anesthesia was then induced by the anesthesia team. The transverse temporal incision was infiltrated with 1 % lidocaine with 1:100,000 epinephrine. The face was prepped and draped in the usual sterile fashion with ophthalmic betadine solution. The eyes were then irrigated with balanced saline solution and taped closed with steri-strips.

A 2 cm transverse temporal incision beveled parallel to the follicles was made at the marked location 2.5 cm anterior and superior to the ear root within the hairline, using caution to avoid the superficial temporal artery. The incision was carried down through skin, temporoparietal fascia, and the superficial layer of the deep temporal fascia with visualization of the superficial temporal fat pad. An elevator was inserted through the incision and advanced to the depressed portion of the zygomatic arch. An outward force was applied to reduce the displaced arch, avoiding pressure on the temporal bone and overlying soft tissue. Symmetry was assessed and seen to be acceptable. The incision was then irrigated and hemostasis obtained. The temporal fascia was closed with 4-0 polyglactin sutures and the skin with surgical staples.

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Transnasal Wiring of a Nasoorbitoethmoid Fracture and Split Calvarial Bone Graft

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Introduction

The nasoorbitoethmoid (NOE) complex represents the confluence of the orbit, frontal bone, and nasal bone. It is damaged in approximately 5 % and 16 % of adult and pediatric facial fractures, respectively [1, 2]. The NOE complex functions as an important facial buttress; thus, fractures can have significant functional and aesthetic ramifications. Often, NOE stability is achieved by anchoring the fracture fragments to the contralateral orbital bone with a transnasal wire. Indications for this technique include NOE fractures with suboptimal positioning despite proper reduction and fixation of the anterior fracture lines [3]. If a preexisting laceration is not available, typically a coronal incision is utilized to expose the NOE fracture for anatomic reduction. In Type 3 NOE fractures, where the medial canthal tendon is detached from the lacrimal crests, holes are drilled through the appropriate piece of the lacrimal bony complex and then the contralateral medial orbital wall. These must be drilled carefully, paying attention to their placement superior and posterior to the lacrimal crests. Subsequently, a wire is passed through the holes and tightened to secure the medial canthal tendon in its proper location. Complications include recurrent deformity, inadequate correction, and asymmetry.

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Indications

1. NOE fractures (types I, II, or III) with suboptimal positioning of the medial orbital wall [3]

Essential Steps

Preoperative Markings

1. N/A

Intraoperative Details

1. Place the patient in supine position, pad all pressure points, and place sequential compression devices on the lower extremities.
2. General endotracheal anesthesia induced by anesthesia team.
3. Prep and drape the face.
4. Infiltrate the coronal incision with 0.5 % lidocaine with 1:200,000 epinephrine.

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5. Incise the coronal line and dissect anteriorly in the subgaleal plane until approximately 4 cm from the orbital rim.
6. Incise the periosteum and continue the dissection laterally in the plane just deep to the temporoparietal fascia and centrally in the subperiosteal plane.
7. Carry the central dissection inferiorly until the NOE fractures can be visualized.
8. Reduce the NOE fracture fragments.
9. Identify the bone fragment attached to the medical canthal tendon (MCT).
10. Using a wire-passing drill bit, drill two holes in the MCT bearing fragment and in the contralateral medial orbital wall posterosuperior to the lacrimal fossa [4].
11. Pass a thin gauge wire transnasally from the NOE fracture fragment to the stable anchor site [4].
12. Tighten the two ends of the wire ensuring the vector of pull is posterior to the superior portion of the lacrimal fossa [5].
13. If bilateral NOE fractures are present, alternately fix the fragments superomedially to the contralateral supraorbital frontal bone [3].
14. In cases of severe comminution, calvarial bone grafts can be harvested and placed medial to the comminuted lamina papyracea and the transnasal wires secured as described above [3]. The nasal dorsum can also be aesthetically optimal to bone graft to give good projection.
15. If the MCT is avulsed, double-cross through the avulsed end in a figure-eight pattern with the transnasal wire and pass the wire transnasally as described above [3].
16. Irrigate all wounds with antibiotic solution.
17. Place bolsters at the medial canthal area to help the thin soft tissues adhere to the bone.
18. Close the scalp incisions in layers with 2-0 Vicryl sutures followed by staples.
19. Assess pupil size and response to light.

Postoperative Care

1. Elevate head of the bed [4].
2. Perform regular pupil and vision checks [4].
3. Suture line care.
4. Nasal hygiene: normal saline irrigation and avoid nose blowing [4].

Possible Complications

1. Persistent telecanthus [5]
2. Nasolacrimal duct obstruction [5]
3. Obstructed breathing
4. Infection
5. Recurrent deformity
6. Inadequate correction
7. Asymmetry
8. Patient dissatisfaction
9. Need for definitive rhinoplasty

Operative Dictation

Diagnosis: Nasoorbitoethmoid fracture
Procedure: Transnasal wiring of nasoorbitoethmoid fracture

Indication

The patient is a _____ presenting with a nasoorbitoethmoid fracture after trauma. A preoperative ophthalmologic evaluation is performed to rule out globe injury and establish a baseline exam prior to proceeding to the operating theater. The patient expresses an understanding of the risks, benefits, and alternatives to the procedure and wishes to proceed.

Description of the Procedure

After informed consent and patient identity was verified in the preoperative area, the patient was taken to the operating room and placed in the supine position. All pressure points were carefully padded and sequential compression devices placed on the lower extremities prior to induction. Prophylactic antibiotics were administered. General endotracheal anesthesia was then induced by the anesthesia team. The coronal incision was

infiltrated with 0.5 % lidocaine with 1:200,000 epinephrine.

A coronal incision was made and dissected anteriorly in the subgaleal plane until approximately 4 cm from the orbital rim when the periosteum was incised, and dissection proceeded in the subperiosteal plane at this point. At this time, care was taken to elevate the temporoparietal fascia and dissect below this plane. Just above the ear, the superficial layer of the deep temporal fascia was incised and dissection continued over the temporal fat pad more inferiorly. More centrally at the level of the orbital rims, the supraorbital pedicles were preserved and dissected carefully. Centrally, the dissection was carried down onto the nose where the NOE fragments were identified. The right fragment was significantly laterally displaced. It was mobilized and reduced medially. Both medial canthal tendons were detached from the bone.

We were able to identify the medial canthal tendons and bony segments of the bilateral nasoorbital ethmoid fractures. Both tendons had been avulsed, so we proceeded with transnasal wiring by grasping the medial canthal tendon from outside through a stab incision at the medial canthal angle through to the underside of the tendon through the coronal incision, then placing this through a drill hole using a wire-passing drill bit toward the contralateral side, and using care to make sure that the vector of pull on the tendon was posterior to the lacrimal fossa and in a superior direction. This restored the appearance of the medial canthal area. A split calvarial bone graft was then placed as a cantilever for dorsal nasal support. The graft was harvested from the patient's right parietal area and measured approximately 5 × 1 cm. A bur was used to score outer table down into the diploic space. We were able to use curved osteotomes in gentle fashion to harvest the bone graft. The graft was further shaped on the back table and introduced into the patient's nasal dorsum using an intercartilaginous incision on the right which was then dissected toward the radix with tenotomy scissors. Upon placement of the graft, which had to be buttressed with two 30-gauge wires, we were able to use plate and screw fixation to secure the bone graft to the radix in the region of the nasal frontal suture. Prior to securing the graft, the radix was burred down to avoid elevating it too much with the graft. The intercartilaginous incision was then closed with 4-0 plain gut suture. We then used Gelfoam to treat the bone graft harvest site.

All wounds were then thoroughly irrigated with antibiotic solution. Next, we placed bolsters at the medial canthal area to help the thin soft tissues adhere back down to the bone in this area. This was done by placing a drill hole transnasally and passing two double-armed 3-0 Prolene sutures through this hole. This maneuver allowed us to bring out each suture out at the region of the medial canthus on each side and secure bolsters. The sutures were tied over Xeroform and cotton eye pad bolsters. Two 10 Fr drains were placed under the scalp, and the scalp incisions were closed in layers with 3-0 Vicryl sutures, followed by 3-0 simple interrupted nylons. The patient was then dressed and transported to the surgical intensive care unit in stable condition. All counts were reported to be correct. The patient's pupils were equal and reactive at the completion of the case. Staff was scrubbed through the duration of surgery, and all counts were correct.

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Closed Reduction of Nasal Fracture

64

Daniel A. Hatef, Jesse D. Meaike,
and Larry H. Hollier

Introduction

The nasal bone is the most commonly fractured bone in facial trauma and the third most commonly fractured bone overall [1, 2]. Nasal bone fractures can produce significant aesthetic deformity and compromise the patency of the upper airway. Consequently, intervention is indicated to minimize deformity and functional impairment. Simple, noncommunited nasal bone fractures are managed with a closed approach [3]. An instrument is inserted into the nasal cavity, and external digital pressure is applied over the fracture location. The nasal bone is then manipulated between the digit and elevator until properly positioned. The septum, if displaced, is realigned using an Asch's forceps. Internal and external splints are placed to stabilize and protect the nasal bones. Complications include obstructed breathing and need for a definitive rhinoplasty.

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Indications

1. Simple, noncomminuted fracture of nasal bones [3]

Essential Steps

Preoperative Markings

1. N/A

Intraoperative Details

1. Place the patient in supine position, pad all pressure points, and place sequential compression devices on the lower extremities.
2. General endotracheal anesthesia induced by anesthesia team.
3. Identify and mark the dorsal aesthetic lines.
4. Perform an intranasal speculum examination to confirm the position of the septum.
5. Prep the nose and infiltrate along the dorsum, septum, and sidewalls with 1 % lidocaine with epinephrine.
6. Prep and drape the face.
7. Insert a Boies elevator into the nasal cavity deep to the nasal bones [4].
8. Apply external digital pressure over the fractured nasal bones and manipulate the bones

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between the digit and the elevator until proper positioning is achieved [4].
9. Introduce Asch's septal forceps on either side of the septum along the floor of the nose, and realign the septal cartilage in the groove of the vomer [4].
10. Confirm proper positioning of the septum and nasal bones.
11. Insert an internal splint into the nares to stabilize the reduced bone fragments.
12. Place an external splint to protect the positioning of the nasal bones.

Postoperative Care

1. Elevate the head of the patient's bed.
2. Remove internal splint after 3–4 days [4].
3. Leave external splint in place for 5–7 days [4].

Possible Complications

1. Obstructed breathing
2. Infection
3. Recurrent deformity
4. Inadequate correction
5. Asymmetry
6. Patient dissatisfaction
7. Need for definitive rhinoplasty

Operative Dictation

Diagnosis: Nasal fracture
Procedure: Closed reduction of nasal fracture

Indication

Patient is a _____ presenting with a fracture of the nasal bones and septum. The patient complains of dissatisfaction with their appearance and bilateral obstructed breathing and desires correction. The patient expresses understanding of the risks, benefits, and alternatives to the procedure and wishes to proceed. After her questions are answered, informed consent is obtained.

Description of the Procedure

The patient was met in the preoperative holding area and marked. The patient was then brought to the operating room and placed in supine position on the operating room table, and the arms were tucked. All pressure points were padded, sequential compression devices were placed, and the patient was grounded. A time out was performed. General anesthesia was induced after oral intubation. The dorsal aesthetic lines were marked out and an intranasal speculum examination performed to confirm the position of the septum. The nose was then prepped in standard fashion, infiltrating along the dorsum, septum, and sidewalls with 5 cm^3 of 1 % lidocaine with epinephrine. The face was prepped and draped in typical sterile fashion. Digital pressure was used to manipulate the nasal bones back into position with a Boies elevator inside the nose to assist in their placement. This was done on both sides to ensure adequate positioning. An Asch forceps was then used to manipulate the septum back into midline. The position of the septum and the nasal bones was confirmed, and Doyle splints coated in bacitracin were inserted into the nares and sutured into place with a 2-0 nylon suture. An external Denver splint was then placed to protect the position of the reduced nasal bones. All sponge and needle counts were correct, and the patient was awoken from anesthesia and transported to recovery without issue.

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Cranial Vault Remodeling for Metopic Craniosynostosis

65

Rizal Lim, Ryan Reusche, and Chad A. Perlyn

Introduction

Craniosynostosis is defined as the premature fusion of one or more cranial sutures. The condition can present as an isolated defect or as a part of a syndrome with other anomalies [1]. Premature fusion of the metopic suture is relatively rare with an incidence of 7 per 2500 births [2]. Thorough preoperative planning and patient education are essential for an ideal aesthetic result and patient satisfaction. A variety of surgical techniques have been described, depending on the age of the patient and the severity of the deformity. These have varied from simple suturectomies to extensive calvarial vault remodeling. More recently, endoscopically assisted procedures followed by helmet therapy and distraction osteogenesis have gained considerable popularity.

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Indications

1. Premature closure of the metopic suture
2. Prominent ridging of the metopic suture, trigonocephaly, and hypotelorism
3. Increased intracranial pressure

Essential Steps

Preoperative Markings

1. Shave hair along coronal line from ear to ear.
2. Coronal zigzag pattern line should be drawn and used for primary incision.

Intraoperative Details

1. Placed in supine position.
2. General anesthesia with endotracheal intubation.
3. Neurosurgical Mayfield horseshoe headrest is used to support the head.
4. Cleanse the hair (braid if necessary), and clip to expose proposed incisions.
5. Infiltrate marked incision with local anesthetic plus 1:100,000 epinephrine.
6. Incise skin and elevate flaps in a supraperiosteal plane.

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7. Dissection should go subperiosteal until 1 cm above orbital rim and along temporal line.
8. Mark skull for planned bifrontal and supraorbital bar osteotomies.
9. Remove frontal bone and supraorbital bar.
10. Recontour the orbital bar to correct trigonocephaly.
11. Affix the supraorbital bar utilizing bioabsorbable mini plates.
12. Flip frontal bones 180° to create normal forehead.
13. Reaffix frontal bones with absorbable suture.
14. Reposition the scalp flap and fixate under mild tension.

Postoperative Care

1. Postoperative CT with 3D reconstruction (not routinely ordered).
2. Follow labs and hemodynamic status, neurochecks, and pain control.

Note These Variations

1. Spring-loaded distractors or metal mini plates may be used in place of bioabsorbable minibars.
2. An endoscopic technique has also been described in literature that may be used for children up to 6 months of age.

Possible Complications

1. There is a risk of early refusion needing secondary surgery.
2. Larger risks, rarely seen, include CSF leak, hemorrhage, or infection.

Operative Dictation

Diagnosis: Premature closure of metopic suture and trigonocephaly

Procedure: Open fronto-supraorbital advancement and remodeling

Indication

This is an infant with premature fusion of the metopic suture. This patient is presenting with a triangular-shaped forehead from caudal view, visible palpable midline ridge, and hypotelorism associated with ethmoidal hypoplasia. The surgery is indicated to allow proper growth and development of the brain and prevent potential increased intracranial pressure. The parents/guardians also desire a more normal cephalic-shaped head. Patient's parents/guardians understand the benefits, risks, and alternatives associated with the procedure and wish to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position with horseshoe head holder and minimal head extension. Time out among operating room staff was taken. General anesthesia was induced. Preoperative antibiotics were given. The hair was cleansed (braided if needed) and clipped to expose the proposed incisions. A path of hair approximately 3 cm wide was shaved behind the anterior fontanel, with interior limits just above the bilateral ears. The incision line was marked in a zigzag fashion. The area was infiltrated with 1% lidocaine plus 1:100,000 epinephrine. The patient was prepped and draped in standard sterile surgical fashion.

The skin was incised through the subcutaneous tissue down to the pericranium. The incision was carried laterally to the root of both ears to facilitate scalp and flap mobilization. The skin flap was dissected exposing the temporal muscles bilaterally down until the borders of both orbital rims became palpable. Next, the flap was elevated and dissected using periosteal elevators as needed to a point 1 cm above the superior orbital rim. At this point of care, the dissection was brought subperiosteal. Care was taken to dissect the supraorbital neurovascular bundle from the foramen and mobilize it as a whole with the periosteum and the skin flap. The temporal muscle was dissected and retracted with care take to preserve form and function.

Meticulous dissection of the orbits was performed to dissect the orbital periosteum from the bony orbit. Hemostasis of the cranium was achieved. Using a marking pen, lines were drawn for both bifrontal and supraorbital bar craniotomies.

Utilizing caution, two burr holes were placed parasagittal behind the anterior fontanel, two laterally on the parietal bone, two on the tip of the sphenosquamous suture, and one midline above the nasofrontal suture. Using the craniotome along with irrigation, bone cuts were made for the frontal craniotomy, passing 1.5 cm above the superior orbital rim and including the anterior fontanel. The frontal bone flap was carefully elevated, and the superior sagittal sinus was covered with laps.

The supraorbital bar was then removed. This was begun by using the saw to make cuts along the lateral advancement struts. At the region of the zygomaticofrontal suture, the reciprocating saw was used to bring the osteotomy across the ZF suture. Malleables were used to protect the ocular contents. Powered saw was then used to complete the osteotomy across the orbital roof. The cut was brought across the nasal bone and continued across the opposite orbital roof. Next, the cut across the sphenoid wing was then finalized with the reciprocating saw. The supraorbital bar was then removed en bloc. (If the bar does not come off easily at this point, an osteotome and mallet can be used to gently tap the bar free at any sites of incomplete bone cuts.)

The supraorbital bar was then brought to the back table. Using bone cutters and a rongeur, staves were made across the top of the supraorbital bar. The midline ridge was burred on both sides. The supraorbital bar was then greenstick fractured to correct the trigonocephaly and expand the bar. (When severe trigonocephaly exists, the bone can be split and an interposition bone graft placed for further expansion.) The new shape is maintained with a bioabsorbable plate or bone graft placed on the dural side of the bar.

The orbital bar was then plated into position with bioabsorbable mini plates. (Plates are only used at the lateral advancement struts. Absorbable sutures are used at the site of the nasal bone and orbital walls.)

The frontal reconstruction was made by affixing the frontal bone to the supraorbital bar with use of absorbable sutures. The frontal bones were switched and rotated 180°. The temporalis muscle were then back cut, and rotated forward to fill the bitemporal narrowing, they were secured with sutures. The wound was irrigated. The galea was closed with interrupted 4-0 Vicryl sutures. The skin edges were re-approximated with running 4-0 chromic suture with attention paid to everting the edges. A drain was placed. The wound was dressed in a nonocclusive dressing and topical antibiotics applied to wound edges to preclude dressing from sticking to the hair. A sterile dressing was applied.

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Cranial Vault Remodeling for Sagittal Craniosynostosis

66

Rizal Lim, Ryan Reusche, and Chad A. Perlyn

Introduction

Craniosynostosis is defined as the premature fusion of one or more cranial sutures, which can present as an isolated defect or as a part of a syndrome with other anomalies [1]. Sagittal suture is the most common suture involved in craniosynostosis [1]. Preoperative planning and patient education is essential for an ideal esthetic result and patient satisfaction. A variety of surgical techniques have been described, depending on the age of the patient and the severity of the deformity. These range from strip and Pi craniectomies, to extensive vault remodeling. Recently, endoscopically assisted procedures and distraction osteogenesis followed by helmet therapy have gained advocates.

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Indications

1. Premature closure of the sagittal suture
2. Elongated skull in the anterior–posterior diameter, shortened biparietal diameter and prominent ridging of the sagittal suture
3. Small or absent anterior fontanel
4. Increased intracranial pressure

Essential Steps

Preoperative Markings

1. Shave hair along incision line from ear to ear
   (a) Cases with severe frontal bossing or occipital bullet—Coronal pattern line should be drawn and used for primary incision, over the vertex of the scalp, from ear to ear, posterior to the coronal suture.
   (b) For moderate cases, a midline longitudinal incision can be used.

Intraoperative Details

1. Place ophthalmic lubricants followed by scleral protectors or Tegaderm.
2. Placed in supine position, with head and neck in flexion in Mayfield horseshoe headrest if there is significant frontal bossing.

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If there is a significant occipital bullet, position the patient prone.
3. General anesthesia with endotracheal intubation.
4. Cleanse the hair (braid if necessary), and shave to expose proposed incisions.
5. Infiltrate marked incision with local anesthetic plus 1:100,000 epinephrine.
6. Incise the skin and enter the subgaleal space; dissect in the subgaleal space until adjacent to the level of the orbital rim, at which point transition to the subperiosteal space.
7. Dissect subperiosteally and reflect scalp posterior to the lambdoid suture and anterior just beyond the coronal suture.
8. Mark skull for planned craniotomies (i.e., Pi, sagittal suturectomy with parietal barrel staving).
9. Make burr holes at the corners of the planned craniotomy lines; then use an osteotome to create craniotomies.
10. Dissect bone flaps free from dura.
11. Reshape bone as desired per the planned.
12. Affix bone flaps in place in the planned fashion using absorbable plates; this should be performed to increase biparietal width and decrease AP diameter.
13. Place a 16 French JP drain, and close scalp in layers (galea using 3-0 Vicryl, and skin 4-0 chromic running).

Postoperative Care

1. Pediatric ICU monitoring with serial hemoglobin monitoring
2. Postoperative CT with 3D reconstruction
3. Control blood pressure, and pain

Note These Variations

1. Current techniques include the Pi or modified Pi procedure, sagittal strip craniectomy with barrel staves, and complete cranial vault reconstruction.
2. Note the endoscopic technique is also a variant which is essentially a modified strip craniectomy followed by use of a cranial molding helmet.

Possible Complications

1. There is a risk of early re-fusion needing secondary surgery.
2. Larger risks, rarely seen include CSF leak, hemorrhage, or infection.

Operative Dictation

Diagnosis: Premature closure of sagittal suture, scaphocephaly

Procedure: Correction of sagittal suture synostosis; craniectomy and cranial vault remodeling

Indication

This is a _____ month old infant with premature fusion of the sagittal suture, confirmed by CT scan. This patient presents with an increased anterior–posterior skull diameter, visible palpable sagittal ridge, and absent/small anterior fontanel. The surgery is indicated to allow proper growth and development of the brain and prevent potential increased intracranial pressure. The parents/guardian also desire a more normal cephalic shaped head. Patient parents/guardian understand the benefits, risks, and alternatives associated with the procedure, and wish to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position with horseshoe head rest and minimal head extension. Time out among operating room staff was taken. General anesthesia was initiated. Preoperative antibiotics were given. Ophthalmic lubricant was applied, followed by Tegaderm closure of the eyes. The hair was cleansed, (braided if needed), and shaved. The incision line was marked in a coronal fashion over the vertex of the skull from ear to ear, and area infiltrated with 1 % lidocaine plus 1:100,000 epinephrine. The patient was prepped and draped in standard sterile surgical fashion.

A coronal skin incision was performed approximately 2 cm behind the coronal suture. The skin flap was dissected down until the coronal ridge was visible/palpable. Next, the flap was dissected posteriorly to level of the lambdoid suture. The scalp was then elevated and dissected using periosteal elevators. The temporal muscle was dissected and retracted with care take to preserve form and function. Hemostasis of the cranium was achieved. Using a marking pen, lines were drawn for a sagittal strip ostectomy about 3–4 cm in width, and for Pi procedure with temporal bone remodeling. (If a 3D model of skull was made preoperatively this may be used as a template at this time to guide in marking and subsequent shaping of the skull.)

A cranial burr was used to create craniotomies at the corners of the planned Pi craniotomies. A craniotome was then used with constant irrigation to complete the planned craniectomies. Blood loss was controlled using bipolar cautery and quick clot/bone wax. Caution was taken to avoid disrupting or entering the sagittal sinus. The Pi procedure was completed in which a 3-cm sagittal oriented strip of bone was retained bilaterally between the sagittal ostectomy and the temporal bone. The temporal bones were removed down to the squamosal sutures. An "L" was drawn on the left temporal bone, and "R" on the right temporal bone, these were saved for remodeling and later replacement. A segment of bone measuring 1.5 cm was removed from the anterior portion of each Pi leg maintaining adequate bone posterior to the coronal suture to allow for subsequent fixation.

Three drill holes were placed at the anterior end of each pi piece with a complimentary three drill holes placed 1 cm posterior to the coronal suture. The drill holes were subsequently threaded with steel wire and tightened to short the AP diameter of the skull achieving closer to normal cephalic measurements. Care was taken to ensure each side was tightened symmetrically. Once optimum AP changes were achieved absorbable sutures were placed through the drill holes and tied down, steel wire was subsequently removed.

Focus was turned to shaping the temporal area. The new AP diameter was measured on each side of the patient's skull then measured out on the temporal bones. The temporal bones were shortened to correlate to the new AP diameter of the skull. Barrel stave osteotomies were created to allow shaping and bone-bending forceps were used to contour the bone around the shape of the protruding brain. The bones were then replaced and secured using by complementary drill holes and 2-0 PDS.

The scalp was closed over a 16 French JP suction drain. The galea was approximated with 3-0 Vicryl buried interrupted sutures then followed skin closure with a running 4-0 chromic suture. The wound was dressed with Xeroform, followed by fluffs, Kerlix roll, and ACE wrap.

The patient tolerated the procedure well, was awakened stable and transferred to the pediatric ICU. All sponge and needle counts were correct.

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Part V

Head and Neck

Scalp Rotation and Advancement Flap

67

Clifford T. Pereira and Malcolm A. Lesavoy

Indications

Scalp defects > 3 cm [1–3]

Essential Steps

Preoperative Markings

1. Flap design determined by at least one of the named arteries of the scalp [4, 5].
   (a) Anterior central scalp—supra-trochlear and supraorbital vessels
   (b) Anterior preauricular scalp—frontal and parietal branches of the superficial temporal artery
   (c) Anterior postauricular scalp—posterior auricular artery
   (d) Posterior scalp—occipital artery
2. The artery is localized with a Doppler probe before the scalp flaps are planned and designed [4].
3. The vascular pedicle is the pivot point of the rotation flap [6–9]. Using a gauze or piece of suture, the arc of rotation is planned. Care must be taken into account for shortening of the flap length as it passes over the convexity of the skull.

Intraoperative Details

1. A rim of scalp around the defect is excised to freshen the edges, and the final scalp defect is measured.
2. The scalp surrounding the initial defect is undermined to allow for some mobilization (albeit minimal).
3. The flap is designed based on one or two vascular pedicles [4, 5, 9].
4. The hairline is excluded from the flap design to maintain the forehead aesthetic unit if possible.
5. The flap is elevated in the subgaleal plane.
6. Hemostasis is secured.
7. The flap is rotated with a cut-back incision and the bony defect is covered [10].
8. Flap is secured with sutures.
9. Secondary defect is reconstructed using a split or full thickness skin graft.

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10. A standard head dressing is applied using Xeroform, gauze fluffs, Kerlix, and a stockinette dressing (halo).

Postoperative Care

1. Blood pressure and pain is controlled.
2. Care is taken to prevent pressure over flap when patient is recumbent. Neurosurgical halo can be applied to protect the skin graft and flap against pressure and shearing [2].
3. The patient may be discharged on day 1 or 2 if adequate pain control is achieved and no postoperative bleeding.
4. Wound check is performed on day 3 or 4 to check the flap viability and the skin graft.
5. Second wound check performed at day 7–10.

Possible Complications

1. Bleeding, hematoma
2. Infection
3. Flap loss—partial or complete
4. Scar alopecia

Operative Dictation

Diagnosis: Scalp defect 3 cm or greater diameter
Procedure: Scalp flap rotation/advancement with split thickness skin graft

Indication

This is a ____ year-old male with a ___ cm scalp defect from a degloving injury requiring soft tissue coverage. The risks and benefits of surgery are explained to the patient, and informed consent is obtained.

Description of the Procedure

The patient was taken to the Operating Room and placed in a supine position on the Operating Table, with a neurosurgical headrest. Prophylactic intravenous antibiotics were administered prior to the commencement of the procedure. The patient was intubated under general anesthesia. All pressure points were padded and a pneumatic sequential compression device was placed on both calves to prevent deep vein thrombosis. A Bair-hugger was placed to maintain intraoperative maintenance of body temperature. The scalp was prepped and draped in the usual sterile fashion.

A rim of scalp around the defect was excised to freshen the edges. The final scalp defect was _____ cm in diameter. The flap was designed based on the _____ vascular pedicle. The hairline was excluded from the flap design to maintain the aesthetic unit. The flap was elevated in the subgaleal plane. Hemostasis was secured using electrocautery. The flap was then rotated with a cutback incision, and the bony defect was covered. The tissue surrounding the initial scalp defect was undermined to allow for greater mobilization. The flap was secured using 2-0 Vicryl interrupted, inverted sutures to the galea. The skin was approximated using 3-0 interrupted Prolene sutures. Xeroform dressings were applied to the wounds.

A split-thickness skin graft was harvested from the thigh using a dermatome for coverage of the secondary defect. The thigh wound was dressed with a large opsite dressing. The split-thickness skin graft, meshed at 1:1, was sutured to the wound edges using 3-0 chromic cat gut continuous sutures. A bolster dressing using Xeroform and cotton soaked in mineral oil was fixed with interrupted 2-0 silk sutures.

A standard head dressing was applied using gauze fluffs, Kerlix, and a stockinette dressing. Sponge, needle, and instrument counts were correct at the end of the case. The patient was awakened from anesthesia and extubated without any complications, and transferred to the Post-Anesthesia Care Unit in a stable condition.

Pearls and Pitfalls

1. Thickness, elasticity, and vascularity of the tissues around the defect and flap reconstruction can be compromised by several factors including previous operations, scarring, burns, previous radiation therapy, local and systemic

infections, preoperative chemotherapy, nutritional status, and comorbidities.
2. Clear margins in oncological extirpative cases must be checked prior to reconstruction.
3. The hair line can be distorted by excessive tissue undermining and recruitment. Preservation of the aesthetic subunit of the forehead must be considered when designing rotational flaps.
4. Tissue expansion can be considered to decrease or eliminate the secondary defect caused by the rotational flap as a secondary procedure.
5. Galeal scoring has been reported to expand the scalp flap. Scoring is performed at 1–2 cm apart, with care taken to preserve the subdermal plexus. In our opinion galeal scoring does little to expand the flap and should be avoided.
6. The pivot point of the rotation flap is planned near the vascular pedicle.
7. It is important to design the rotation of the flap beyond the defect to account for shortening of the flap as it is passed over the convexity of the skull.
8. Simple single flaps, two-flap, three-flap, and four-flap techniques have been described. Temporoparietal flap, occipitoparietal (Juri) flap, and tissue expander-based flaps are other variants of the scalp rotational/advancement flap.

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Tenzel Semicircular Flap

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Steven Ovadia and Chrisfouad Alabiad

Indications

1. Twenty-five to sixty percent lid defect
2. Lower eyelid repair (Tenzel flap)
3. Upper eyelid repair (Reverse Tenzel flap)
4. Centrally or laterally positioned defect
5. Tarsal plate ideally present on both sides of the surgical defect

Essential Steps

Preoperative Markings

1. Semicircular flap designed to be approximately 2 cm in diameter
   (a) Upside down "U" shaped for lower eyelid; "U" shaped for upper eyelid.

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Intraoperative Details

1. Semicircular flap incised with dissection of myocutaneous flap
2. Lateral canthotomy is performed
3. Inferior cantholysis (lower lid); superior cantholysis (upper lid)
4. Lateral aspect of surgical defect along with semicircular flap mobilized
5. Tarsal plate on either side of wound defect reapproximated
6. Skin and orbicularis muscle on either side of wound defect is reapproximated
7. Lateral eyelid tissue rotated to close initial defect
8. Lateral canthus reconstructed by suturing semicircular flap to periosteum
9. Semicircular flap trimmed and sutured in place

Postoperative Care

1. Pressure dressing to remain in place for 5–7 days
2. Silk suture on eyelid margin removed after 14 days

Note These Variations

A periosteal bone flap may be used to provide support and suspension of the eyelid as an alternative to lateral canthal fixation by suturing the flap to the lateral orbital periosteum.

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Possible Complications

1. Ectropion
2. Eyelid notching
3. Facial nerve damage
4. Lower lid retraction

Operative Dictation

Diagnosis: Status post MOHs resection of basal cell carcinoma of lower eyelid
Procedure: Reconstruction of (upper/lower) eyelid defect via Tenzel flap

Indication

This is a __/__ (Age/gender) with a history of basal cell carcinoma to the lower eyelid. He/she presents with a 40 % defect to the central portion of the lower eyelid secondary to MOHs excision of the basal cell carcinoma indicating this reconstructive procedure. In consideration of the size and position of the defect, the Tenzel semicircular flap is selected for reconstruction of the eyelid. Risks, benefits, and alternatives are explained to the patient in detail and he/she understands and agrees to the procedure.

Description of the Procedure

The patient was brought to the operating room and positioned in the supine position. The anesthesia team induced the patient under monitored anesthesia care. The patient was prepped and draped in the usual sterile fashion. Time-out was completed amongst operative staff verifying the patient's identity, procedure, consent, operative side and site.

Local anesthetic consisting of 2 % lidocaine with 1:100,000 epinephrine was injected in a subcutaneous fashion in the area of the defect and in a subconjunctival fashion in the lower lid fornix. The edges of the defect were grasped with 0.3 forceps to evaluate for primary closure. A significant deficit remained so it was decided to proceed with the semicircular flap.

A marking pen was used to modify the surgical defect into the shape of a pentagon and to ensure the edges of the defect were even and contained all layers of the lower eyelid. A chalazion clamp was applied to the wound and a #15 scalpel was used to make a full thickness incision in the area of the eyelid markings. Hemostasis was attained with bipolar electrocautery. The chalazion clamp was removed and attention was drawn to the lateral canthus.

A marking pen was then used to outline a semicircular flap measuring 2 cm in width and 1 cm in height. Care was taken to ensure the marking took the shape of an upside down U with the marking beginning at the lateral canthus without extending beyond the lateral brow. Two percent lidocaine with 1:100,000 epinephrine was injected in the area delineated by the skin markings. Incision was made using a #15 scalpel. The anterior lamella including skin and muscle was carefully dissected from the underlying orbital septum using Westcott scissors.

A lateral canthotomy and inferior cantholysis were then performed with scissors. Care was taken to avoid damaging the superior crus of the lateral canthal tendon. Bleeders were cauterized with bipolar electrocautery.

The medial and lateral edges of the lid defect were then grasped and found to come together with minimal tension. The wound was then prepared so as to close the defect in a layered fashion. The pretarsal orbicularis along the lower 3 mm of the tarsal plate was undermined on either side of the wound so as to expose the tarsal plate. The eyelid margin was reapproximated using a 5-0 silk suture in a vertical mattress fashion. The tarsal plate was reapproximated using three interrupted 5-0 Vicryl sutures on a spatulated needle in a horizontal lamellar fashion. The eyelid was everted after each pass to ensure the sutures were not exposed and scratching the cornea. All sutures were then tied. The ends of the silk margin suture were left long so as to avoid irritation to the cornea. The skin along the defect was then closed using 7-0 Vicryl sutures in an interrupted fashion. The lash line was further reapproximated with 7-0 Vicryl suture. The ends of the silk suture were incorporated into the sutures used for skin closure.

Next, the lateral canthus was recreated. The deep aspect of the semicircular flap was sutured to the periosteum adjacent to the insertion of the lateral canthal tendon using 4-0 Vicryl suture. The semicircular flap was then closed using 5-0 Vicryl sutures in a deep buried and interrupted fashion. Excess skin and muscle were removed with Westcott scissors. The skin was closed with 7-0 Vicryl sutures in an interrupted and running fashion. The drapes were removed. The wound was dressed with ophthalmic antibiotic ointment. A pressure dressing was applied to the eye. The patient tolerated the procedure well. There were no intraoperative complications. All instrument, sponge, and needle counts were correct. The patient was then transported to the post-anesthesia care unit in stable condition.

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Bridge Flap: Cutler Beard Flap

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Indications

1. Upper eyelid defects >60 %

Essential Steps

Preoperative Markings

First Stage

1. Markings for the flap are completed intraoperatively
2. Vertical edges of final defect designed to be perpendicular to lid margin

Second Stage

1. Markings for this procedure are completed intraoperatively

Intraoperative Details

First Stage

1. Local anesthesia achieved with 2 % lidocaine with 1:100,000 epinephrine.
2. Upper eyelid defect trimmed to take a rectangular shape.
3. Width of flap determined by size of defect while gently bringing wound edges together.
4. Full thickness lower lid blepharotomy created 5–6 mm below eyelid margin with vertical relaxing incisions on medial and lateral ends.
5. Conjunctiva dissected from lower lid flap and advanced superiorly (under the lower eyelid bridge) to be secured to upper lid forniceal conjunctiva.
6. Capsulopalpebral fascia/lower lid retractor secured to remnant of levator aponeurosis.
7. Skin and muscle advanced under lower lid bridge and secured to upper eyelid skin and muscle.

Second Stage

1. Local anesthesia achieved with 2 % lidocaine with 1:100,000 epinephrine
2. Grooved director placed under flap
3. Skin of flap incised with #15 scalpel and flap is divided with Stevens scissors
4. Cut end of conjunctiva sutured to skin at upper eyelid margin
5. Inferior portion of flap sutured to inferior base of the lower lid bridge

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Postoperative Care

First Stage

1. Pressure dressing applied for 1 week
2. Divide flap after 6–8 weeks

Second Stage

1. Ophthalmic antibiotic ointment applied to incision sites daily for 5–7 days
2. Remove lower lid nylon sutures after 5–7 days

Note These Variations

1. *Autogenous tissue, including cartilage and free tarsal graft, may be utilized to provide additional structure to the upper eyelid.*
2. *Can be done under general or local anesthesia.*

Possible Complications

1. Necrosis of the lower lid margin
2. Flap retraction
3. Upper lid entropion
4. Lower lid ectropion
5. Trichiasis
6. Lagophthalmos

Operative Dictation

First Stage Operative Note

Diagnosis: Upper Eyelid Basal Cell Carcinoma s/p MOH Excision

Procedure: First stage upper eyelid reconstruction with bridge flap

Indication

This is a __/__ (Age/gender). The patient has a history of upper eyelid basal cell carcinoma and underwent MOHs excision yesterday. The defect was centrally located. It included the lid margin, and spanned 70 % of the horizontal dimension of the eyelid. In consideration of the size and location of the defect, the bridge flap was selected for reconstruction of the defect. Risks, benefits, and alternatives are explained to the patient in detail and he/she understands and agrees to the procedure.

Description of the Procedure

The patient was brought to the operating room and positioned in the supine position. The patient was prepped and draped in the usual sterile fashion. Time-out was completed amongst operative staff verifying the patient's identity, procedure, consent, operative side and site. After instillation of topical ophthalmic proparacaine in the eye, a corneal protector was placed on the ocular surface. The upper and lower eyelid operative sites were anesthetized through local infiltration of 2 % lidocaine with 1:100,000 epinephrine in a subcutaneous fashion. Additional anesthetic was injected in a subconjunctival fashion in the upper and lower lid fornix.

The upper eyelid defect was trimmed with Stevens scissors to create a rectangular defect from the initial defect. Meticulous hemostasis was achieved with the bipolar electrocautery.

The medial and lateral edges of the upper eyelid were grasped with 0.3 forceps and brought towards each other under minimal tension. The horizontal length of the remaining defect was measured at this point. The lower eyelid flap was marked with care to ensure that the superior portion of the flap was 5–6 mm below the eyelid margin. The horizontal span of this marking was approximately 1–2 mm larger than the measured defect size. Vertical markings were added alongside and perpendicular to the medial and lateral margins of the horizontal marking, measuring 15 mm in height.

A chalazion clamp was then placed along the lower lid, allowing exposure of the skin markings. A 15 blade was used to fashion a full thickness incision along the skin markings. Hemostasis was again achieved using the bipolar electrocautery.

The chalazion clamp was removed. The flap was advanced under the lower lid margin and secured to the upper lid defect. The conjunctiva of the lower lid flap was carefully dissected and secured to the conjunctiva of the upper eyelid

fornix using 6-0 gut sutures in a running fashion. The lower lid retractor/capsulopalpebral fascia was secured superiorly to the residual levator aponeurosis using 6-0 vicryl suture in a running fashion. (*If there was residual upper eyelid tarsal plate in the superior aspect of the wound: the conjunctiva and lower lid retractors were secured to the tarsal plate using 6-0 vicryl in a running fashion with care to take lamellar passes through the tarsal plate.*) The lower lid retractor/capsulopalpebral fascia was secured medially and laterally to the residual medial and lateral tarsal plate, respectively, in an interrupted and horizontal lamellar fashion using 6-0 vicryl suture. The skin muscle flap was secured to the residual upper eyelid skin and muscle with 7-0 vicryl suture in an interrupted and running fashion. Ophthalmic antibiotic ointment was then applied to the incision sites and a pressure dressing was applied to the eyelids.

All instrument, sponge, and needle counts were correct. The patient tolerated the procedure well. There were no intraoperative complications. The patient was then transported to the post-anesthesia care unit in stable condition.

Second Stage Operative Note

Diagnosis: Upper eyelid basal cell carcinoma status post excision and first-stage Cutler-Beard procedure

Procedure: Division of Bridge flap

Indication

This is a __/__ (Age/gender) with a history of upper eyelid basal cell carcinoma status post MOHs excision. Six weeks ago the patient underwent first stage reconstruction with a bridge flap procedure. On exam, the flap was noted to be fully viable with healed incisions. The patient now presents for second stage reconstruction with division of the flap. Risks, benefits, and alternatives are explained to the patient in detail and he/she understands and agrees to the procedure.

Description of the Procedure

The patient was brought to the operating room and positioned in the supine position. The patient was prepped and draped in the usual sterile fashion. Time-out was completed amongst operative staff verifying the patient's identity, procedure, consent, operative side and site. The flap and upper and lower eyelid operative sites were anesthetized through local infiltration of 2% lidocaine with 1:100,000 epinephrine.

A grooved director was placed beneath the flap superior to the lower eyelid margin. A Stevens scissor was used to make a beveled incision along the flap (skin side shorter than conjunctival side). The conjunctiva along the newly created upper eyelid was then reflected anteriorly, aligned with the skin, and approximated to the skin using 6-0 gut suture in a running fashion.

Next, the lower eyelid donor site was addressed. The lower lid margin was debrided with a #15 scalpel to remove keratinized tissue in contact with the globe. The conjunctiva and lower lid retractors along the remaining portion of the flap were secured to the lower lid tarsal plate using 6-0 gut sutures in a running fashion. The skin of the remaining portion of the flap was reapproximated to the skin along the inferior margin of the lower lid bridge using 7-0 nylon suture in an interrupted and running fashion. Ophthalmic antibiotic ointment was then applied to the incision sites. The surgical drapes were removed.

All instrument, sponge, and needle counts were correct. The patient tolerated the procedure well. There were no intraoperative complications. The patient was then transported to the post-anesthesia care unit in stable condition.

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Fricke Temporal Forehead Flap

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Indications

1. Lateral upper or lower eyelid defects

Essential Steps

Preoperative Markings

1. Inferior border of flap is designed along the superior aspect of the eyebrow hairs
2. Dimensions of the flap determined by the size of the defect
3. Flap is designed with a maximal length to width ratio of 4:1
4. Distal aspect of the flap should be lateral to supraorbital neurovascular bundle

Intraoperative Details

1. Two percent lidocaine with 1:100,000 epinephrine is injected into the wound and the planned flap
2. Flap is incised with #15 scalpel and elevated with Westcott scissors (*or cutting cautery*)
3. Flap is thinned with Westcott scissors
4. The brow defect is closed in a layered fashion
5. Flap is rotated into the defect, trimmed to fit, sutured in place

Postoperative Care

1. Pressure dressing left in place for 1 week
2. Patient may gently massage brow scar 2–3 weeks postoperatively to minimize scar and promote laxity and counteract brow elevation. This should be done at least three times daily for 5 min. Brow massage can be continued for several months until satisfactory correction of brow elevation has been achieved. (*Alternatively, the contralateral eyelid may be elevated with a brow lift for symmetry.*)

Note These Variations

1. For full thickness defects, the posterior lamella may be reconstructed with a hard

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palate graft, chondromucosal flap, hard palate graft, xenogeneic collagen matrix, etc.
2. A second stage procedure involving trimming and insetting the pedicle may be indicated if the flap is bridged over healthy tissue to correct a medial upper or lower eyelid defect.

Possible Complications

1. Cicatricial ectropion
2. Lateral canthal tendon dystopia

Operative Dictation

Diagnosis: 80 % lateral upper eyelid defect s/p MOHs surgery for basal cell carcinoma
Procedure: Temporal forehead flap

Indication

This is a __/__ (Age/gender). The patient is presenting with a large, 80 % upper eyelid anterior lamellar defect after undergoing MOHs excision of a basal cell carcinoma. The patient previously underwent lower eyelid reconstruction after lower eyelid tumor excision limiting reconstructive options for the current defect. Consequently, the frontotemporal forehead flap is selected for reconstruction of the patient's upper eyelid defect. Risks, benefits, and alternatives are explained to the patient in detail and he/she understands and agrees to the procedure.

Description of the Procedure

The patient was brought to the operating room and positioned in the supine position. The patient was prepped and draped in the usual sterile fashion. Time-out was completed amongst operative staff verifying the patient's identity, procedure, consent, operative side and site.

The planned incisions were marked in the preoperative holding area. The handheld Doppler was used to locate a branch of the superficial temporal artery adjacent to the lateral orbital rim (*optional*). The flap was designed with a temporally based pedicle to include the identified branch of the superficial temporal artery. The distance from the pedicle to the medial aspect of the defect measured 6.4 cm. The length of the flap measured 7 cm. The height of the flap measured 1.75 cm.

The upper eyelid and planned flap operative sites were anesthetized through local infiltration of 2 % lidocaine with 1:100,000 epinephrine. The flap was incised along the markings with a #15 scalp. The cutting cautery with a Colorado needle was used to dissect the flap from the underlying orbicularis and frontalis muscles. Care was taken to avoid a deep dissection so as to preserve temporal branches of the facial nerve. Meticulous hemostasis was achieved. After the flap was raised, the inner surface of the flap was trimmed with Westcott scissors.

The flap was then rotated and inset into the defect bridging over the residual healthy tissue located between the flap and the defect. The flap was sutured in place with interrupted subcutaneous 5-0 vicryl sutures. The skin was reapproximated with 7-0 vicryl sutures.

The donor site was then undermined using Stevens scissors. Bipolar electrocautery was used to obtain meticulous hemostasis. The deep tissue of the donor site was sutured with 5-0 vicryl in a buried and interrupted fashion. The skin was reapproximated using interrupted 6-0 Prolene sutures in an interrupted vertical mattress fashion. The skin was further closed with 6-0 Prolene sutures in a running locking fashion.

Ophthalmic antibiotic ointment was applied to the incision sites and a pressure patch was applied to the eye.

All instrument, sponge, and needle counts were correct. The patient tolerated the procedure well. There were no intraoperative complications. The patient was then transported to the post-anesthesia care unit in stable condition.

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Tripier Bipedicle Musculocutaneous Flap

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Indications

1. Lower eyelid reconstruction
2. Defects with horizontal dimension up to 100 % of eyelid
3. Defects with short vertical dimension (8–10 mm)

Essential Steps

Preoperative Markings

1. Upper eyelid crease marked for planned horizontal incision.
2. Second marking superior and parallel (making sure there is enough residual skin for upper eyelid closure).
3. Connect medal and lateral aspect of lid crease markings to medial and lateral lower lid defects, respectively.
4. Flare medial and lateral aspects of superior markings (just beyond medial and lateral canthus) approximately 45° so as to direct the pedicle in direction of the lower lid.

Intraoperative Details

1. Two percent lidocaine with 1:100,000 epinephrine injected into the wound and upper eyelid
2. Flap is incised and raised at the level of the orbital septum to include skin and muscle
3. Flap is inset and sutured into place at the site of defect

Postoperative Care

1. Pressure dressing for 1 week

Note These Variations

1. A monopedicle flap can be utilized for medial or laterally based defects.
2. When a full thickness defect is present, the posterior lamella defect should be reconstructed through a hard palate graft, chondromucosal flap, hard palate graft, xenogeneic collagen matrix, etc., in conjunction with the bipedicle myocutaneous flap.

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3. When the flap is constructed in such a way that there is a bridge (no medial and lateral flare to the flap), a second stage surgery is required to trim and inset the medial and lateral pedicles (approximately 6–8 weeks after first stage surgery).

Possible Complications

1. Flap necrosis
2. Cicatricial ectropion
3. Webbing of medial and lateral canthus

Operative Dictation

Diagnosis: Lower eyelid malignancy status post MOHs excision

Procedure: Bipedicle flap for lower eyelid reconstruction

Indication

This is a __/__ (Age/gender) who is presenting with an anterior lamellar lower eyelid defect after undergoing a MOHs resection for a lower eyelid basal cell carcinoma. On exam, the defect measures 8 mm vertically and 30 mm horizontally approximately 1 mm below the lower lid lash line. The posterior lamella is intact. The upper eyelid is noted to have sufficient redundancy to allow for a lid sharing procedure. In consideration of the position of the defect, a bipedicle Tripier flap is selected for the reconstruction. Risks, benefits, and alternatives are explained to the patient in detail and he/she understands and agrees to the procedure.

Description of the Procedure

The patient was brought to the operating room and positioned in the supine position. The patient was prepped and draped in the usual sterile fashion. Time-out was completed amongst operative staff verifying the patient's identity, procedure, consent, operative side and site.

The lid crease was marked with a marking pen. The markings were extended to the medial and lateral canthus in order to be contiguous with the lower lid defect. Two non-toothed forceps were then used to elevate redundant upper eyelid skin, the superior borders of which were marked with a marking pen. The superior markings were made parallel to the lid crease. These marks were then flared approximately 45° just medial to the medial canthus and just lateral to the lateral canthus in anticipation of directing the pedicle into the lower lid defect.

The upper and lower eyelid operative sites were anesthetized through local infiltration of 2% lidocaine with 1:100,000 epinephrine. An incision was made with a #15 blade. The flap was undermined in the post-orbicular fascial plane using Westcott scissors. Hemostasis was attained with bipolar electrocautery.

The bipedicle upper eyelid flap was then inset into the defect. The skin was closed with 7-0 Vicryl sutures in an interrupted and running fashion along the superior and inferior aspects of the wound. The upper lid wound was then closed using 7-0 Vicryl sutures in an interrupted and running fashion.

Ophthalmic antibiotic ointment applied to the incision sites and a pressure patch was applied to the eye.

All instrument, sponge, and needle counts were correct. The patient tolerated the procedure well. There were no intraoperative complications. The patient was then transported to the post-anesthesia care unit in stable condition.

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Hughes Tarsoconjunctival Flap

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Indications

1. Full thickness lower eyelid margin defect
2. Defect >33 % of horizontal dimension of eyelid

Essential Steps

Preoperative Markings

First Stage

1. Markings for this procedure completed intraoperatively

Second Stage

1. No markings necessary

Intraoperative Details

First Stage

1. Two percent lidocaine with 1:100,000 epinephrine is injected into the wound and the upper eyelid.
2. Frost suture placed on upper eyelid.
3. Upper eyelid everted over a Desmarres retractor.
4. With lower lid wound edges gently drawn towards one another, the width of flap along upper lid is marked.
5. Horizontal incision through conjunctiva and tarsus is made 4 mm above lid margin.
6. Pretarsal orbicularis is dissected off the flap.
7. Vertical cuts are made on both sides of the flap extending to superior fornix.
8. Muller's muscle dissected from conjunctiva using Westcott scissor.
9. Flap is advanced into the defect.
10. Flap is secured to the lower lid retractors inferiorly.
11. Flap is secured to the tarsal plate medially and laterally.
12. A local myocutaneous flap is created (with a horizontal vector) to cover defect.

Second Stage

1. Local anesthesia achieved with 2 % lidocaine with 100,000 epinephrine
2. Grooved director placed under the eyelids

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3. Incision is made with Westcott scissor to recreate the lower lid margin
4. Upper eyelid everted and remaining excess flap tissue excised at its base

Postoperative Care

First Stage

1. Pressure patch left in place for 5–7 days
2. Divide flap after 4–8 weeks

Second Stage

1. Ophthalmic antibiotic ointment three times a day for 3 days

Note These Variations

1. The tarsus of the tarsoconjunctival flap may be sutured to a periosteal bone flap at the lateral canthus if there is no residual tarsus lateral to the defect.
2. Multiple options are available for reconstruction of the anterior lamella, including skin and muscle transposition flap from the upper eyelid or full thickness skin graft harvested from the upper eyelid, supraclavicular, or postauricular region. If a full thickness skin graft is used, then it is better to create the tarsoconjunctival flap to include Muller's muscle so as to improve blood supply to the skin graft.

Possible Complications

1. Upper eyelid retraction
2. Lower eyelid retraction
3. Lower eyelid ectropion

Operative Dictation

First Stage Operative Note

Diagnosis: Lower eyelid basal cell carcinoma s/p MOHS Excision
Procedure: First stage lower eyelid reconstruction with a tarsoconjunctival flap

Indication

This is a __/__ (Age/gender) with a history of lower eyelid basal cell carcinoma. The patient previously underwent MOHs excision and now presents with a lower eyelid defect encompassing 60 % of the lower eyelid margin. The vertical dimension of the resulting defect was short making the patient a good candidate for reconstruction by tarsoconjunctival flap. Risks, benefits, and alternatives are explained to the patient in detail and he/she understands and agrees to the procedure.

Description of the Procedure

The patient was brought to the operating room and positioned in the supine position. The patient was prepped and draped in the usual sterile fashion. Time-out was completed amongst operative staff verifying the patient's identity, procedure, consent, operative side and site. A corneal protector was placed over the operative eye. The upper and lower eyelid operative sites were anesthetized through local infiltration of 2 % lidocaine with 1:100,000 epinephrine in a subcutaneous fashion. Additional anesthetic was injected in a subconjunctival fashion along the upper and lower lid fornix. A 4-0 silk Frost suture was placed through the gray line of the upper eyelid which was then double everted over a Desmarres retractor.

The medial and lateral edges of the lower eyelid defect were grasped with 0.3 forceps and brought towards each other under mild tension and the horizontal extent of the defect was measured with calipers. This length was then marked onto the conjunctival surface of the everted upper eyelid. A horizontal marking 4 mm above the upper eyelid margin was then delineated corresponding to the length of the defect previously measured. Vertical marking were created along the medial and lateral margins of the horizontal marking extending to the superior fornix.

The tarsoconjunctival flap was incised along the markings with a number 15 blade. The conjunctiva and full thickness tarsal plate were included in the incision. A Westcott scissor was used to bluntly dissect the pretarsal orbicularis from the tarsal plate. Two vertical cuts were then made on either side of the flap extending to the

superior fornix using the Westcott scissors. The tarsus was found to be attached superiorly to a healthy flap consisting of Muller's muscle and conjunctiva. Anesthetic was injected between the Muller muscle and conjunctiva in an effort to hydrodissect the surgical plane. The Muller muscle was then separated from the underlying conjunctiva with Westcott scissors until an adequate amount of forniceal conjunctiva was released.

The Desmarres retractor, corneal protector, and silk margin suture were then removed. Attention was drawn to the lower lid defect. The pretarsal orbicularis along the lower 3 mm of the tarsal plate was undermined on either side of the lower lid defect so as to expose the tarsal plate. The tarsoconjunctival flap was advanced inferiorly into the lower lid defect. The flap was inset such that the superior aspect of the flap containing tarsal plate was aligned with the lower lid margin. The medial and lateral borders of the tarsoconjunctival flap were then secured to the medial and lateral tarsal plate, respectively, using 5-0 vicryl suture on a spatulated needle in a horizontal lamellar fashion. The lower lid retractors and conjunctiva were secured to the inferior portion of the tarsoconjunctival flap using 7-0 vicryl suture in a running fashion.

The anterior lamellar defect was reconstructed via adjacent tissue rearrangement along the lower eyelid. A marking was created in a subciliary fashion extending from the lateral aspect of the original wound defect to the lateral canthus. A marking pen was then used to outline a semicircular flap measuring 2 cm in width and 1 cm in height. Care was taken to ensure the marking took the shape of an upside down U with the marking beginning at the lateral canthus without extending beyond the lateral brow. 2 % lidocaine with 1:100,000 epinephrine was injected in the area delineated by the skin markings. Incision was made using a number 15 blade. The anterior lamella including skin and muscle was carefully dissected from the underlying orbital septum using Westcott scissors. Once an adequate amount of tissue was released, the myocutaneous flap was advanced medially to cover the anterior lamellar defect. Care was taken to ensure that the flap would not induce a vertical vector of cicatrix postoperatively. The flap was trimmed accordingly with Westcott scissors. The flap was secured to the lid margin using interrupted 7-0 vicryl sutures in a horizontal mattress fashion. The flap was also secured to the medial aspect of the wound with 7-0 vicryl suture in a running fashion. The subciliary incision was closed using 7-0 vicryl suture in a running fashion. Ophthalmic antibiotic ointment was applied to the incision sites and a pressure patch was applied to the eye.

All instrument, sponge, and needle counts were correct. The patient tolerated the procedure well. There were no intraoperative complications. The patient was then transported to the post-anesthesia care unit in stable condition.

Second Stage Operative Note

Diagnosis: Lower eyelid basal cell carcinoma status post excision and first-stage reconstruction with tarsoconjunctival flap
Procedure: Second stage tarsoconjunctival flap—Division of conjunctival pedicle.

Indication

This is a __/__ (Age/gender) with a history of lower eyelid basal cell carcinoma. The patient previously underwent excision and then first stage reconstruction with tarsoconjunctival flap. The flap remains in place with the conjunctival bridge connecting the upper and lower eyelids. The patient now presents for second stage reconstruction with division of this conjunctival bridge. Risks, benefits, and alternatives are explained to the patient in detail and he/she understands and agrees to the procedure.

Description of the Procedure

The patient was brought to the procedure room and positioned in the supine position. The patient was prepped and draped in the usual sterile fashion. Time-out was completed amongst office procedure staff verifying the patient's identity, procedure, consent, operative side and site. The upper and lower eyelid operative sites were anesthetized through local infiltration of 2 % lidocaine with epinephrine. A drop of proparacaine 0.5 % was instilled on the ocular surface.

A grooved director was placed underneath the eyelids. One blade of the Westcott scissor was then passed along the grooved director, placing this blade posterior to the pedicle of conjunctiva connecting the upper and lower eyelids. The flap was divided along its horizontal axis slightly above (1 mm) the anticipated lower lid margin. The upper eyelid was then everted and excess bulky tissue from the flap was trimmed using Westcott scissors.

All instrument, sponge, and needle counts were correct. The patient tolerated the procedure well. There were no intraoperative complications. The patient was then transported to the post-anesthesia care unit in stable condition.

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Bilobed Flap for Nasal Reconstruction

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Adam M. Feintisch, Aditya Sood, and Mark Granick

Indications

1. Repair of circular defects on the caudal third of the nose, particularly the tip and dorsum.
2. Ideal for defects less than 1.5 cm in maximum dimension and 0.5 cm above the nostril margin.
3. Defects of the cephalic half of the nose 0.5 cm or less in size.

Essential Steps

Preoperative Markings

1. Mark the lesion to be excised or defect to be reconstructed, noting proper laterality.

Intraoperative Details

1. Placed in supine position.
2. General anesthesia or Monitored Anesthesia Care.
3. Cleanse area—avoid skin preps caustic to eyes (i.e., Chlorhexidine, undiluted Betadine).
4. Protect eyes with lubricating ointment, semi-permeable dressing, or protective shields.
5. Mark out bilobed nasal flap:
   (a) Design lobes in areas of greatest skin laxity or in areas where scar camouflage will be maximized. Base typically oriented laterally.
   (b) With defect diameter being d, radius of defect is measured at $\frac{1}{2}d$
   (c) For laterally based flaps, pivot point is marked in the alar groove at a distance $\frac{1}{2}d$ from the defect border.
   (d) Two arcs are drawn: The first makes a tangent with the border of the distal most point of the defect and the second arc passes through the center of the defect.
   (e) The bases of the two lobes are designed to rest on the lesser arc. The linear axes through the center of each lobe are positioned approximately 45° from each other.
   (f) The height of the first lobe extends to the greater arc, its width equal to or slightly less than the size of the defect.

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(g) The width of the second lobe is the same or slightly less than the width of the first lobe. Its height is 1.5–2 times greater than the height of the first lobe.
(h) Total pivotal movement between defect and second lobe should be 90°–100°.

6. Infiltrate nasal area with local anesthetic plus 1:100,000 epinephrine. Avoid use of epinephrine at base of flap where vascular supply enters.
7. Incise the skin and subcutaneous tissue down through the nasal muscles.
8. Excise the triangle-shaped peninsula of skin located at the base of the defect.
9. Dissect in the tissue plane between the nasal muscles and underlying perichondrium and periosteum.
10. Perform wide undermining in all directions, as far laterally as the cheek, in order to reduce wound closure tension, facilitate flap transfer, and minimize trap-door deformity.
11. Excise any standing cutaneous deformities.
12. Fixate the flaps under zero tension. Close the donor site of the second lobe first via primary closure of the muscle layer.
13. Transpose first lobe into nasal defect and secure with a few deep dermal sutures.
14. Transpose the second lobe and trim excess tissue so flap fits precisely without redundancy into the first lobe donor site.
15. Approximate skin incisions with 5-0 nylon, prolene or fast-gut sutures in a vertical mattress, simple or running fashion.

Postoperative Care

1. Keep head elevated ≥45°.
2. Control blood pressure and pain.
3. Patient can take down dressing and shower in 48 h with gentle cleanser.
4. Apply antibiotic ointment of choice once or twice daily for no more than 1 week.
5. Follow-up and remove permanent sutures on POD#5-7 in an office setting.
6. Dermabrasion 6 weeks after flap transfer may be necessary.

Possible Complications

1. Partial or complete flap necrosis.
2. Scarring.
3. Standing cone, pincushion effect, or trap-door deformity.

Operative Dictation

Diagnosis:

1. Basal cell carcinoma of the nose.
2. Complicated, open wound of the nose, left lateral tip.

Procedure: Bilobed nasal flap reconstruction for nasal tip defect

Indications

This is a _____ year-old _____ who underwent Mohs surgery at the Dermatology Office __ days ago and presented with a __cm × __cm defect of the right/left nasal sidewall/tip. The plan today is to debride the wound and then elevate and transpose an adjacent skin flap. All relevant benefits, risks, alternatives, and complications were explained to the patient, including the possibility of scarring, flap loss, and reoperation. The patient understands and accepts these benefits, risks, alternatives, and potential complications, and wishes to proceed with the operation. Informed consent is obtained.

Description of the Procedure

The patient's identity was verified. He/she was brought into the operating room and placed into the supine position on the operating table. Sequential compression devices were placed to the lower extremities, bilaterally. Time out was performed by all operating room staff. Anesthesia was induced by the anesthesia team. The surgical area was infiltrated with Marcaine 0.25% with 1:100,000 epinephrine. The face was prepped with dilute Betadine and draped in the standard,

sterile fashion. The eyes were covered with sterile OpSite for protection. The nose was then examined and the skin evaluated. A laterally based bilobed flap was then marked and an incision was made down to the nasal cartilage and nasalis muscle. The flap was then elevated at the level below the nasal musculature, with careful attention to preserve the dermal plexus and sucutaneous adipose tissue. Wide undermining in the submuscular plane over the perichondrium and periosteum was performed. Once elevated, the flap was transposed into the defect. It was tailored to fit the defect precisely and no dog-ear was evident. The flap was inset with buried 4-0 vicryl and running 5-0 nylon sutures. A dressing consisting of bacitracin, Telfa, and paper tape were applied. There were no complications. The patient tolerated the procedure well, was extubated and transferred to the PACU in stable condition. All instrument and lap counts were accounted for and correct at the end of the procedure.

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Two-Stage Interpolated Nasolabial Island Flap and Conchal Cartilage Graft

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Tom Reisler and Mark Granick

Indications

1. Reconstruct a composite nasal alar defect involving skin and cartilage only, and spared nasal mucosa. Defect is greater than 50 % of the nasal alar subunit.

Essential Steps

Preoperative Markings

1. Mark all 9 aesthetic subunits of the nose, paying particular attention to the nasal alar lobule subunit which is to be reconstructed.
2. An exact template of the alar unit is made from the contralateral normal side with a malleable material such as suture foil.
3. Reverse over the alar template to the defect alar side as a mirror image in order to delineate and mark the exact alar subunit.
4. The fashioned foil template of the new ala is rotated 90° and placed on the ipsilateral nasolabial fold so that the center of the flap is centered just lateral and superior to the level of the lateral oral commissure. The template is positioned so that the lower border of the flap lies exactly at the deepest point of the nasolabial fold.
5. The flap is designed to pivot 90° towards the midline in a clockwise direction when harvested from the left cheek and counterclockwise when harvested from the right cheek.
6. A tracing is made around the template. Triangles of skin are marked superiorly and inferiorly to the tracing in order to fashion a crescent-shape island of skin. The size of the superior skin triangle is minimized as much as possible.
7. Using a marking pen, mark the desired upper limit, i.e., the width of the ear graft, on the anterior surface of the concha. Pass a 30-gauge needle through the anterior surface of the concha along the marking. Using methylene blue, touch the needle tip prior pulling it out in order to tattoo the cartilage. This will guide the margin of resection.
8. Mark a 4 cm horizontal line on the posterior conchal skin in order to access the ear cartilage graft.

Intraoperative Details

1. General anesthesia or Monitor Anesthesia Care.
2. Placed in supine position.

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3. Prep and drape the patient's head, neck, and ears in the usual sterile fashion using betadine.
4. The flap is designed as a two-staged procedure.
5. A second stage of flap division is performed at 3 weeks.
6. Harvest ear cartilage from the more prominent ear. Bolster dressing applied at the donor site.
7. Excise the remainder of the nasal alar subunit skin except for a rip of 1 mm of alar skin just anterior to the alar facial sulcus, preserving the alar facial sulcus.
8. Ipsilateral superiorly based nasolabial island flap is raised.
9. The flap is elevated distally in a subcutaneous plane and as one approaches the nasal base, the dissection deepens down towards the facial muscles.
10. Cheek donor defect is closed.
11. The ear cartilage graft, which spans the entire defect length, is sewn in place.
12. The island flap is inset over the cartilage graft.
13. Pedicle division after 3 weeks.
14. Further thinning and insetting the skin flap. Less aggressive sculpturing of subcutaneous fat is recommended for patients who use tobacco products.

Postoperative Care

1. Pain control
2. 45° head of bed elevation
3. Wound check in 5 days and removal of sutures
4. Dressing change every 2 days after initial wound check: bacitracin, Xeroform, telfa, tape

Possible Complications

1. Prolonged edema
2. Facial nerve damage to zygomatic major and minor muscles
3. In male, transfer of hair-bearing skin to the nose
4. Hyperpigmentation of the flap
5. Vascular complications and infections in smokers or patients who have undergone previous radiotherapy
6. Ear deformity or unfavorable scaring

Operative Dictation

Diagnosis: Subtotal nasal ala Mohs defect with intact lining comprising more than 50 % of the alar aesthetic subunit
Procedure: Interpolated nasolabial island flap and conchal cartilage graft

Indication

This is a _____ with a nasal alar defect. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After informed consent was verified, the patient was taken to the operating room and placed in supine position. Care was taken to pad all pressure points properly. Time out was performed. Sequential compression devices were placed on the legs. General laryngeal mask anesthesia was initiated. Warming devices were placed on the trunk and lower extremities. Preoperative intravenous antibiotic was administered. Dressings were removed from the nose, revealing the defect as noted above. The patient was prepped and draped with Betadine in standard sterile surgical fashion.

The wound was inspected and irrigated. Once the nasal and flap markings were complete, the nasal alar subunit was infiltrated with 0.25 % Marcaine with 1:100,000 epinephrine. The same infiltration was used to inject the surrounding tissue pointing away from the nasolabial flap and its blood supply.

At this point, attention was turned to the ear with its makings. Approximately 5 mL of 0.25 % Marcaine with 1:100,000 epinephrine was infiltrated into the concha on its anterior and posterior surfaces, facilitating the dissection.

A #15 scalpel was used to incise along the posterior conchal skin and a Freer elevator was utilized to lift the soft tissues off the posterior aspect of the conchal cartilage in a submucoperichondrial plane. Then an appropriate size of cartilage graft was harvested. The grafts dimension was made slightly smaller than the overlying nasal alar skin defect. The graft was placed aside in a saline gauze. Hemostasis was obtained with bipolar electrocautery. Bovie electrocautery was also employed as needed. Two layers closure was performed with 3-0 monocryl in the deep dermis and 4-0 monocryl subcuticular suture. A petrolatum gauze bolster was placed both anterior and posterior to the conchal defect and placed in a sandwich dressing using a 2-0 Prolene suture. Antibiotic ointment was applied generously. Leaving the bluster on for few days will help to ensure hemostasis, as well as even distribution of loose conchal skin.

Next, the entire skin envelope of the nasal alar lobule aesthetic subunit was excised, except for 1 mm of alar skin just anterior to the alar facial sulcus. The resected skin was sent for pathologic evaluation to look for residual skin cancer despite previous Mohs resection.

Using a fresh #15 scalpel, the proposed flap template was incised and the distal third of the flap was elevated in the subcutaneous tissue plane, leaving 1–2 mm of subcutaneous fat attached to the undersurface. As the dissection proceeded superiorly, the plane extended deeper to facilitate development of the subcutaneous tissue pedicle. The deep dissection continued perpendicular to the skin surface down to the level of the superficial surface of the zygomatic major and levator labii muscles. On reaching the zygomatic major muscle, blunt dissection continued upwards on the surface of the muscle, releasing the attachments of the pedicle to deeper structures until the flap could reach the recipient site without tension. Donor defect was closed by undermining in the superficial subcutaneous plane superiorly and laterally only, extended to the cheek to create enough laxity for closure without creating upper lip distortion. No undermining was done inferiorly into the skin of the upper lip. A layered closure with 3-0 monocryl deep dermal sutures and a continuous simple cutaneous 6-0 nylon suture was performed. Superiorly, a small wound was left open for the subcutaneous pedicle to exit.

At this point, the auricular cartilage graft was sculpted and positioned to span the defect of the nostril margin. It was secured in place with through-and-through tapered needle of 5-0 PDS or Vicryl sutures and tied to the inside of the nasal vestibule with knots placed in the nasal lumen.

The nasolabial flap was turned towards the midline. After checking that the flap will reach, the excess skin from the distal end of the flap was excised. The flap was slightly thinned in order to fit the normal couture of the alar and sutured to the nasal skin with interrupted cutaneous 6-0 nylon sutures. The inferior border of the flap was sutured to the vestibular skin with a continuous absorbable 5-0 suture.

Second Stage

The nasolabial flap was divided 3 weeks following transfer, enabling the establishment of collateral vascularity. The pedicle was transected at the base and the cheek skin was undermined peripherally. The skin edges were refreshed with a scalpel and the cheek wound was closed primarily using the same method described in closing the donor site in the first-staged operation.

The lateral portion of the flap attached to the nose was released from the adjacent nasal skin for a distance of 0.5–1.0 cm to achieve sufficient freedom to unfurrow the flap. Release enabled debulking the subcutaneous fat, which was not trimmed at the time of flap transfer. The flap was precisely trimmed to fit the skin defect and was carefully elevated over 80 % of its maximum length, thinned, and inset. Great care was taken to evert the skin edges. The flap was sutured in place with simple interrupted 5-0 nylon cutaneous sutures.

Paramedian Forehead Flap

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Husain T. AlQattan and Seth R. Thaller

Indications

1. Nasal defects greater than 2 cm in length
2. Excellent for tip, dorsum, subtotal or total nasal reconstruction

Essential Steps

Stage One of a Paramedian Forehead Flap for Nasal Reconstruction

Preoperative Markings

1. Midline of the scalp is marked from the hairline down to the nasal bridge.
2. Supratrochlear artery's course from the medial brow going superiorly is marked with the aid of a Doppler ultrasound or by anatomical landmarks (1.7–2.2 cm from the midline on either side).
3. Nasal subunits are marked to help guide need for defect modification to enhance donor fit and optimize final aesthetic result. If more than 50 % of a nasal subunit had been removed then excising the remaining portion may give a better final aesthetic result.
4. An exact template of the defect is made using a suitable material (e.g., foil from a suture pack). This permits a 3-dimensional representation of flap design to ensure adequate dimensions. Distal end of the template lies over the defect whilst the proximal part is centered on the axis of the supratrochlear artery. Template is placed over the ipsilateral supratrochlear artery if the defect is unilateral. However, if the defect is in the midline or covers most of the nose, then either vessel is suitable. Template is rotated 180° superiorly to lie directly vertical and above the pedicle, at the hairline. Then using this template the flap is now outlined on the skin.

Intraoperative Details

1. Patient is in the supine position.
2. General anesthesia with endotracheal tube.
3. Scalp, face, and neck are prepped and draped to permit access to the nose and ears in case conchal cartilage grafts are needed.
4. Skin incision over the template is made on the inside of the ink mark to avoid including excess skin in the flap. Pedicle width is 1–1.5 cm to ease arc of rotation.

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5. Distal third of flap dissection is carried into the subcutaneous plane using electrocautery and/or sharp dissection.
6. Once the area where the template will cover the nasal defect is elevated, the dissection progresses through the muscle and into a subgaleal plane. Dissection in this plane is continued until corrugator supercilii muscle is identified.
7. At this point the dissection goes deeper into a subperiosteal plane to protect the vascular pedicle.
8. Dissection is performed inferiorly up to 1.5 cm into the root of the nose to enable a tension free arc of rotation.
9. Donor site is closed by wide undermining in a subgaleal plane followed by primary closure in layers. Ensure the pedicle is not constricted with the closure. Any open wound is allowed to heal by 2nd intention, cover the area with petroleum gauze and remove after 10 days.
10. At the columella inset and alar rims the forehead flap can be thinned if desired (avoid in smokers). Tacking sutures are placed to hold the distal end of the flap in place. Avoid tension or blanching.

Postoperative Care

1. Overnight stay for pain control and observation.
2. Non-adherent absorbent dressings are loosely placed around the pedicle and incision to collect any drainage. These are removed after 48 h and the patient is permitted to shower.
3. Fine nonabsorbable skin sutures are removed on postoperative day 5–7. Tension bearing nonabsorbable sutures are removed on day 10. Any petroleum gauze is also removed on day 10.
4. Oral antibiotic is administered prophylactically.

Possible Complications

1. Complete flap necrosis is rare but can occur. Mostly encountered in smokers and at the random transverse limb of the flap if too aggressive thinning is undertaken. Thus, consider a 3-stage operation in these patients with a separate intermediary stage for thinning rather than at the initial operation. In certain instances, delay of the flap might be considered.
2. Wound infection.
3. Scarring (hypertrophic or keloids).

Intermediate Stage of a Paramedian Forehead Flap for Nasal Reconstruction (Optional)

1. Intermediary stage is carried out 3 weeks after the initial operation under general anesthesia.
2. Nasal subunits are marked.
3. Forehead flap is elevated along its edges with sharp dissection except at the columella. This creates a bipedicled flap.
4. Underlying soft tissue is excised then sculpted to create the desired nasal shape.
5. Place the forehead flap on the recipient bed with quilting and simple interrupted skin sutures.

Intermediate stage of the procedure is usually completed at the initial operation in patients with no history of smoking or other comorbidities that may compromise flap viability. However, in those at risk of flap necrosis, then the intermediate stage is done as a separate procedure for thinning and sculpting of the flap.

Stage Two of a Paramedian Forehead Flap for Nasal Reconstruction

1. Completed under general anesthesia as local anesthesia can lead to tissue distortion and affect aesthetic outcome. Pedicle is marked and divided 3 weeks after the first stage of the reconstruction.
2. Proximal flap is thinned with excision of any scar tissue, frontalis, or excess fat.
3. Proximal flap is inset into a small inverted V defect at the medial end of the eyebrow.
4. Distal flap is elevated and thinned with excision of any scar, frontalis, or excess fat until it matches in thickness the nasal skin. Edges are shaped according to the nasal subunits.

5. Recipient bed is sculpted to provide desired contour.
6. Distal flap is inset with quilting and interrupted nylon skin sutures.

Postoperative Care

1. Quilting sutures are removed at 24 h.
2. Any pressure on the flap (e.g., eyeglasses) is avoided for 2 weeks.
3. Fine nonabsorbable skin sutures are removed on postoperative days 5–7.
4. Oral antibiotic is used prophylactically.

Operative Dictation

First Stage Operative Note

Diagnosis: Nasal basal cell carcinoma status post Moh's excision.

Procedure: Paramedian forehead flap for nasal reconstruction.

Indication

This is a _____ with a locally aggressive basal cell carcinoma involving the tip of the nose, status post Moh's excision that wishes to undergo nasal reconstruction. Benefits, risks, and alternatives of the procedure were discussed, patient understands and wishes to proceed.

Description of the Procedure

Consent was verified in the preoperative area. Patient was then brought to the operating suite, placed in the supine position, and underwent general endotracheal intubation. Endotracheal tube was taped inferiorly towards the patient's chest and out of the operative field. IV antibiotics were administered and a time out performed. Scalp, face, and neck were then prepped and draped in the usual sterile fashion. A Moh's excision of the basal cell carcinoma was performed by the Dermatology service; please see their separate operative note for details on that portion of the procedure. Following this, the reconstructive portion of the surgery started. Midline, nasal subunits and template of the defect over the scalp were marked. Supratrochlear artery's course was identified by Doppler and also marked. Skin was incised on the inside of the outline to elevate the flap. Distal third of the flap was then elevated in the subcutaneous plane, of approximately 15–20 mm thickness, using electrocautery and sharp dissection. Once the distal 1.5 cm was elevated, the dissection was taken down into the subgaleal plane thus including the frontalis with the flap. This continued to the level of the eyebrow. Inferior to this, the corrugator supercilii was also elevated and the dissection proceeded into the subperiosteal plane using a periosteal elevator with a raytec at its tip, to protect the vascular pedicle. Once sufficient length was obtained to allow rotation of the flap into the defect without tension, 6-0 nylon sutures were placed to tack the flap to the nasal defect. Donor site was then widely undermined in the subgaleal plane to assist with primary closure. Forehead was approximated with multiple 4-0 nylon sutures. Remainder of the donor site was closed in layers: 4-0 vicryl for frontalis, 5-0 deep monocryl, and 6-0 simple interrupted nylon sutures for the skin. Any open wounds of the donor site were covered with petroleum gauze. Attention was then directed to the insetting of the flap. Flap was closely examined against the nasal skin and the distal portion at the columella and along the alar rim thinned to about 2–3 mm to better fit the defect. Interrupted 6-0 nylon sutures are used to position the flap into the nasal defect. If any blanching or tension occurs then the flap is sutured to the nasal defect only at the columella inset and along the alar rim. Exposed posterior surface of the forehead pedicle was then dressed with petroleum gauze and antibiotic ointment applied to the wound edges. All instruments, sponge, and needle counts were correct. Procedure was completed with no intraoperative complications. Patient was then transferred to the post-anesthesia care unit in stable condition.

Second Stage Operative Note

Diagnosis: Nasal basal cell carcinoma status post Moh's resection and first stage reconstruction with a paramedian forehead flap.

Procedure: Second stage paramedian forehead flap for nasal reconstruction, division of the pedicle.

Description of the Procedure

Consent was verified in the preoperative area. Patient was then brought to the operating suite, placed in the supine position, and underwent general endotracheal intubation. IV antibiotics were administered and a time out performed. Scalp, face, and neck were then prepped and draped in the usual sterile fashion. Pedicle was then marked and divided. Proximal flap was unrolled and debulked to better fit the inverted V defect at the medial eyebrow. Proximal flap was then inset into the defect. We then turned our attention to the distal flap attached at the nose. This was elevated and thinned of excess scar, frontalis, and fat to match the thickness of nasal skin. Recipient nasal bed and flap was sculpted until a satisfactory nasal contour was achieved. Excess skin was trimmed and the flap was inset with quilting sutures to eliminate dead space followed by 6-0 interrupted nylon skin sutures. Antibiotic ointment was applied to the wound edges. All instruments, sponge, and needle counts were correct. Procedure proceeded with no intraoperative complications. Patient was then transferred to the post-anesthesia care unit in stable condition.

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Antia-Buch Procedure (Chondrocutaneous Advancement Flap)

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Husain T. AlQattan and Seth R. Thaller

Indication

1. Reconstruction of full thickness helical rim defects up to 3 cm in diameter or less, which involve the upper or middle third of the helix.

Essential Steps

Preoperative Markings

1. Mark the helical sulcus, starting at the root of the helix and continuing inferiorly towards the ear lobule.

Intraoperative Details

1. Patient is placed in the supine position.
2. Local anesthesia with sedation or general anesthesia with endotracheal intubation.
3. Patient's head is placed on a horseshoe headrest and turned away from the operating surgeon to give full access to the ear.
4. Prep both ears, hair, and scalp.
5. Incise the anterior skin and cartilage at the helical sulcus starting at the root of the helix and proceed around and inferiorly into the soft tissue of the lobule. Ensure the posterior skin remains intact. This frees the entire helix from the scapha. This maneuver is essential to provide the required mobility for rotation.
6. Posteromedial auricular skin is undermined ensuring the perichondrium is left down. Dissection is taken down to the auriculocephalic sulcus.
7. Helix is rotated superiorly into the defect based on a posterior skin flap. (Only the caudal chondrocutaneous flap needs to be advanced in small-moderate sized defects.)
8. Larger defects of the helix will also need mobilization of the cephalic chondrocutaneous component. Cephalic portion is lifted on a preauricular skin flap and rotated backwards into the defect in a V-Y fashion.
9. A small amount of scaphal cartilage may need to be excised to further ease rotation of the flap and reduce tension.
10. Any redundant skin/Burow's triangle at the caudal flap can be excised as it is rotated into the defect.
11. Chondrocutaneous flaps are then sutured in layers without tension.

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12. Secondary defect at the helical root is closed in a V-Y fashion.
13. Resultant ear will lose some height and appear smaller than the contralateral ear. Wedge excision of the contralateral ear with or without setback (if prominence is present) will correct the discrepancy if noticeable.

Postoperative Care

1. Daily monitoring to check for viability, infection, and venous engorgement. Each may require a separate intervention ranging from topical nitroglycerin to revisional surgeries.
2. Avoid any contact sports for at least 6 weeks to avoid additional trauma to the reconstructed auricle.
3. Remove fine nonabsorbable sutures on postoperative day 4 in the office.
4. Cephalexin (or in those who are penicillin allergic, clindamycin) is used prophylactically.

Possible Complications

1. Wound infection (ranging from cellulitis to chondritis).
2. Scarring (hypertrophic or keloids).
3. Hematoma.
4. Suture extrusion.

Operative Dictation

Diagnosis: Squamous cell carcinoma of the left ear status post excision.
Procedure: Antia-Buch chondrocutaneous advancement flap for left ear reconstruction.

Indication

This is a _____ with a squamous cell carcinoma involving the upper third of the left ear. She/he has undergone excision and wishes to undergo immediate ear reconstruction. Benefits, risks, and alternatives of the procedure are discussed, patient understands and wishes to proceed.

Description of the Procedure

Consent was verified in the preoperative area. Patient was then brought to the operating suite, placed in the supine position, and underwent local infiltration anesthesia with sedation. IV antibiotics were administered and a time out performed. Scalp, face, and neck were then prepped and draped in the usual sterile fashion. The squamous cell carcinoma underwent Mohs surgical excision by the Dermatology service; please see their separate operative note for details on that portion of the procedure. Following this, the reconstructive portion of the surgery was initiated. Helical sulcus was marked from the root towards the lobule. Skin was incised at the root of the helical sulcus. This was carried down through the anterior auricular skin and cartilage without disrupting the posterior auricular skin. Posterior auricular skin was then undermined with sharp dissection in a plane above the perichondrium. This was extended towards the auriculocephalic sulcus. We continued with this meticulous dissection until the entire helix was freed from the scapha and both helical remnants were designed as composite flaps. Caudal and cephalic chondrocutaneous flaps were then advanced into the defect along the curve of the scapha with the helical margins closely approximated. Closure was accomplished in layers without tension. Secondary defect at the helical root was closed in a V-Y fashion. Antibiotic ointment was applied to the wound edges followed by a bolster dressing. All instruments, sponge, and needle counts were correct. There were no intraoperative complications. Patient was then transferred to the post-anesthesia care unit in stable condition.

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Postauricular Flap

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Husain T. AlQattan and Seth R. Thaller

Indication

1. Medium to large defects of the middle third of the helix and/or antihelix with minimal or no cartilage loss.

Essential Steps

Stage One of a Postauricular Flap

Preoperative Markings

1. A template of the helical defect is made using a suitable material (e.g., foil). This template is then placed and marked behind the ear with its anterior most edge towards the auriculocephalic sulcus and its base towards the hairline.
2. Of note, flap width is the same as width of the defect. However, length should be made at least 2 mm longer than the defect and up to 4 mm longer if it will be rolled up to allow a 3-dimensional reconstruction of the helical rim.

Intraoperative Details

1. Patient is in the supine position.
2. Under sedation and local infiltration of 2% lidocaine with 1:100,000 epinephrine.
3. Patient's head is placed on a horseshoe headrest and turned away from the operating surgeon to give full access to the ear.
4. Prep both ears, hair, and scalp.
5. Incise the skin starting at the defects border (posterior ear skin) and continuing onto the retroauricular and mastoid skin towards the hairline along the outline of the template.
6. Flap is elevated deep to the subcutaneous plane using sharp and blunt dissection. This maintains a thick pedicle with branches of the postauricular artery. Surrounding tissue is also undermined for 1–2 cm to facilitate ease of flap advancement.
7. Flap is now advanced over the defect ensuring that the anterior most part of the defect is covered with no tension on the flap. Temporary tension relieving sutures can be placed to anchor the pinna to the mastoid.

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8. Any redundant skin/Burow's triangles at the base of the subcutaneous pedicle are marked and excised.
9. Interrupted absorbable sutures are placed to hold the flap in place.
10. Fine nonabsorbable skin sutures are placed for precise alignment of skin edges.

Postoperative Care

1. A non-adherent dressing is loosely applied to the exposed base of the pedicle followed by an absorbent dressing over the wound. These are changed on a weekly basis in clinic until the second stage of the procedure.
2. Fine nonabsorbable skin sutures are removed on postoperative day 5–7 and tension bearing nonabsorbable sutures are removed on day 10.
3. Patients are followed up weekly until the second stage of the procedure at 3 weeks.
4. Oral antibiotic is prescribed prophylactically.

Possible Complications

1. Wound infection (ranging from cellulitis to chondritis).
2. Scarring (hypertrophic or keloids).
3. Hematoma.
4. Flap necrosis (extremely uncommon due to the rich vascular supply from the postauricular, superficial temporal and occipital arteries).

Stage Two: Dividing and Insetting the Flap

1. Completed at 3 weeks from the initial operation to allow adequate collateral revascularization of the flap.
2. Under local anesthesia with sedation using 2% lidocaine with 1:100,000 epinephrine.
3. Flap is divided at its base ensuring adequate length is present to cover the posterior portion of the defect.
4. Recipient bed is debrided and the flap thinned for an exact fit to recreate the auriculocephalic sulcus.
5. Flap is inset and sutured in place with fine nonabsorbable interrupted skin sutures for precise approximation.
6. Donor defect is resurfaced with a full thickness skin graft.

Postoperative Care

1. A non-adherent absorbent dressing is applied. The patient is advised to remove it in 24–48 h, gently clean the area with soap and water, and change daily.
2. Fine nonabsorbable skin sutures are removed on day 5–7 at the next follow-up clinic.
3. Cephalexin (or in those who are penicillin allergic, clindamycin) is used prophylactically.
4. Patients are then seen at 4–6 weeks to evaluate need for any revisional procedures.

Operative Dictation

First Stage Operative Note

Diagnosis: Basal cell carcinoma of the left ear status post excision.

Procedure: First stage postauricular advancement flap for left ear reconstruction.

Indication

This is a _____ with a basal cell carcinoma involving the middle third of the left ear helix. She/he has undergone excision and wishes to undergo immediate ear reconstruction. Benefits, risks, and alternatives of the procedure are discussed, patient understands and wishes to proceed.

Description of the Procedure

Consent was verified in the preoperative area. Patient was then brought to the operating suite and placed in the supine position. Scalp, face, and neck were prepped and draped in the usual sterile fashion. IV antibiotics and sedation were administered and a time out performed. Ear was anesthetized with infiltration of 2% lidocaine with 1:100,000 epinephrine. A Moh's excision of

the tumor was performed by the Dermatology service; please see their separate operative note for details on that portion of the procedure. Following this, the reconstructive portion of the surgery was initiated. Using a foil as a template, we marked the size of the helical defect onto the retroauricular skin to outline our flap. Base of this flap will lie towards the hairline. Surgeon's goal is to maintain equal width of skin to the defect but up to 4 mm longer in flap length to avoid any tension on advancement. An incision was then made using a #15 scalpel in the outline starting at the defect edge on the posterior ear skin and moving posteroinferiorly towards the hairline. Flap was elevated using sharp and blunt dissection ensuring a plane deep to the subcutaneous tissue to maintain adequate vascularity of the flap. Tissue surrounding the flap was undermined with sharp dissection in all directions for 1–2 cm to ease advancement of the flap. Flap was then advanced into the defect with placement of 4-0 prolene sutures fixing the pinna to the mastoid to again relieve any tension on the flap. Burow's triangles at the base of the pedicle were marked and excised. Adequate hemostasis was achieved with electrocautery. Simple interrupted 5-0 vicryl sutures were placed in the subcutaneous tissue to inset the flap; this was followed with simple interrupted 6-0 prolene to precisely align the skin edges. Exposed base of the pedicle was then dressed with non-adherent and absorbent dressing. Antibiotic ointment was then applied to the wound edges. All instruments, sponge, and needle counts were correct. There were no intraoperative complications. Patient was then transferred to the post-anesthesia care unit in stable condition.

Second Stage Operative Note

Diagnosis: Basal cell carcinoma of the left ear status post excision and first stage reconstruction.

Procedure: Second stage postauricular advancement flap for left ear reconstruction, division of the pedicle.

Description of the Procedure

Consent was verified in the preoperative area. Patient was then brought to the operating suite and placed in the supine position. Scalp, face, and neck were prepped and draped in the usual sterile fashion. IV antibiotics and sedation were administered and a time out performed. We then anesthetized the ear with infiltration of 2% lidocaine with 1:100,000 epinephrine. This was injected into the subcutaneous tissue circumferentially around the auricle. Special attention was given to the auriculocephalic sulcus, area anterior to the tragus and the posterior part of the external auditory meatus to block the greater auricular nerve, auriculotemporal nerve and sensory branches of cranial nerve VII and X, respectively. Flap was divided at its base, this is to ensure adequate flap length to cover the posterior portion of the defect. We then trimmed and thinned the flap to precisely match the defect. Recipient bed was debrided followed by insetting the flap with attention given to replicate the natural contour of the posterior ear. Interrupted simple 6-0 prolene was then used to fix the flap in place. Remnant base of the pedicle is then undermined for 1–2 cm and advanced to repair the donor site. Non-adherent dressing was applied to any open areas. These were left to heal by secondary intention. Antibiotic ointment was then applied to the wound edges followed by a bolster dressing. All instruments, sponge, and needle counts were correct. Procedure was completed without any intraoperative complications. The patient was then transferred to the post-anesthesia care unit in stable condition.

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Facial Nerve Repair in Acute Facial Nerve Injury

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Salim C. Saba and Shai Rozen

Indications

Primary Neurorrhaphy

1. Sharp laceration to the face.
2. Repair within 72 h of the acute injury.
3. Repair after 72 h as long as a distal stump is identified and clear anatomic correlation is seen between proximal and distal stumps.
4. Subacute or late (up to 18 months following injury) repair of facial nerve trunk or any of its major branches provided the distal stump is identifiable and electromyographic studies demonstrate end-plate potentials (EPP).

Repair with Nerve Graft

1. Inability to achieve a tension-free repair of the affected nerve ends following acute injury
2. Late repairs requiring grafts for cross facial nerve donor sites

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Contraindications

1. Life-threatening injuries
2. Blast and other injuries with significant soft tissue destruction that precludes the presence of clean, easily identifiable nerve stumps
3. Self-imposed injuries in patients with serious psychiatric conditions

Essential Steps

Preoperative Considerations

1. Carefully examine the injured, awake patient prior to administration of local anesthesia
2. Examine facial tonicity on the injured side
3. Evaluate blink reflex and forceful voluntary eye closing
4. Examine other voluntary mimetic muscle groups, e.g., eyebrow and eyelid movement, smile, lip closing, lower lip depression, and platysmal tensioning
5. Consider associated injuries to the facial skeleton and the parotid ductal system
6. Extend lacerations just enough to provide adequate exposure of the structures to be repaired, and if possible, respect facial aesthetic subunits
7. Consider delaying repair in facial wounds with significant soft tissue damage, however an attempt should be made to tag nerve ends in anticipation of delayed repair

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8. Nerve stimulation for identification of distal nerve stumps is useful within the first 72 h after initial injury
9. Note that facial nerve branches distal to their exit from the parotid gland course just deep the Superficial Musculo-Aponeurotic System and parotid-masseteric fascia layers and enter the midface mimetic facial muscles on their deep surface

Preoperative Markings

1. Side of paralysis is always important to mark. Often identifying the palsied side is very difficult under general anesthesia especially if preoperative photos are not available in the OR. This will help prevent avoidable mistakes. (It is highly recommended to bring the pre-op photos to the OR.)
2. Depending on the location of injury, a preauricular incision or an incision through the wound is performed.

Harvest of Nerve Grafts

1. Greater Auricular Nerve: A line running along the mid-portion of the Sternocleidomastoid is drawn starting 3 cm inferior to the earlobe and extending approximately 5 cm caudally.
2. Sural Nerve: Identified distally 2 cm posterior and 2–3 cm proximal to the lateral malleolus. Several incision options are available. A longitudinal incision is made and the nerve is in proximity to the lesser saphenous vein. Alternatively, stair-stepping the incision avoids a continuous pattern and can be done by pulling gently on the distal nerve in order to determine subsequent proximal cuts. Up to 25–30 cm may be harvested and used as cable graft. Another option is sural nerve harvest via two incisions. A proximal incision is made between the heads of the gastrocnemius muscle, and a distal incision is made as previously described. A nerve harvester is placed around the nerve proximally and carefully slid caudally. If resistance is met, a small incision is performed at the area of resistance in order to safely dissect under direct visualization possible nerve branching, namely at the convergence of the lateral sural nerve into the common sural nerve. The advantage of this approach is minimal incisions, but potential draw back is either injury to the nerve or cutting the lateral sural nerve contribution resulting in significant shortening of effective nerve especially when the nerve could be used for more than one graft. Endoscopic harvest has been described, possibly offering the best of both worlds.
3. Medial Antebrachial Cutaneous Nerve: Identify the Basilic Vein in the proximal aspect of the medial forearm. The anterior division of the MABC is anterior, while the posterior division is posterior to the Basilic Vein. The anterior branch of the MABC is targeted for harvest as the posterior branch provides critical sensory input from the contact (dorso-ulnar) surface of the forearm.
4. Lateral Antebrachial Cutaneous Nerve: Identify the Cephalic Vein in the proximal aspect of the lateral forearm. The LABC is located in the close proximity to this vein. Note that the LABC and the Superficial Branch of the Radial Nerve may overlap sensory territories.

Intraoperative Details

1. 3.5× magnification surgical loupes or a microsurgical microscope will be required for nerve repair with microsurgical 10-0 to 11-0 caliber nylon suture.
2. Epineurial repairs suffice in general.
3. Foreseen tension in the nerve ends requires interpositional autografting.
4. Nerve regeneration occurs at 1 mm per day so expect a post-repair functional delay commensurate with the distance between the injury and the target muscle(s).
5. Consider cross-facial nerve grafting or other nerve transfers when a distal nerve stump is available in the setting of an absent proximal nerve stump and functional target muscles.

6. Meticulous nerve coaptation technique is very important for maximal axonal capture.
7. In injuries of intermediate or questionable chronicity, electromyography may be used to determine target muscle function by detecting end-plate potentials.

Possible Complications

1. Failure of repair
2. Sensory deficit from nerve graft donor site
3. Neuroma formation at nerve repair site or donor site

Operative Dictation

Diagnosis: Facial injury or laceration lateral to the lateral canthus associated with total/partial facial paralysis.

Procedure: Facial nerve exploration and primary repair (repair with interpositional graft when tension free repair is not possible).

Indication

This is a _____ patient who presents with an (sub)acute history of laceration in the preauricular area of the face with resultant loss of ipsilateral facial movement. The patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

Scenario A

Proximal and distal facial nerve branches are identified with a nerve gap enabling primary coaptation.

Indication: Sharp penetrating trauma resulting in facial paralysis.

Procedure: Exploration of facial nerve with primary neurorrhaphy.

Narrative

After the informed consent was obtained, the patient was taken to the operating room and placed in supine position. Sequential Compression Devices (SCD's) were applied and successful endotracheal intubation was performed with an oral RAE tube without taping. All pressure points were verified to be protected and the patient was prepped and draped in a sterile fashion. Time out was performed. Exploration of the laceration revealed a transection of the facial nerve stump proximal to its entry into the parotid gland. Hemostasis was achieved with bipolar electrocautery set at 8 and careful dissection of the proximal and distal ends of the nerve is performed under loupe magnification. Frayed ends of the transected nerve are sharply cut in a guillotine fashion until the ends appear crisp and healthy. Corresponding branches proximal and distal branches were identified anatomically or via nerve stimulation. Epineurial 10-0 nylon monofilament suture is used to coapt the ends. The wound was irrigated and closed in two layers (deep dermal and skin).

Scenario B

Proximal and distal facial nerve branches are identified with a nerve gap limiting primary coaptation and necessitating a nerve graft.

A nerve gap between the proximal and distal nerve endings could not be approximated and therefore a nerve graft was harvested, using the great auricular nerve on the ipsilateral side, performing a tension free coaptation of the nerve endings with a 10-0 nylon.

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Nerve Transfers in Facial Palsy

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Indications

1. Acute or subacute (up to 12 months—preferably 6) facial palsy when direct coaptation to proximal stump is or was not feasible.
2. Six to twelve months after intracranial or extracranial facial nerve reconstruction without evidence of motion.

Contraindications/Relative Contraindications

1. Distal facial nerve branches are not available for coaptation.
2. Absence of target mimetic muscle secondary to trauma or extirpation.
3. Disease process likely involving the full extent of the facial nerve branches.
4. Donor nerve palsy/involvement by tumor.
5. Long-standing facial paralysis

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Essential Steps

Preoperative Considerations

1. Accurate history of length of palsy prior to first encounter cannot be overemphasized. If the palsy is longer than 12 months (preferably six) other options should be considered since target mimetic muscle may not be salvageable to obtain motion.
2. Accurate previous operative reports are cardinal, especially if performed elsewhere. In cases of intracranial tumor extirpation it is important to assess intactness of the facial nerve after surgery, reconstructive efforts in cases of resection, or inability to reconstruct the facial nerve. In cases of extracranial trauma surgical details of attempted repairs are important.
3. Physical examination is of tremendous value:
   (a) In cases of trauma note location. More proximal injuries (lateral to the lateral canthus) tend to involve the nerve while more distal injuries (medial to the lateral canthus) tend to be combined muscle and nerve injuries. The more distal the injury the more the muscular component is important and emphasis should be on muscle repair.
   (b) At 6 months after palsy there is a significant difference between a patient

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showing increase in motion to a patient demonstrating no motion. The latter will likely benefit from nerve transfers at this point attempting to salvage neuromuscular units.

(c) Assess whether the facial paralysis involves the entire hemiface or selective branches. This may affect the selection of nerve transfers.

Preoperative Markings

1. In non-traumatic cases a preauricular incision is performed. In women a post-tragal course may be preferable while in men a pre-tragal course is preferred decreasing the chance to change sideburn location. If needed, extension of the inferior incision into a post-ramal (mandible) trajectory may improve exposure.
2. In cases of Trauma one may consider utilizing an existing traumatic wound especially in cases of distal muscle repair. A preauricular incision maybe utilized if a nerve transfer is planned allowing meticulous mapping of the nerve as necessary.

Intraoperative Details

1. Prior to intubation communicate with the anesthesia team regarding avoiding paralysis other than for induction.
2. We generally prefer a RAE tube without taping to the face. This can safely be used for long surgeries without concern for losing the airway, granted caution is taken by all members of the team.
3. The first cm of dissection is performed in a subcutaneous plane, the remainder in a sub-SMAS plane. If one is unsure of the plane one may dissect one layer deeper and identify parotid, then return to one layer more superficial above the parotid-masseteric fascia.
4. Depending on the clinical scenario and location of nerve injury careful dissection is performed identifying the facial nerve on the paralyzed side. In cases of intracranial injury, identification of the facial nerve branches and often pes-anserinus via retrograde parotid approach may be of benefit depending on the planned location of coaptation. In cases of more peripheral injury careful antegrade dissection is performed to identify the distal branches of the facial nerve that may be coapted to the donor nerve.
5. Mapping of facial nerve branches is critical, especially in cases when more than one nerve transfer is planned if differential facial innervation is desired, i.e., midface and periorbital or midface and depressors with two nerve transfers, for example, hypoglossal and masseter nerves.
6. Donor nerve dissection is beyond the scope of this text but the two most commonly used are the masseter and hypoglossal nerves.
7. Nerve coaptation should always be tension free and with minimal injury. Epineurial coaptation with 10-0 or 11-0 sutures under a microscope is our preferred choice. The use of biological glues is surgeon's choice.

Possible Complications

1. Failure to achieve motion secondary to:
   (a) Inaccurate history—excessively prolonged palsy resulting in absence of motor units to innervate.
   (b) Failure to identify facial nerve injury distal to placement of coaptation (trauma cases or facial nerve neuropathy, i.e., Bell's palsy, Ramsay Hunt).
   (c) Technical failure of coaptation.
   (d) Failure to identify paralysis of the donor nerve.
2. Inability to reach the recipient nerve with the donor nerve (rare). This may necessitate a nerve graft with the disadvantage of two coaptations and subsequent reduction of axonal load.
3. Complete destruction of recipient nerves of target muscles precluding effectiveness of any nerve transfer.

Operative Dictation

Diagnosis: (sub) acute peripheral partial/complete facial paralysis resulting from trauma/previous resection of intracranial tumor/resection of extracranial tumor (i.e., parotid tumor) resulting in: midface paralysis, paralytic lagophthalmos, oral incompetence, external nasal valve obstruction—or a combination of any of the above.
Procedure: Facial nerve exploration, extensive mobilization of cranial nerve, extra cranial suturing of facial nerve to other cranial nerve (nerve transfer).

Indication

This is a _____ patient with a history of (sub) acute facial palsy secondary of ____ months duration with resultant partial/complete facial paralysis. We extensively discussed the different options of treatment during multiple previous clinic visits and the patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After preoperative markings were performed we proceeded to the operating room. SCDs were applied prior to induction. All pressure points were verified to be protected after intubation. The patient was prepped and draped in a sterile fashion.

A preauricular incision was performed with a #15 scalpel. Subcutaneous dissection was performed anteriorly and inferiorly for about 1–1.5 cm. At this point, the dissection proceeded in a sub-SMAS plane while verifying the sub-SMAS fat was carried with the SMAS and revealing the parotid masseteric fascia. As the anterior parotid border was identified, careful antegrade dissection of the facial nerve branches was performed. (This portion of the dictation depends on the location in which the nerve transfer is performed). Optional: intraparotid retrograde dissection of the facial nerve branches was performed to the level of _____ (depending on extent of dissection). At this point attention was directed towards the donor nerve dissection. (The following description depends on the donor nerve—masseter, hypoglossal, or spinal accessory nerve—below is description of the masseter nerve dissection.) The lower border of the zygomatic arch was identified as well the mandibular notch. Dissection proceeded through the parotid and the superficial and middle portions of the masseter muscle. Fibers were dissected to open an area of approximately one and a half cm square. At this level dissection proceeded slowly with special attention to hemostasis, and the anterior branch of the masseter nerve was identified. Dissection proceeded along the nerve for approximately one and a half cm and small side branches were clipped and cut. Once the nerve was released from its surrounding tissue, it was cut distally and was readily mobilized towards the previously dissected facial nerve. At this point the operating microscope was brought into the field; the facial and masseteric nerves were cleaned of any connective tissue and well defined. Tension free coaptation was performed with 10-0 nylon. Irrigation was performed, hemostasis verified one last time, and closure performed in layers with 3-0 monocryl at the deep dermal layer and 5-0 interrupted nylon at the skin layer. Anesthesia extubated the patient with an emphasis to avoid coughing and surges in blood pressure. The patient was transferred to the PACU in good condition.

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Free Muscle Transfer for Long-Standing Facial Palsy

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Shai Rozen and Salim C. Saba

Indications

1. Long-standing facial paralysis (>18–24 months)
2. Absence of mimetic muscles secondary to trauma or tumor extirpation
3. Congenital facial paralysis with no evidence of motion

Contraindications/Relative Contraindications

1. Medical comorbidities precluding longer surgeries.
2. Progressive disease possibly involving donor cranial nerves.
3. Brain damage with possible cognitive disability, especially when using non-facial nerves, likely precluding effective postoperative utilization of transplanted muscle, exercises, and cortical adaptation.

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Essential Steps

Preoperative Considerations

1. Accurate history regarding duration of facial palsy, etiology of facial palsy, and status of disease in cases of cancer—cure, stable, progressive.
2. Physical exam must denote function of all cranial nerves, especially potential donor nerves.
3. Assess function of donor muscles—local trauma, paresis, previous vascular bypass surgery in the area.
4. Characterize type, vector, and excursion of smile on the non-paralyzed side.
5. Note previous facial surgeries possibly affecting donor vessels or nerves.

Preoperative Markings

1. Face—preauricular incision extending into the temporal hairline superiorly and Post Ramus inferiorly on the paralyzed side in a fashion that incisions are not seen on an anterior-posterior (AP) view at eye level. If a CFNG is used then a shorter pretragal incision is performed on the non-paralyzed side and extended as necessary for mapping of facial nerve.
2. Donor muscle incision depends on muscle of choice. In case of a gracilis muscle, the posterior

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border of the adductor magnus is identified and a line is drawn approximately 3 cm posterior to it on the proximal third of the thigh. The thigh side is not so important but our preference is ipsilateral thus inset of the muscle in the face is cranial to cranial and caudal to caudal.

3. The nasolabial fold and vector of smile are drawn on the normal side and then transposed to the paralyzed side. This will help with intraoperative placement of sutures at muscle insertion and placement of muscle in an appropriate vector.

Intraoperative Details

1. Prior to intubation communicate with the anesthesia team regarding avoiding paralysis other than for induction if felt necessary.
2. We generally prefer a RAE tube without taping to the face. This can safely be used for long surgeries without concern for losing the airway, granted caution is taken by all members of the team.
3. Verify the endotracheal tube is sufficiently free yet secure enabling free motion of the face from side to side enabling comfortable dissection of both sides of the face.
4. Prepping includes the entire head and neck above the clavicle and the donor muscle area. For gracilis muscle the ipsilateral lower extremity is prepped in its entirety. Non-sterile SCDs used during induction are changed to sterile ones after prepping.
5. Eyes are lubricated and covered with small Tegaderm.
6. Ears are plugged.
7. If a first stage CFNG procedure is planned, the following is performed:
   (a) Sural nerve harvest may be done endoscopically, via several skip incisions, or with a nerve stripper (the latter has somewhat of a risk for nerve injury shortening the harvested nerve length).
   (b) The facial nerve on the healthy side is dissected and mapped as previously described in a sub-Superficial Muscular Aponeurotic System (SMAS) layer.
   (c) The contralateral paralyzed side is dissected in a sub-SMAS layer as previously described with a limited dissection via a narrow sub-SMAS and more anterior sub cutaneous tunnel towards the upper lip.
   (d) Once the nerve is harvested passage of the CFNG from side to side can be performed with several techniques. Basic to all techniques is a-traumatic transfer of the nerve.
   (e) The nerve is coapted to the selected non-paralyzed facial nerve branch with 10-0 or 11-0 nylon suture.
   (f) In one stage procedures or second stage of the two-stage procedure, the selected muscle is inserted into the dissected pocket in the paralyzed side, secured at the insertion including the modiolus, mid-upper lip, alar root, and lateral lower lip and origin at the temporalis fascia above the zygomatic arch.
   (g) After insetting the muscle the vascular anastomosis is performed followed by nerve coaptation. In cases of two-stage techniques the nerve is generally coapted above the contralateral canine and in one stage techniques we use the minimum length of obturator nerve of the gracilis to reach the donor nerve.
   (h) After skin closure is performed with 3-0 monocryl and 5-0 nylon, a small label on which “no pressure” is written, is applied to the involved cheek.
   (i) Soft diet is given for 3 weeks.
   (j) Aspirin is given for 3 weeks.

Possible Complications

1. Failure to achieve motion secondary to:
   (a) Technical failure of coaptation.
   (b) Failure to identify paralysis of the donor nerve.
   (c) Vascular compromise of flap.
   (d) Unexplained failure to achieve neurotization of muscle despite technical success.
2. Misplaced muscle—incorrect vector causing asymmetry of smile, unintended eversion or inversion of lips.
3. Dehiscence of insertion of muscle.

Operative Dictation

Diagnosis: partial/complete long-term facial paralysis resulting from trauma/previous resection of intracranial tumor/resection of extracranial tumor (i.e., parotid tumor) resulting in: midface paralysis, paralytic lagophthalmos, oral incompetence, external nasal valve obstruction—or a combination of any of the above.

Procedure:

Cross facial nerve graft—(First stage) Mapping (stimulation) of facial nerve; Cross Facial Nerve Graft—Nerve graft over 4 cm in length. Free Functional Muscle Transfer—(either as part of second stage in a two-stage procedure or as a one stage procedure)—Free muscle transfer for facial reanimation; Extensive mobilization of facial nerve (dissection of the donor nerve).

Indication

This is a _____ patient with a history of long-standing facial palsy secondary of ___ months/years duration with resultant partial/complete facial paralysis. We extensively discussed the different options of treatment during multiple previous clinic visits and the patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After preoperative markings were performed we proceeded to the operating room. SCDs were applied prior to induction. All pressure points were verified to be protected after intubation. The patient was prepped and draped in a sterile fashion from clavicle above circumferentially and the entire lower extremity from pubis to foot circumferentially.

Cross Facial Nerve Graft: (First Stage)

Selection of Donor Facial Nerve Branches

A preauricular incision was performed with a #15 scalpel. Subcutaneous dissection was performed anteriorly and inferiorly for about 1–1.5 cm. At this point, the dissection proceeded in a sub-SMAS plane while verifying the sub-SMAS fat was carried with the SMAS and revealing the parotid masseteric fascia. As the anterior parotid border was identified, careful antegrade dissection of the facial nerve branches was performed. Once the branches were identified, each branch was separately stimulated; the branches that produced a strong motion of the zygomaticus major and minor muscles with minimal involvement of the orbicularis oculi muscle and no motion of the risorius or depressor oris muscles were identified. Optional: intraparotid retrograde dissection of the facial nerve branches was performed to the level of _____ (depending on extent of dissection). A subcutaneous dissection was performed towards the modiolus and upper lip. A similar incision was performed on the contralateral side and a sub-SMAS dissection proceeded through the immobile to mobile SMAS. The remainder of the anterior dissection was in the subcutaneous level. At this point a small incision was performed on the labial aspect of the upper lip on the paralyzed side superior to the canine tooth. A Pediatric no. 8 endotracheal tube stylet was used to pass between sides and once it traversed sides a 6 French red rubber feeding tube was attached to the stylet and passed between sides. At this stage the very edge of the previously harvested sural nerve was sown to the edge of the feeding tube and traversed between sides after it was wetted with some saline to help friction free transfer. The transferred nerve was trimmed at the edge with a fresh #15 scalpel and under a microscope coapted to the selected facial nerve branch with a 10-0 nylon in an end to end fashion. Irrigation was performed, hemostasis verified, and skin was closed in layers with a 3-0 monocryl and 5-0 nylon.

Functional Free Muscle Transfer: (Second Stage in a Two-Stage Procedure or First Stage When Using a Non-facial Donor Nerve)

Gracilis Muscle Harvest

Preoperatively the patient was asked to flex the knee in 90° in abduction. The posterior border of the adductor longus was palpated and a line is drawn 2.5 cm posteriorly. A skin incision was performed and any branches of the saphenous vein coursing anteriorly-posteriorly were

ligated. The adductor longus was identified as well as the gracilis muscle. The covering deep fascia was incised and proximal and distal dissection of the gracilis muscle along the anterior and posterior borders was performed, while carefully identifying the major pedicle anteriorly. The anterior branch of the obturator nerve was identified and carefully dissected cranially. The neurovascular pedicle was dissected to the medial circumflex source vessel, while ligating any branches into the adductor longus. The length of the muscle needed was measured in the face from the modiolus insertion to the origin at the temporalis fascia and 2 cm were added to the muscle to allow baseball stitches at the distal and proximal edges of the harvested partial gracilis muscle to prevent slippage of the securing sutures. The caudal and cranial edges are marked on the muscle as well as the posterior edge at approximately one third of the muscle width. Longitudinal dissection proceeded while ligating the neurovascular pedicle intramuscularly until the entire planned length was separated longitudinally. We then proceeded to cut the caudal border followed by the cranial border. These borders were then over-sewn with 0-0 vicryl sutures in a continuous interlocking fashion. The obturator nerve was then cut cranially and the vascular pedicle cut as well. The muscle was weighed and transferred to the face. The caudal edge of the muscle was sewn with the 0-0 PDS suture previously placed at the modiolus, upper lip, nasal root, and lower lip and slid down into position. The sutures were tied down with special attention to firmly securing the muscle as distal as possible. The cranial edge of the gracilis muscle was then pulled towards the temporalis fascia and secured once a small pull was noted at the lip. Again it was verified that the lips were not everted nor inverted upon pull of the muscle. Also intraoral visualization was important to verify that the sutures did not penetrate the oral mucosa. The microscope was then brought in and the venous and arterial anastomoses were performed. The edge of the obturator nerve was then freshened with a 15 blade. Tension free coaptation was performed with 10-0 nylon to the previously placed CFNG (or any other donor nerve). Irrigation was performed, hemostasis verified one last time, and closure performed in layers with 3-0 monocryl at the deep dermal layer and 5-0 interrupted nylon at the skin layer. Prior to extubation, the skin over the muscle was Dopplered and a 5-0 Prolene suture was stitched where a strong signal was noted to assist postoperative monitoring of the flap. A small soft tape was applied to the cheek instructing on "No Pressure." Anesthesia was asked to awaken the patient with an emphasis to avoid coughing and surges in blood pressure. The patient was extubated and transferred to the PACU in good condition.

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Local Muscle Transfer for Long-Standing Facial Palsy

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Indications

1. Chronic facial paralysis.
2. Desire for a dynamic reanimation procedure.
3. Functional temporalis muscle.
4. Motivated patient willing to undergo postoperative physical therapy.
5. Patient with comorbidities precluding free muscle tissue transfer.

Contraindications/Relative Contraindications

1. Medical comorbidities posing serious surgical risk.
2. Temporalis muscle damage due to ballistic or post-radiation injury.
3. Compromised sliding plane for the tendon (especially post-radiation).
4. Paralysis of the trigeminal nerve.

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Essential Steps

Preoperative Considerations

1. Capability of patient to understand how to activate the smile with the temporalis muscle.
2. Position of hairline, i.e., receding, affects placement of coronal incision.
3. Good temporalis muscle range of motion.

Preoperative Markings

1. Coronal incision extending between the helical roots.
2. Ipsilateral nasolabial fold extending from base of ala to oral commissure.

Intraoperative Details

1. Supine positioning enabling full motion of head from side to side.
2. Nasotracheal intubation or RAE tube without taping to minimize lip distortion.
3. Following coronoidotomy, maintain connection between the temporalis tendon and coronoid process to facilitate delivery through Bichat's fat pad and into the commissural area.

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4. Complete elevation of the temporalis muscle in the temporal fossa and anterior and inferior displacement to allow for maximal advancement.
5. Complete splaying of the temporalis tendon off of the coronoid to allow a broad attachment to the oral musculature.
6. Temporalis stretch prior to final fixation along the crest creates an overcorrection in repose that will resolve within 6–12 months.
7. Occasionally, parasitic fiber attachments from the masseter and the medial pterygoid to the temporalis tendon have to be incised.

Postoperative Details

1. Maintain head elevation postoperatively.
2. Patient may be discharged the next day after adequate pain control.
3. Physical therapy for smile training may begin on the 21st postoperative day 4.

Possible Complications

1. Slight weakening of the ipsilateral bite.
2. Asymmetric smile resulting from suboptimal positioning of the temporalis tendon or inadequate advancement.
3. Stiffness of the ipsilateral buccal region (may be softened with massage).
4. Collateral smile movements with mandibular ranging (may be avoided in some patients with adherence to physical therapy).
5. Insufficient excursion.
6. Temporal hollowing.

Operative Dictation

Diagnosis: Chronic facial paralysis
Procedure: Dynamic facial reanimation with lengthening temporal myoplasty.

Indication

This is a _____ patient who presents with a chronic left-sided facial paralysis resulting from resection of acoustic neuroma. Different reconstructive options were discussed with the patient and the patient opted for lengthening temporal myoplasty given that it offered him a locoregional option without the need for a distant donor site. The patient understands the benefits, risks and alternatives associated with the procedure, and wishes to proceed. The patient also understands that smile excursion with this technique will not exceed 2 cm or the capabilities of the free muscle transfer.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time out among operating room staffs was performed. The patient underwent nasotracheal intubation with the tube extending cephalad and away from the ipsilateral side / oral RAE tube without taping. A 2–3 cm strip of hair was shaved extending from one helical root to the next. The head and face were prepped and draped in standard aseptic fashion.

The coronal incision line was injected with a 1:1,000,000 epinephrine solution. The zygomatic arch was similarly injected.

A coronal incision was made in the direction of the hair fibers extending vertically on the temporal region and then running approximately 5 cm posterior to and parallel to the hairline. The forehead flap was dissected in the subgaleal plane and extended to a point 1–2 cm above the supraorbital rim. Temporally, the flap was raised between the superficial temporal fascia and deep temporal fascia to a point that is 1–2 cm above the zygomatic arch. An incision was made in the superficial temporal fascia parallel to the zygomatic arch and extended between the two layers

of the deep temporal fascia leaflets. Subperiosteal dissection was carried on the medial surface of the arch to expose the bony surface and extended to the lateral orbital rim.

The zygomatic arch was now clearly visible and sectioned with a saw. (This is the original description but today most authors would not remove the zygomatic arch). Sectioning was made far enough anteriorly to expose the coronoid process. Once the tendinous insertion of the temporalis was identified, the coronoid process was osteotomized and left attached to the tendon for easier transfer through a cheek tunnel which was via buccal fat pad.

Before tunneling, the deep fascia of the temporalis was incised 1 cm below the temporal crest along its anterior half. The entire muscle was then elevated off the temporal fossa and as far inferiorly as the infratemporal fossa so as not to injure the neurovascular bundle.

A 4-cm nasolabial fold incision was then made and extended in a submuscular plane toward the zygomatic arch (Today many authors do not perform a nasolabial incision but approach the fold through the mouth or via a subcutaneous dissection). Dissection was carried deep to the masseter within buccal fat pad to create a cheek tunnel. The coronoid process/temporalis tendon was grabbed with forceps and passed caudally to the commissure area through the cheek tunnel. The tendon was then separated from the coronoid and fanned to a width of 3–4 cm. The tendon was then sutured to the perioral musculature non-absorbable braided suture. The nasolabial fold incision was closed in two layers (in case of a percutaneous approach).

The temporalis muscle body was then stretched and sutured to the 1 cm fascial cuff left along the anterior half of the temporal crest. The sectioned zygomatic arch was fixed with plates and screws prior to closing the coronal incision in two layers. Standard dressing for the coronal incision was applied.

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Free Temporoparietal Fascial Flap

82

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Indications

Free Tissue Transfer Use

1. Hand and wrist coverage, ideal for tendon gliding properties.
2. Lower extremity reconstruction (Achilles tendon, pretibial surface, dorsum of the foot).
3. Post-oncologic soft tissue reconstruction where no bulk is needed.

Pedicled Use

1. Congenital ear deformities.
2. Reconstruction of periorbital, malar, auricular area.

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Contraindications

1. Carotid occlusion.
2. History of previous surgeries in the temporal area.
3. History of irradiation of the temporal area.

Possible Complications

1. Alopecia.
2. Facial nerve damage.
3. Insufficient tissue.
4. Loss of the auriculotemporal sensory nerve.
5. Hematoma.
6. Partial/total flap loss.

Preoperative Evaluation

1. Review history of previous surgeries, irradiation, carotid occlusion.
2. Palpate superficial temporal vessels in the pretragal area.

Essential Steps

Preoperative Considerations

1. Patient education.
2. Informed consent.

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3. Palpate superficial temporal vessels in pretragal area.
4. Mark the course of the vessels.
5. Marking of the flap design.
6. Shave incision line only.

Intraoperative Details

1. Verify the informed consent as supposed to informed consent verification.
2. Perform time out among surgical team members as supposed to time out.
3. Make pre-auricular incision similar to rhytidectomy incision type.
4. Extend the incision superiorly into a T or Y shape incisions at the upper border of the temporal fascia.
5. Identify the superficial temporal artery and vein.
6. Identify the auriculotemporal nerve.
7. Raise scalp and skin flaps anteriorly and posteriorly in a retrograde fashion in the areolar plane.
8. Control hemostasis by cauterizing the vascular branches from the fascia to the skin, avoiding damage to hair follicles.
9. Mark size of desired superficial temporal fascia.
10. Elevate deep temporal fascia along attachment on superior temporal line on temporal bone.
11. Elevate inferior attachment of deep temporal fascia, with periosteum of zygomatic arch.
12. Elevate the two layers of the flap on the common pedicle.
13. Dissect the superficial temporal artery pedicle.
14. Insert two suction drains.
15. Close donor site in layers.
16. (a) For pedicled flap.
    - Creation of subcutaneous tunnel between the donor and recipient site.
    - Transposition of the flap for inset.

    (b) For free flap transfer, the recipient vessels are dissected and prepared for transfer.
17. Inset flap with absorbable sutures, (mark location of Doppler signal in case of free flap transfer with nonabsorbable sutures).
18. Cover flap with split thickness skin graft, or perform tendon transfer as needed.
19. Apply dressing.

Operative Dictation

Diagnosis: Soft tissue defect in various locations, especially with exposed tendon.

Procedure: Free temporoparietal fascial flap transfer to dorsum of right hand.

Indication

This is a X-year-old patient with soft tissue defect in dorsum of right hand with exposed extensor tendon, which requires soft, unbulky coverage (that can glide over the underneath structures). Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time out among operating room staffs was taken. General anesthesia was instituted. The entire right hand, scalp and face were prepped using Cetrimide solution.

The superficial temporal artery course previously marked was verified using a handheld Doppler machine.

Afterwards, a rhytidectomy-type incision was performed. It started in the pretragal region, with a T-extension, and the superficial temporal fascia was dissected sharply while preserving the hair follicles. Marking of the flap and axis of rotation was performed. 3 cm of tissues was preserved around the pedicle at the pretragal level. The desired size of the flap was marked. The scalp and skin flaps were raised anteriorly and posteriorly in a retrograde fashion in the areolar plane. We subsequently elevated the deep temporal fascia along attachment on superior temporal line on temporal bone. We then proceeded with elevation of the inferior attachment of deep temporal fascia, with perios-

teum of zygomatic arch, followed by elevation of the two layers of the flap on the common pedicle.

A fine tipped bipolar electrocautery was used to assure hemostasis, and preserve hair follicles. A subcutaneous tunnel was created between the donor and recipient sites, and the flap is tunneled. *(For a free tissue transfer, the superficial temporal artery and vein were clipped, marked and divided after preparation of the recipient vessels.)*

Suction drain was placed at donor site, and wound was closed using 4-0 Monocryl for the deep dermal layer, followed by 5-0 Prolene in a simple interrupted fashion.

In distant transfers, the flap was inset with absorbable sutures, and the Doppler signal was marked with a nonabsorbable suture in case of free flap transfer with nonabsorbable sutures. The flap was then covered with a split thickness skin graft.

Light non-adherent dressing is applied.

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Facial Artery Myomucosal (FAMM) Flap

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Andreas Michael Lamelas and Peter J. Taub

Indications

1) Loco-regional flap consisting of oral mucosa and buccinator muscle for reconstruction of a variety of structures:
   (a) Upper/lower lip.
   (b) Hard/soft palate.
   (c) Alveolus.
   (d) Nasal lining.
   (e) Maxillary antrum.
   (f) Tonsilar fossa.
   (g) Floor of the mouth.

Essential Steps

Preoperative Markings

1) The proposed defect or area of resection is outlined and measured to determine the size of the desired FAMM flap.
2) Depending on the location of the defect, this flap can be inferiorly or superiorly based. A Doppler ultrasound is used to mark the course of the facial artery. The flap design is marked with an average width of 1.5–2 cm such that the artery remains axial throughout its entire length.
3) The flap is typically oriented obliquely extending from the retromolar trigone to the level of ipsilateral gingival labial sulcus at the level of the alar margin.
4) Care must be taken to preserve the opening of Stenson's duct located adjacent to the second maxillary premolar.

Intraoperative Details

1) Performed in supine position.
2) General anesthesia with either orotracheal or nasotracheal intubation.
3) Stay sutures or oral retractors are placed to allow for optimal intraoral exposure.
4) Infiltrate the proposed mucosal markings with local anesthetic plus 1:100,000 epinephrine.
5) Incision is made at the distal end of the flap through the mucosa and buccinator. *For inferiorly based flaps the initial incision with be near the gingival labial sulcus. For superiorly based flap the incision will be made near the retromolar trigone.*

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6) The facial artery is identified, and its distal portion is ligated and cut.
7) The rest of the flap markings are incised and dissection proceeds proximally just deep to the facial artery.
8) The arc of rotation is variable based on the reconstructive needs with pivot points located inferiorly at the retromolar trigone, superiorly at the gingival labial sulcus or anywhere in between.
9) Inset of the flap is completed.
10) The donor site is closed in two layers. The buccinator muscle is first re-approximated, followed by closure of the overlying mucosa with care to avoid the opening of Stenson's duct.

Postoperative Care

1. Patient should be given Peridex solution to rinse the mouth twice daily.

Notes on Flap Orientation

1. Superiorly based FAMM flap is based on retrograde flow through the facial artery from the angular artery.
2. In a third of patients, a second stage may be necessary to reduce the bulky mucosal paddle at the base of the flap. This may be avoided by extending the defect to include the area adjacent to the base of the flap.

Possible Complications

1. Flap necrosis.
2. Thinning of the ipsilateral cheek.
3. Changes in facial expression on the ipsilateral side.

Operative Dictation

Diagnosis: Defect of the lower lip or palate.
Procedure: Facial artery myomucosal flap reconstruction.

Indications

A ___-year-old ___ presenting with a significant ___ defect of the ___ for reconstruction following ___. Preoperatively, the nature, benefits, risks, and alternatives to reconstruction with a facial artery myomucosal flap are discussed with him in detail and he agrees to proceed. Specific complications include, but were not limited to, bleeding, infection, wound healing problems, injury to surrounding structures (skin, vein, arteries, nerve, and teeth), persistent deformity, recurrent deformity, and the need for additional surgery. He again understands these and agrees to proceed.

Description of the Procedure

After the site was marked and informed consent was verified, the patient was brought to the operating room and placed in supine position with all bony prominences well-padded. Venodyne boots were placed. A formal team huddle was performed. Following the induction of anesthesia (general or monitored), a time-out was performed. Preoperative antibiotics were given. Using a Doppler ultrasound, the facial artery was identified and marked along the oral mucosa using a surgical marker. The proposed flap with base and pivot point at the retromolar trigone adjacent to the right lateral edge of the lip mucosal defect was marked with a 2 cm width centered along the facial artery for the entire length. *For superiorly based flaps*, *the base of the flap will be located at the gingival labial sulcus at the level of the alar base*. Care was taken to avoid inclusion of the opening of Stenson's duct within the flap design. The proposed incision on the donor flap was infiltrated with 1 % lidocaine and 1:100,000 epinephrine. The patient was prepped and draped in standard sterile surgical fashion being careful to avoid exposure keratitis.

The procedure was begun by optimizing the wound bed. A 1 mm of tissue was excised along the edge of the defect and adequate pinpoint bleeding was noted. The wound was thoroughly irrigated and covered with moist gauze. 3-0 silk

sutures were placed within the vermillion of the ipsilateral lip and left long to be used for retraction. In this way, the oral cavity was adequately exposed. The mucosa at the distal/superior tip of the flap was incised and dissection carried down until the facial artery was identified. The distal portion of the artery was suture ligated and divided. The remainder of the flap markings were incised and the flap was raised deep to the facial artery moving proximally towards the base. Once fully elevated, the flap was noted to have good pinpoint bleeding with no signs of venous congestion. The flap was rotated into the defect and inset using interrupted 4-0 chromic sutures. Once inset, the flap was pink with no signs of venous congestion. The facial artery continued to have strong Doppler signals. The donor site was thoroughly irrigated and hemostasis achieved. The buccinator muscle was approximated with interrupted 4-0 Vicryl suture and the overlying mucosa was closed with a running 4-0 chromic suture. The silk stay sutures were removed. Topical antibiotics were applied to any external incisions. The patient tolerated the procedure well, was awakened in the operating room, and discharged to the recovery room in good condition, where he will be followed postoperatively. At the conclusion of the procedure, all sponge and needle counts were correct.

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Cervicofacial Flap

84

Peter J. Taub

Indications

1. Reconstruction of medium to large full-thickness defects of the cheek, often from tumor excision, but possibly from trauma.
2. Restoration of normal malar architecture with minimal disruption to lower eyelid contour or upper lip position.

Essential Steps

Preoperative Markings

1. Landmarks are less critical with this flap, but those such as the nasolabial fold may be marked with methylene blue or similar ink prior to injection of local anesthesia.
2. The margins of the defect or area to be resected are marked.
3. For a medial defect, the incision travels posteriorly at a level equal to the superior extent of the defect. This may be within the territory of the lower lid—making lid malposition a greater concern postoperatively—or beneath the lower lid proper.
4. At the commissure of the eye, the incision should continue superiorly, arc, then turn inferiorly at the level of the temporal hairline. This will offset the tendency for the medial aspect of the flap to pivot lower than the medial corner of the defect and unnecessarily pull on the lower eyelid.
5. At the lobule of the ear, the incision will turn posteriorly and be carried along the mastoid hairline to create an adequate-sized flap.
6. The inferior extent of the incision posteriorly will depend on the amount of rotation/advancement required. As noted it may cross the jawline or extend onto the chest.

Intraoperative Details

1. Performed in the supine position with the head able to be turned so that the posterior incision is easily visible.
2. Oral prophylactic antibiotics are administered if indicated.
3. A mental nerve block may be performed if indicated.
4. The flap may be tumesced with dilute epinephrine to minimize bleeding. Distortion is of less concern with this type of flap.
5. Scar tissue from the periphery of the defect should be excised to healthy margins.

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6. The incisions are made sequentially and the flap continuously mobilized to check for adequate rotation and coverage of the defect.
7. The medial corner of the flap is secured to deep, immobile tissue such as the periosteum of the infraorbital rim to provide support to the flap.
8. The dog-ear at the base of the flap in the area of rotation may be conservatively managed, cognizant of how it might affect the inferiorly based blood supply. This can also be addressed at a more-limited second stage.

Postoperative Care

1. Bacitracin ointment to the suture lines.
2. Suture line can get wet in 48 h.
3. Oral pain medications.
4. Overnight observation if indicated.
5. Office follow-up in 1 week for superficial suture removal.

Possible Complications

1. Bleeding.
2. Wound infection.
3. Wound dehiscence.
4. Lower lid malposition.
5. Partial or complete flap loss: the random pattern vascularity of the flap implies that not all portions of the flap in not every patient will survive.
6. Facial nerve injury: elevation of a cervicofacial flap can potentially damage branches of the facial nerve, as well as the greater auricular nerve. The possibility of this happening is minimized by dissecting above the level of the SMAS. The surgeon however should be aware that the thickness of the soft tissue varies in the face and be careful not to dissect too deeply.
7. Lower eyelid malposition: the weight of the elevated flap with minimal deep soft tissue support combined with the natural contracture of healing wounds applies stress to the lower eyelid and can lead to lid retraction or ectropion once the flap is healed. During inset of the flap, sutures can be anchored to the periosteum of the zygomatic arch and inferior orbital rim to decrease this possibility. A lateral canthopexy can also be added to similarly minimize this occurrence.

Operative Dictation

Diagnosis: _____ cm defect of the right/left cheek.
Procedure: cervicofacial flap reconstruction.

Indications

A _50__-year-old _man__ presenting with a significant cheek defect following _Moh's micrographic excision of a squamous cell carcinoma_____. Preoperatively, the nature, benefits, risks, and alternatives to reconstruction with local tissue rearrangement are discussed with him in detail and he agreed to proceed. He is given ample time to ask questions and all of his questions are answered appropriately. Specific complications include, but were not limited to, bleeding, infection, wound healing problems, injury to surrounding structures (skin, vein, arteries, and nerves), persistent deformity, associated deformity of the lower eyelid, recurrent deformity, and the need for additional surgery. He again understands these and agrees to proceed.

Description of Procedure

After the site was marked and informed consent was verified, the patient was brought to the operating room and placed in supine position with all bony prominences well-padded. Venodyne boots were placed. A formal team huddle was performed. Following the induction of anesthesia (general or monitored), a time-out was performed. Preoperative antibiotics were given. The proposed incision and donor flap were infiltrated

with 0.5 % lidocaine and 1:200,000 epinephrine. The patient was prepped and draped in standard sterile surgical fashion. Care was taken to avoid exposure keratitis.

The procedure was begun by examining the defect and exicising the existing margins with a #15 scalpel blade. Adequate hemostasis was achieved with the electrocautery. The donor flap was incised with the scalpel to a depth below the subcutaneous fat and above the level of the SMAS. Scissors dissection was performed inferiorly until sufficient laxity for rotation was achieved. The flap was elevated and rotated to fill the defect. The superomedial corner of the flap was inset to deeper, less mobile soft tissue with a single PDS suture. The skin was re-approximated with interrupted deep 5-0 Monocryl and superficial 6-0 nylon sutures. A dressing consisting of Bacitracin and Xeroform was applied. Care was taken to avoid any dressing that would put pressure over the inferior blood supply. The patient tolerated the procedure well, was awakened in the operating room, and discharged to the recovery room in good condition, where he will be followed postoperatively. At the conclusion of the procedure, all sponge and needle counts were correct.

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Abbe and Estlander Flaps

85

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Indications

1. Reconstruction of medium to large full-thickness defects of the upper or lower lip, often from congenital deformity, trauma, or after surgical resection for neoplasia.
2. Restoration neuromuscular function with the least disruption to perioral anatomy.
3. More often utilized in reconstruction of the upper lip with a lower lip flap.
   (a) Upper lip reconstruction: can use central and lateral lower lip, and even possibly including skin of chin, depending on size/location of defect.
   (b) Lower lip reconstruction: generally avoid including central philtral region in the flap due to aesthetic balance of central upper lip.
4. Abbe flap is applicable to:
   (a) Defects that are midline or lateral to midline but do not involve the oral commissure.
   (b) Philtral deformity, as often seen in bilateral cleft lip or after repair.
   (c) Defects that consume ⅓ to ½ of the lip in width.
   (d) Involve significant loss of orbicularis oris muscle.
5. Estlander flap is applicable to:
   (a) Similar to Abbe but used for defects that include oral commissure.

Essential Steps

Preoperative Markings

1. Landmarks, including philtrum, nasal sill, vermilion borders, white roll, bilateral commissures, alar groove, melolabial folds are marked with methylene blue or similar ink PRIOR to injection local anesthesia.
2. The defect/area to be resected are marked.
3. Design and mark the flap (described here as a lower lip Abbe flap for upper lip reconstruction. However, this can be adapted into an upper lip flap for lower lip reconstruction). When selecting which side of the donor lip will serve as the base of the flap, the pivot point should be placed closest to the commissure (more proximal blood supply). Flap should be half the width of the defect, generally no wider than 2 cm, to minimize donor-side morbidity. Length of flap should be equal to the length of the defect.

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4. If performing philtral reconstruction, distance from each commissure to the new philtral columns should be measured and made equal to ensure symmetry.
5. Flap tip is a "V" shape or can be "W" shape around the chin aesthetic unit if a larger flap is needed.
6. Upper pole of flap include wet vermillion, depending upon the extent of the defect into wet vermillion.

Intraoperative Details (Abbe Flap)

1. Performed in the supine position.
2. Administer oral prophylactic antibiotics if indicated.
3. Perform mental nerve blocks if indicated.
4. Administer minimal amount of local anesthesia to minimize deforming flap/recipient site. Attention should be paid to avoid labial artery.
5. Wait for tissue distention from local anesthesia to subside.
6. Defect of recipient lip should then be excised, including any scar tissue or orbicularis oris, as needed. Of note, all normal vermillion of the recipient site should be preserved to aid in flap inset. If defect is pre-existing, widen the defect to include the entire subunit to accommodate the incoming flap.
7. Dissect the recipient lip into three layers with identification of the normal lateral orbicularis oris, to aid in three-layer closure.
8. Make full-thickness incision, beginning with dissection of orbicularis oris on contralateral side of flap pedicle.
9. Identify course of labial artery contralateral to planned pedicle labial artery. Artery is left intact until the time of flap transfer.
10. Utilize course of identified labial artery to mark contralateral course of labial artery, which will be used as the pedicle.
11. Continue the dissection on the side of the pedicle. A cuff of tissue surrounding the labial artery pedicle should be left intact, as to maintain venous drainage to the flap.
12. The flap is then mobilized. The labial artery contralateral to the pedicle is clamped and divided with silk suture. Mobilize the flap by rotating the flap 180°. The nasal spine is utilized as an anchor, and the tip of the flap is anchored using resorbable sutures.
13. Orbicularis oris muscle of the flap should then be sutured into place bilaterally using resorbable sutures, with close attention to maintaining continuity of the white roll of the flap and the recipient lip. Cuticular plain gut sutures can be utilized to align the white roll of the recipient lip prior to dermal approximation.
14. Recipient wet and dry vermilions should then be approximated using interrupted resorbable suture.
    (a) Donor lip should then be re-approximated in a similar three-layer closure. Again, close attention should be paid to ensuring accurate approximation of vermillion-cutaneous borders and donor lip white roll.

Postoperative Care

1) Bacitracin ointment to the suture lines.
2) Suture line can get wet in 48 h.
3) Oral pain medications.
4) No excessive mouth opening. Small food pieces that can enter through the open sides of the mouth.
5) Office follow-up in 1 week.
6) Pedicle is divided in 2–3 weeks under local anesthesia.

Possible Complications

1) Bleeding.
2) Wound infection.
3) Wound dehiscence.
4) Microstomia if flap is too large.
5) Philtral reconstruction can have uneven outcome with poor aesthetic result, if flap is not well designed/centered.

6) Partial or complete flap loss: Patient selection is critical, as diet, speech, and socialization are altered during the staged reconstruction. Poor compliance may lead to flap compromise.

Operative Dictation

Diagnosis: upper/lower lip defect.
Procedure: Abbe/Estlander flap reconstruction.

Indications

A_24__-year-old _man__ presenting with a significant upper/lower lip defect for reconstruction following _ prior bilateral cleft lip repair__ Preoperatively, the nature, benefits, risks, and alternatives to reconstruction with local tissue rearrangement are discussed with him in detail and he agrees to proceed. He is given ample time to ask questions and all of his questions are answered appropriately. Specific complications include, but were not limited to, bleeding, infection, wound healing problems, injury to surrounding structures (skin, vein, arteries, nerve, and teeth), persistent deformity, recurrent deformity, and the need for additional surgery. He again understands these and agrees to proceed.

Description of Procedure

After the site was marked and informed consent was verified, the patient was brought to the operating room and placed in supine position with all bony prominences well-padded. Venodyne boots were placed. A formal team huddle was performed. Following the induction of anesthesia (general or monitored), a time-out was performed. Preoperative antibiotics were given. The proposed incision on the donor flap was infiltrated with 1 % lidocaine and 1:100,000 epinephrine. The patient is prepped and draped in standard sterile surgical fashion. Care was taken to avoid exposure keratitis.

The procedure was begun by examining the defect and excising the existing margins/scarred portion of the upper/lower lip with a #15 scalpel blade. Adequate hemostasis was achieved with the electrocautery. The margins of the donor flap were incised with the scalpel, being careful to leave a small amount of skin over the chosen pedicle to be divided last. The corresponding mucosal incisions on the inner aspect of the lip were similarly incised with the scalpel. Again, care was taken to avoid division of the vascular pedicle. The intervening soft tissue within the substance of the lip, including fat and muscle, were divided with the electrocautery. The position of the pedicle on the opposite side of the flap that would not be used as the vascular supply was examined. The flap was elevated leaving a small cuff of soft tissue around the pedicle and rotated into the defect. It was inspected for any signs of vascular compromise. The mucosal incision at the recipient site was closed with interrupted 4-0 chromic sutures. The muscle within the flap was sutured to the remaining muscle within the lateral lip elements with interrupted 4-0 Vicryl sutures. The skin was re-approximated with interrupted 6-0 nylon sutures. The donor defect was closed in a similar, layered fashion. A dressing consisting of Bacitracin and Xeroform was applied to both the donor and recipient sites. The patient tolerated the procedure well, was awakened in the operating room, and discharged to the recovery room in good condition, where he will be followed postoperatively. At the conclusion of the procedure, all sponge and needle counts were correct.

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Karapandzic Flaps

86

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Indications

1. Full-thickness *upper lip* central defects involving 33-80 % of the lip using bilateral rotational advancement flaps with or without an Abbe switch lip flap for philtral reconstruction.
2. Full-thickness *lower lip* central defects involving 33 % to 80 % of the lip using bilateral rotational advancement flaps.
3. Full-thickness *lower-lip* or *upper-lip* lateral defects involving 33–80 % of the lip using a contralateral-unilateral rotational advancement flap with or without an ipsilateral Bernard–Burow cheiloplasty.

Essential Steps

Preoperative Markings

1. Nasolabial fold, labiomental sulcus, and philtral ridges should be marked and preserved.
2. The flap(s) is marked as a semicircular circumoral flap(s) around the remaining portion of lip within the confines of the nasolabial fold(s).
3. The flap(s) should maintain a constant width corresponding to the defect vertical height.
4. The incision(s) are curved either toward the nasal ala or the labiomental sulcus if reconstructing a lower lip or an upper lip defect, respectively.

Intraoperative Details

1. Supine position, soft headrest, arms tucked with the OR table rotated 90°.
2. General anesthesia with nasotracheal intubation using a right angle endotracheal (RAE) tube or monitored anesthesia care (MAC).
3. Prep with dilute 10 % Povidone iodine solution (i.e., 1:1 with normal saline), and drape with sterile head-wrap and surgical split-sheet drape.
4. Place a throat pack to prevent inadvertent ingestion of blood during procedure.
5. Infiltrate incisions with local anesthetic containing 1:100,000 epinephrine after the markings have been made (see *Preoperative Markings* above)
6. The first 1 cm of the incision is carried through all the lip layers, but beyond that the mucosa is preserved while only the skin and muscle are divided. The small mucosal incision

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ensures preservation of an adequate gingivobuccal sulcus.
7. Perioral muscle fibers are mobilized by blunt dissection rather than by division in order to preserve the vascular pedicles (i.e., labial arteries) and buccal facial nerve branches. This preserves muscular continuity and innervation to the orbicularis oris in order to reestablish oral sphincter competence.
8. Similar to other rotational flaps, redundant skin along the outer circumference of the flap can be excised as Burrow's triangles.
9. Perform three-layered tensionless closure following medial advancement of the flaps.

Postoperative Care

1. Patients are discharged home the same day with a five-day course of liquid pain medication and prophylactic antibiotics to cover oral flora.
2. Dressings are removed at 48 hours. Patients are encouraged to sponge bathe until the first postoperative visit.
3. Nutrition consists of a diet that easily accommodate the size of the oral aperture or a pureed/liquid diet.
4. Patients can swish and expectorate with oral solution if they have oral competence. Gentle intraoral cleaning is performed with swab or soft bristled brush.
5. Patients are seen on post-op day 5–7 for suture removal.

Possible Complications

1. Bleeding, hematoma.
2. Wound healing problems.
3. Wound infection.
4. Microstomia in large defects.
5. Upper lip may appear tight.

Operative Dictation

Diagnosis: Full-thickness lower lip central defect involving 75 % of the lip

Procedure: Bilateral musculocutaneous rotation-advancement flaps with neurovascular preservation for lower lip reconstruction (i.e., Karapandzic flaps)

Indication

A ___-year-old ___ presenting with a full-thickness lower lip central defect involving 75 % of the lip requiring reconstruction. Preoperatively, the nature, benefits, risks, and alternatives to reconstruction with local tissue reconstruction are discussed with him in detail and he agrees to proceed. He is given ample time to ask questions and all of his questions are answered appropriately. Specific complications include, but were not limited to, bleeding, infection, wound healing problems, injury to surrounding structures (skin, vein, arteries, nerve, and teeth), persistent deformity, recurrent deformity, and the need for additional surgery. He again understands these and agrees to proceed.

Description of Procedure

After the site was marked and informed consent was verified, the patient was brought to the operating room and placed in supine position with all bony prominences well padded. The arms were tucked, a foam donut headrest placed and the table was rotated to 90 degrees. Venodyne boots were placed. A formal team huddle was performed. Following the induction of anesthesia (general or monitored), a time-out was performed. Preoperative antibiotics were administered. The circumoral bilateral superior-medially based musculocutaneous rotation-advancement flaps were marked. A throat pack was placed. The perioral area was infiltrated with 1 % lidocaine with 1:100,000 epinephrine. The patient was the prepped and draped in the standard sterile fashion.

The procedure was begun by optimizing the wound bed. A 1 mm of tissue was excised with a #15 scalpel along the edge of the defect and adequate pinpoint bleeding was noted.

The wound was thoroughly irrigated and covered with moist gauze. An incision was carried from the base of the defect through all lip layers for approximately 1 cm to the right and left of the lower lip defect. Beyond this point, the mucosa was preserved. The skin incisions were carried circumorally from the lower lip defect and into the nasolabial folds toward the nasal alar bases. The underlying muscle fibers were mobilized via blunt dissection along this path. The labial arteries and facial nerve branches were identified and preserved. The area was irrigated thoroughly and hemostasis obtained with bipolar electrocautery. The bilateral perioral musculocutaneous flaps were rotated and advanced to the midline. After medial approximation of the flaps, a layered tensionless closure was performed using interrupted 5-0 chromic sutures for the mucosa, 4-0 Vicryl sutures for the muscle, 5-0 Monocryl sutures for the deep dermis and 6-0 Nylon for skin. Redundant skin along the outer circumference of the incision was excised as two burrows triangles buried into the nasolabial creases. The throat pack was removed. The area was cleaned, dried and dressed with topical antibiotic ointment. The patient tolerated the procedure well, was awakened in the operating room, and discharged to the recovery room in good condition, where he will be followed postoperatively. At the conclusion of the procedure, all sponge and needle counts were correct.

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Pectoralis Major Flap for Head and Neck Reconstruction

87

Stephan Ariyan

Indications

Primary or secondary reconstruction of surgical defects of the head and neck region.

1. Repair of defects following partial or total glossectomy.
2. Repair of defect following orbital exenteration.
3. Repair of defect following radical maxillectomy.
4. Repair of defect following temporal bone resection.
5. Repair of pharyngeal defects after total laryngectomy.
6. Repair of soft tissue defects of the neck following radical neck dissection.

Possible Complications

1. Wound separation.
2. Fistula formation.
3. Chest donor site would infection.
4. Ischemic tissue necrosis of skin paddle.

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Essential Steps

Preoperative Markings

1. Measure template dimensions of surgical defect.
2. Draw a line from shoulder tip to xiphoid.
3. Draw a perpendicular line from mid clavicle to the shoulder tip–xiphoid line; this is vascular axis.
4. Measure distance from that clavicular line to surgical defect.
5. Draw this distance along vascular axis.
6. Draw template of surgical defect beyond this distance on vascular axis.

Intraoperative Details

1. Incise the skin only along the lateral aspect of this template down to the pectoralis major muscle.
2. Split muscle fibers of muscle to get under sub-pectoral space.
3. Place Deaver retractor in sub-pectoral space and elevate muscle off the chest wall.
4. Identify location and path of the thoracoacromial vessels.
5. Incise along the perimeter of the remainder of the template of the skin paddle down to muscle.

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6. Place multiple temporary sutures anchoring dermis of skin paddle to fascia of pectoralis muscle.
7. Incise the skin of the chest to pectoral fascia from the mid- clavicular line along vascular axis to skin paddle.
8. Elevate medial and lateral skin flaps off the pectoralis muscle.
9. Incise the muscle pedicle from clavicle to skin paddle 4–6 cm in width centered over the vascular pedicle.
10. Elevate skin paddle and the muscle pedicle to the clavicle.
11. Excise transverse fibers of pectoral muscle for distance of 4 cm below the clavicle leaving only vascular pedicle and the subpectoral fascia intact.
12. Transfer entire flap over the clavicle with only the vascular pedicle and subpectoral fascia draped over the clavicle.
13. Place skin paddle into surgical defect.
14. Place multiple interrupted anchoring sutures from pectoral fascia to fascia of surgical wound along the entire perimeter of wound.
15. Sutures skin paddle to perimeter of surgical wound.
16. Elevate lateral incision on chest wall and the second skin-fat flap off pectoralis muscle and fascia to anterior axillary or mid-axillary line.
17. Close chest wound over suction drain.

Postoperative Care

1. If the flap is an exterior coverage, apply topical antibiotic ointment to wound edges, cover with single layer of Xeroform gauze. If there is any question of cutaneous circulatory compromise, apply liberal Silvadene cream daily.
2. If the flap is for intraoral reconstruction, have the patient rinse the oral cavity with antibacterial solution (e.g., chlorhexidine or ciprofloxacin) every 4 h during the day.
3. If the flap is for intraoral reconstruction, to remain on liquid diet for 7–10 days, until it is confirmed that there is no fistula developing.

Operative Dictation

Diagnosis: Surgical defect of _____.
Procedure: Reconstruction of _____ with pectoralis major myocutaneous flap (__cm × __cm).

Indications

This is a _____ patient who had a resection of _____ resulting in a defect measuring (__ cm × __ cm). The patient is being treated at this time with a definitive reconstruction with a musculocutaneous flap from the chest wall.

Description of Procedure

The patient was placed in the supine position. General anesthesia was performed with nasotracheal intubation (or tracheostomy). The left/right chest was then prepped beyond the sternum, below the rib cage, including the shoulder and the upper arm below the deltoid region. The face and neck were also prepped. The entire operative site was then draped appropriately.

A straight line was drawn from the shoulder tip to the xiphoid on the chest. The perpendicular line was drawn from the mid portion of the clavicle down to the shoulder–xiphoid line.

A tape measure was used to determine the distance from the inferior border of the mid-clavicle to the surgical defect, and this was plotted from the clavicle down along the vascular pedicle line. Dimensions of the surgical defect were measured to be (__cm × __cm), and this was drawn as a template on the chest wall along the axillary line distal to the pedicle distance previously marked.

An incision was made along the lateral aspect of the drawn template of the skin paddle down to the pectoralis muscle fascia. The muscle fascia was split longitudinally along its fibers with the Metzenbaum scissors down to the subpectoral fascia. The subpectoral fascia was cut with the Metzenbaum scissors for length of 6 cm, and the subpectoral space was then gently dissected out

with finger dissection. A Deaver retractor was placed in the subpectoral space, and the pectoralis muscle fascia was elevated off the chest wall. The operating lights were then focused on the infra clavicular area on the chest wall. Direct examination of the subpectoral space identified the vascular pedicle silhouetted against the transmitted light on the chest wall skin, and was confirmed to traverse along the line drawn on the chest skin.

Once this vascular pedicle was confirmed, the remainder of the skin paddle template was then incised with a number 10 scalpel, circumferentially down to the muscle fascia. Multiple interrupted temporary sutures of 4-0 Vicryl were placed from the skin paddle dermis to the underlying muscle fascia circumferentially.

Using Metzenbaum scissors, the pectoralis major muscle was cut along the medial and lateral borders of the skin paddle to free up the musculocutaneous flap. Small bleeders were coagulated with electrocautery. Bigger intramuscular bleeders were clamped and ligated with 4-0 Vicryl ties. Intercostal perforating vessels were clamped and ligated with 3-0 Vicryl ties.

An incision was made from the mid-clavicular line along the plotted line on the chest wall to the skin paddle. This was carried through the soft tissue down to the pectoralis muscle fascia. Skin hooks were then place on both the medial and lateral borders of this skin incision and elevated. The skin and fat within this portion of the pectoralis major muscle were dissected off of the fascia for 8 cm on each side of this axis and retracted. All bleeding points were coagulated with the needle tip electrocautery.

The vascular pedicle was kept under direct visual contact while the muscle pedicle was then cut to a 6 cm width located equidistant to the vascular pedicle. Small bleeding vessels were coagulated with electrocautery, and larger bleeding vessels were clamped and ligated with 4-0 Vicryl ties. This cutting was continued on both sides of the vascular pedicle all the way to the clavicle.

A 6 cm segment of pectoralis muscle in the infra clavicular portion of the pedicle was excised with Metzenbaum scissors. The muscle fibers were dissected off the thoracoacromial artery and vein and accompanying nerve. The subpectoral fascia underlying the vascular pedicle was left undisturbed.

The entire flap was then transferred over the clavicle, such that only the vascular pedicle and its accompanying subpectoral fascia were overlying the clavicle.

The flap was then transferred under the next skin to the surgical defect in the (location of the wound). In order to avoid tension on the skin paddle, the pectoralis muscle fascia was anchored along the deep fascia of the surgical wound with interrupted sutures of 3-0 Vicryl circumferentially. Once this was secured, the skin paddle was evaluated to make sure that it resurfaced the area without any tension. It was then sutures along its entire perimeter with interrupted sutures of 4-0 nylon.

To close the chest wall donor site of the flap, skin hooks were placed on the lateral chest wall skin and elevated. Using electrocautery, this flap was then dissected along the pectoral fascia overlying the muscle laterally towards the anterior axillary line. This allowed enough of a dissection to permit expansion of the flap and closure of the donor site. A large # 19 round J-P drain was placed on the chest wall. The chest wall closure was then suture with interrupted sutures of 3-0 Vicryl through the deep fascia. The dermis was closed with interrupted inverted sutures of 4-0 Vicryl. The skin was closed with a running suture of 4-0 Vicryl.

The skin paddle reconstruction site was covered with bacitracin (or Silvadene) and xeroform gauze. The chest down the site closure was covered with half-inch Steri-Strips dry gauze dressing and tape.

All sponge and needle counts were determined to be correct. The patient was evaluated to tolerate the procedure well, was awakened, extubated, and taken to the recovery room in satisfactory condition. The estimated blood loss was determined. Any intraoperative complications were noted.

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Fibula Osteocutaneous Flap for Mandibular Reconstruction

88

Stephan Ariyan

Indications

Primary or secondary reconstruction of surgical defects of the mandible

1. Repair of defects following composite resection of tongue/floor of mouth and mandible.
2. Repair of defect following radiation necrosis of mandible.
3. Repair of defect following mandibulectomy for fibrous dysplasia.

Possible Complications

1. Wound separation.
2. Fistula formation.
3. Leg donor site would infection.
4. Ischemic tissue necrosis of skin paddle.

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Essential Steps

Preoperative Markings

1. Measure template dimensions of surgical defect.
2. Draw a line from head of the fibula to lateral ankle.
3. Using a Doppler probe, mark out perforating vessels along the length of the fibula.
4. This is vascular axis.
5. Draw template of surgical defect on the skin along this axis, centered over the perforating vessels.

Intraoperative Details

1. Elevate the leg to get only gravity exsanguination of the leg and inflate thigh tourniquet to 450 mmHg compression—this permits some blood in the vessels to allow for better visualization prevent damage to small vessels.
2. ANTERIORLY: incise the skin only along the anterior border of the skin paddle together with the deep fascia from the lateral compartment musculature (peroneus longus muscle fascia).
3. Use a needle tip electrocautery to dissect lateral compartment muscles (peroneus longus

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and peroneus brevis) from the fibula, leaving 1–2 mm of muscle on the bone to prevent damage to periosteum.
4. Divide the septum between the lateral and anterior compartments (anterior perineal septum) along its entire length.
5. Remove muscles of anterior compartment (extensor digitorum longus and extensor hallucis longus) from the fibula, taking care not to damage the deep peroneal nerve or the anterior tibial vessels.
6. POSTERIORLY: incise the skin along the posterior border of the skin paddle together with the underlying deep fascia from the posterior compartment musculature (soleus and gastrocnemius).
7. The musculocutaneous perforator from the peroneal artery and vein penetrate through the soleus and flexor hallucis longus muscles—therefore, take a portion of these two underlying muscle as a cuff together with the fascia and the fibula to incorporate these perforators.
8. Transect the fibula distally, transect fibula proximally, and place lateral traction on fibula.
9. Ligated and transect vascular pedicle distally.
10. Released tourniquet and evaluate blood flow to bone and skin.
11. Cut through the interosseous membrane anteriorly, while protecting peroneal vessels.
12. If only body of mandible will be reconstructed, measure and cut length of fibula while vessels are still attached.
13. If body and symphysis will be reconstructed, perform osteotomy is an plating while vessels are still attached.
14. Dissect and prepare vessels in the neck from microvascular attachment before transection of vascular pedicle of flap.
15. Vessels are free flap can be attached end-to-end with vessels in the neck, or end to side to carotid artery and internal jugular vein (latter is more preferable in radiated neck).

Postoperative Care

The patient is kept in the intensive care unit over the next 24–48 h for monitoring. If a cutaneous paddle is included with the bone flap, the skin paddle can be monitored for capillary refill by stroking with a cotton-tipped swab. If the bone flap is without a skin paddle, then the monitoring can be done with a Doppler probe, or an implanted Doppler.

Operative Dictation

Diagnosis: Surgical defect of mandible secondary to _____

Procedure: Reconstruction of mandible with fibular osteocutaneous microvascular free flap (__cm × __cm)

Indications

This is a _____ patient who had a resection of mandible for _____ resulting in a defect measuring (__cm × __ cm). The patient is being treated at this time with a definitive reconstruction with a microvascular free flap from the (Left/Right) fibula.

Description of Procedure

The patient was placed in the supine position. General anesthesia was performed with nasotracheal intubation (or tracheostomy). The right leg was then prepped circumferentially. The face and neck were also prepped. The entire operative site was then draped appropriately (The mandible and skin/floor of the mouth was resected-as indicated.).

Prior to the transection of the mandible, a reconstruction plate was bent to accommodate the entire length and surface angles of the

mandible to be resected and adjacent areas for plating. These were conformed to the surface pattern of the mandible. The reconstruction plate was then drilled and screwed to the segments of the mandible proximal and distal to the resection site for subsequent re-plating.

After the mandible was resected, the measured length necessary for reconstruction was outlined on the lateral aspect of the leg. This axis was on the line drawn from the lateral portion of the head of the fibula to the lateral ankle. A Doppler probe was used to identify and mark the perforators to the overlying skin. The pattern and size of the oral/skin defect were outlined on the mid portion of the fibula along this axis.

The leg was elevated for gravity exsanguination, and the thigh tourniquet was inflated to 450 mmHg.

An incision was made circumferentially around the skin paddle down through the underlying muscle fascia. The skin paddle was then sutured to the muscle fascia with interrupted sutures of Vicryl.

At this point, the dissection began along the anterior portion of the skin paddle. The muscles of the lateral compartment (Peroneus Longus and Peroneus Brevis) were dissected bluntly along the under surface of the fascia, and along the posterior crural septum, to the fibula. Using a needle tip electrocautery, these lateral compartment muscles were dissected off the fibula leading a small cuff on the periosteum to protect it from damage. The dissection was then carried through the intramuscular septum (anterior perineal septum). The extensor digitorum longus and extensor hallucis longus muscles were dissected off along the entire length, with care to avoid any damage to the peroneal nerve and accompanying vessels. This revealed the interosseous membrane along the entire length of the fibula.

At this point, the dissection along the posterior border of the skin paddle was carried along the portion underlying the fascia of the soleus muscle. A portion of the soleus and gastrocnemius muscles were left attached to this fascia to preserve the perforating vessels from the peroneal artery and vein. This dissection was carried through the septum between these two muscles until the peroneal vessels were reached.

The attention was directed again to the anterior dissection, and the interosseous septum was incised along its distal length of the fibula, while protecting the peroneal nerve and accompanying vessels.

At a distance of 6 cm above the ankle, the distal fibula was cleared circumferentially, and the deeper tissue was protected with a small malleable retractor. Using a sagittal saw, the distal fibula was transected. At the upper portion of the fibula, the bone was dissected circumferentially approximately 4–6 cm below the head of the fibula. Again using a malleable retractor, the deeper tissues were protected and the fibula was transected with a sagittal saw.

With the two ends of the fibula cut, genital traction is placed laterally on the fibula, and the interosseous septum was then open the along its entire length, identifying the peroneal artery and vein up to the bifurcation of the anterior tibial vessels. Smaller muscular branches were clipped with micro clips and transected.

The tourniquet was then released, and bleeders were controlled with Vicryl ties/vascular clips. The fibula and perimeter of the skin paddle were evaluated to assess the blood flow to the flap.

The reconstruction plate was screwed back on the proximal and distal ends of the mandible and the missing reconstructed segment was then measured. These dimensions and markings of then drawn on the fibula flap. If a straight line segment was required, this length was cut with a sagittal saw. *[If angles were required, each angle was cut with a sagittal saw, protecting the vascular pedicle, and plated with screws before the next angle was cut]*. Once the correct pattern and angulation from the resected specimen was duplicated on the segment of the fibula, this flap was ready for transfer.

The external carotid artery or its branches, including the superior thyroid or ascending pharyngeal, were prepared for the vascular anastomosis. The internal jugular vein was also dissected circumferentially and prepared for the vascular attachment.

Attention was then directed to the leg where the vascular pedicle of the peroneal artery and accompanying veins were clamped transected and ligated with 3-0 silk ties. This timer clock was turned on to record the ischemia time.

The fibula together with its mandibular plate were brought up to the mandible and screwed to the proximal and distal segments of the mandible. A small vascular clamp was placed on the external carotid/or superior thyroid/or ascending pharyngeal artery. The peroneal artery was then sutured (end–side to the external carotid/end-to-end to the superior thyroid/end-to-end to the ascending pharyngeal) with interrupted sutures of 8-0 nylon. The vascular clamp on the artery was released and the flow through the fibula flap was evaluated for adequacy.

The vascular clamp was placed again on the artery to stop the flow for the venous repair. Two vascular clamps were placed on the internal jugular vein at the point of vascular attachment. Small circular segments were excised in the wall of the internal jugular vein and each of the 2 venae comitantes were then separately anastomosed end-to-side to the internal jugular vein with interrupted sutures of 8-0 nylon.

The vascular clamps were removed from the internal jugular vein and return flow through the anastomosis was evaluated. The arterial clamp was removed and blood flow through the flap was evaluated. The ischemia time of the vascular transfer was noted and recorded.

The skin paddle was cut to the size and shape of the defect in the intraoral region/jaw. The skin paddle was then sutured to the intro oral mucosal borders/skin borders of the jaw with interrupted sutures.

A large # 19 suction drain was placed under the mandible into this cavity.

The intention was then directed to the donor site of the leg. Complete and adequate hemostasis was ensured before the skin wound was closed. A large # 19 suction drain was placed percutaneously into this cavity. The posterior end was dissected off the underlying fascia of the gastrocnemius muscle for distance of 4–6 cm along its entire length of the incision. This was then advanced anteriorly and sutured to the anterior border of the skin incision with interrupted inverted dermal sutures of 3-0 Vicryl. The entire length of the skin closure was then reinforced with multiple surgical staples. The dorsalis pedis and posterior tibial pulses were evaluated for adequacy, as well as flow and circulation to the toes.

Attention was then directed back to the jaw. Good circulation to the flap was ensured before closure of the skin wound. The remaining skin wounds were then closed with interrupted inverted dermal sutures of 4-0 Vicryl. The skin of the jaw was sutured with running 4-0 nylon.

All sponge and needle counts were correct. The patient tolerated the procedure well, was awakened, extubated, and taken to the recovery room in satisfactory condition. The estimated blood loss was _____. There was no intraoperative complication.

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Free Parascapular Flap for Head and Neck Reconstruction

89

Katherine Fedder and Chetan S. Nayak

Indications

1. Reconstruction of large complex composite defects of the head and neck requiring skin, muscle, and thin bone.
2. Need for an osseous or osteocutaneous free flap in patients with contraindications to other osteocutaneous flaps, such as severe peripheral vascular disease precluding the use of fibula free flap.

Essential Steps

Preoperative Markings

1. Outline the landmarks of the scapula including lateral border, tip, and spine.
2. Identify the muscular triangle between teres major, teres minor, and long head of triceps as a depression in the soft tissue along the lateral border of the scapula just slightly superior to the midpoint between spine and tip. Circumflex scapular vessels traverse this triangular space and their location can be confirmed with Doppler.
3. A parascapular flap should be marked out as an ellipse centered with its long axis along the lateral border of the scapula and with the superior aspect encompassing vessels at the triangular space. The inferior aspect of the flap can extend beyond the scapular tip, and large chimeric flaps can be harvested to include serratus or latissimus muscles if desired.

Intraoperative Details

1. Patient placed supine on beanbag on operative table for induction. Avoid IVs in the ipsilateral arm as it will be included in the sterile field.
2. General anesthesia induction with intubation. Secure the endotracheal tube with suture to prevent extubation with patient repositioning during the case.
3. Shave ipsilateral chest, axilla, and back to midline. Identify parascapular flap landmarks, mark out skin paddle, and prep entire surgical site including ipsilateral chest, arm, axilla, and skin to midline of the back. Place sterile drapes underneath patient as far as

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possible to keep site sterile during resection. Return patient to supine position, cover the ipsilateral arm in a stockinette and place on a draped arm board.
4. Once resection is complete, roll the patient to lateral decubitus position with an axillary roll, inflate the beanbag, and place the sterile arm on a padded Mayo stand.
5. Make skin incision at inferior aspect of the flap down through subcutaneous tissue to muscular fascia. Begin to raise flap superficial to the muscular fascia.
6. Identify latissimus dorsi and retract inferiorly to expose teres major.
7. Raise flap to level of superior border of teres major and identify circumflex scapular pedicle exiting triangular space. Descending branch of circumflex scapular artery should be incorporated on the deep side of the skin paddle.
8. Complete skin incision at superior aspect of the flap down to muscular fascia. Raise the flap in suprafascial plane over deltoid then identify pedicle again at inferior aspect of teres minor.
9. Dissect pedicle proximally toward axilla. Divide teres major for improved exposure or in osteocutaneous flaps, making cut lateral to the scapular border to preserve bony perforators. For harvest of scapular tip, trace thoracodorsal vessels inferiorly and identify and preserve angular artery. Ligate thoracodorsal pedicle distal to this point along with any muscle perforators.
10. For bone harvest, retract infraspinatus medially and skeletonize dorsal aspect of scapula 2 cm medial to lateral border. Make bony cuts with oscillating saw up to 1 cm inferior to glenohumeral joint. Distract bone segment and sharply divide subscapularis.
11. Complete pedicle dissection into axilla as far as the takeoff of subscapular vessels off axillary artery and vein if needed.
12. Irrigate wound, reapproximate cut edge of teres major to cut scapular border, and place two suction drains into axilla and deep to the skin flaps. Skin flaps are widely undermined and closed primarily with a resultant linear scar.

Postoperative Care

1. Routine drain management.
2. Immobilize shoulder in soft sling for 5 days, then begin physical therapy.
3. Remove skin staples or sutures at 14 days.

Note These Variations

1. A scapular flap can also be harvested as a transverse ellipse centered over the transverse branch of the circumflex scapular artery parallel to the scapular spine. Dissection for this flap proceeds in a medial to lateral fashion with similar technique described for the parascapular flap. The lateral border of the scapula can be harvested with either skin paddle geometry due to the mobility of the bone relative to the overlying skin.
2. A combined bilobed skin paddle can be harvested by identifying and preserving both descending and transverse branches of the circumflex scapular vessels. The skin closure requires extensive undermining and can have increased tension with increased risk of postoperative scar widening or superficial wound dehiscence.
3. This free flap has multiple variations which can be tailored for specific defects. Along with large available skin paddle and adequate bone stock, portions of teres major, serratus anterior, latissimus dorsi, and rib can be harvested based on the subscapular system.
4. For head and neck reconstruction, supine positioning during resection often precludes simultaneous harvest at the scapula site. Once resection is complete, the patient can be quickly repositioned if the harvest site was prepared prior to initiation of the case.

After flap harvest, donor vessels can be prepared on a back table while the donor site is rapidly closed.

Possible Complications

1. Large cutaneous defects can have increased tension upon closure with some risk of wound dehiscence or scar widening.
2. Shoulder weakness is often reported but improves with physical therapy. Preservation of the glenohumeral joint is essential to avoid significant shoulder dysfunction.

Operative Dictation

Diagnosis: Squamous cell cancer of oral cavity involving the mandible with a large composite defect after oncologic excision
Procedure: Osteocutaneous parascapular free flap.

Indication

This is a _____ male with oral cavity squamous cell carcinoma that involves the mandible requiring en bloc excision. The head and neck surgical team has extirpated all of the tumor and involving structures including a portion of the mandible. This leaves a sizable composite defect that requires the transfer of osteocutaneous parascapular free flap for reconstruction of oral soft tissues as well as the mandible. This has been anticipated and discussed with the patient before the excision commenced. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in the supine position. Timeout among operating room staff was performed. The patient was sedated and intubated by the anesthesia team. The skin of the shoulder, back, and armpit was shaved. The patient was prepped and draped for surgery to the shoulder. The resection was then completed by the resecting team and was dictated separately. The patient was then turned to lateral decubitus position with an axillary roll placed. A parascapular flap was marked out to include the triangular space centered over the lateral border of the scapula. Incision was made inferiorly and the skin flap was raised inferior to superior in a plane superficial to the muscular fascia of the latissimus and teres major. The circumflex scapular pedicle or its descending branch was identified traveling through the triangular space at the superior border of the teres major. This muscle was then divided. The skin incisions were then completed superiorly and raised superficial to the muscular fascia overlying deltoid and teres minor until pedicle was again identified inferior to teres minor in the triangular space. The cut edge of the teres major and long head of triceps were then retracted superiorly and the circumflex scapular vessels are traced proximally. Perforators to the bone were preserved. Once the thoracodorsal vessels were identified at the takeoff from the subscapular pedicle, they were traced inferiorly and muscular branches were divided. The angular artery was identified and preserved, and the thoracodorsal vessels were divided distal to this branch. The vascular pedicle was traced proximally to the subscapular system as far as the takeoff from axillary vessels. The dorsal surface of the scapula was skeletonized 2 cm from the lateral border from the tip to a point 1 cm inferior to the glenohumeral joint using bovie cautery. Bone cuts were then made with oscillating saw and the underlying subscapularis divided sharply. Any remaining soft tissue attachments were divided. The pedicle was ligated proximately. The flap was transferred to a Mayo stand in order to clean vessels. The flap inset at the soft tissue defect and microvascular anastomoses were performed. After securing patent vessels anastomoses, inset was completed and closure over suction drains (applied away from the pedicle) were performed.

Attention was turned back to the donor site. The wound was then irrigated copiously with saline and hemostasis was obtained. Skin flaps were then widely undermined to allow for tension free primary closure. The cut edge of the teres major was sutured to the cut edge of the lateral border of scapula. Two Jackson–Pratt suction drains were then placed in the axilla and under the skin flaps and secured to the skin through separate stab incisions. Deep tissue was closed in an interrupted fashion with vicryl suture and the skin was closed in a linear fashion with nylon suture or staples.

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Free Anterolateral Thigh Flap for Pharyngoesophageal Reconstruction

90

Amir Ibrahim, Peirong Yu, and Edward I. Chang

Indications

Acquired partial or total pharyngoesophageal defect post oncologic resection (laryngopharyngectomy) with or without neck skin defect.

Possible Complications

Recipient Site

1. Flap failure
2. Partial flap necrosis
3. Hematoma/Bleeding
4. Neck infection
5. Delayed wound healing
6. Fistula
7. Stricture
8. Speech and swallow dysfunction

Donor Site

1. Seroma
2. Wound infection
3. Delayed wound healing
4. Hematoma

Other Complications

1. Cardiac and pulmonary
2. Stroke

Essential Steps

Preoperative Markings

1. Preoperative markings of the donor thigh are made with the patient in the supine position. Flap harvest can occur either during or after the oncologic resection.
2. A line is drawn connecting the anterior superior iliac spine and the superolateral corner of the patella. Midpoint of the line is marked. Doppler examination 3-cm radius around the midpoint to identify perforator B. Then perforators A and C are examined in a 3-cm radius 5 cm proximal and 5 cm distal to the perforator B.
3. For circumferential defects, a flap width of 9.4 cm is designed to achieve a 3-cm-diameter

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tubed neopharynx. For partial defects, flap width was calculated by subtracting the width of the remaining pharyngeal mucosa from 9.4 cm.
4. Two cutaneous perforators are included in the flap design whenever possible so that the flap could be divided into two skin islands, one for reconstruction of the pharyngoesophageal defect and one for monitoring or for anterior neck resurfacing.
5. To decrease the risk of stricture, at the distal anastomosis, the anterior cervical esophageal end is incised longitudinally for 1.5 cm to spatulate the anastomosis.
6. An extra width of fascia was taken during flap harvesting so that the fascia could be wrapped around the flap to reinforce the suture lines to minimize of dehiscence, leakage and fistula.

Intraoperative Details

1. An appropriate time-out, prepping and draping are performed.
2. Attention is directed to the thigh. Medial skin incision is performed according to preoperative marking.
3. The fascia is incised with additional cuff and elevated off the underlying muscles until identifying the perforators.
4. Dissection between the rectus femoris and vastus lateralis muscle of the main pedicle is performed.
5. Perforators are then carefully dissected from the vastus lateralis muscle.
6. Posterior incision is made and dissected down to the fascia that is raised off the underlying vastus lateralis muscle until the perforators are approached.
7. The skin paddle is split into two separate skin paddles, each based on a distinct perforator.
8. Attention is directed to the neck to prepare the donor vessels.
9. The flap is rendered ischemic for transfer.
10. Flap is inset and the distal anastomosis is spatulated.
11. Microvascular anastomosis is performed.
12. Inset completion is done by wrapping the fascia to provide a second layer for closure of the pharyngoesophageal defect.
13. Hemostasis, irrigation, are drains placed.
14. Second skin paddle is inset at the neck skin defect.
15. Neck and thigh wounds closure after checking Doppler signal.
16. A dopplerable arterial and venous signal are checked in the flap prior to patient transfer to PACU or ICU.

Postoperative Care

1. Monitor vital signs, pain, urine output and drainage.
2. Flap check (color, bleeding, temperature, capillary refill, Doppler signal).
3. Antibiotics prophylaxis therapy for 2 doses postoperatively.
4. Drains and wound care.

Operative Dictation

Diagnosis: Acquired pharyngoesophageal and neck skin defect.

Procedure: Free Anterolateral Thigh Flap for Pharyngoesophageal Reconstruction

Indications

This is an X-year-old M/F with a history of laryngeal cancer treated with chemo-radiation. The patient developed progressive disease is undergoing salvage surgery with a total laryngopharyngectomy. The patient will certainly require free tissue reconstruction of the defect. Risks and benefits of the operation are explained and informed consent is obtained. All questions are answered.

Description of the Procedure

The patient was taken to the operating room, placed in supine position, given preoperative antibiotics, placed in sequential compression devices, and all pressure points were appropriately padded. The patient was intubated, prepped and draped in standard sterile fashion. An appropriate time-out was performed identifying the correct patient and operation.

Attention was directed to the thigh. Markings were performed as previously stated. Medial skin incision was performed and then dissected down with electrocautery to the deep investing muscle fascia of which a cuff was harvested with the flap. The fascia was incised and elevated off the underlying muscles with gentle blunt dissection until identifying the perforators that were marked at the skin level with 6-0 Prolene suture. Dissection between the rectus femoris and vastus lateralis muscle was done until the main pedicle (descending branch of the lateral circumflex femoral artery) was identified and protected. Whether septocutaneous or musculo-cutaneous, perforators were then carefully dissected from the vastus lateralis muscle. The main pedicle was dissected as proximally as possible to the first branch to the rectus femoris muscle to gain additional length. A number of muscular branches were ligated and divided.

According to confirmed defect measurements, a posterior incision was made and dissected down to the fascia again with electrocautery and harvested a cuff of fascia. The fascia was then raised off the underlying vastus lateralis muscle until the perforators are approached that were carefully dissected consecutively. At this point, the entire flap was isolated on the main pedicle. The skin paddle was split into two separate skin paddles, each based on a distinct perforator; a doppler signal was double checked before splitting. The distal continuation of the main pedicle was ligated and divided.

Attention was directed to the neck to prepare the donor vessels. Whenever an adequate artery and vein were dissected and rendered ready for microvascular anastomosis, attention was directed again to the thigh and the flap was rendered ischemic for transfer. The flap was exsanguinated with gravity and flushed with heparinized saline. The flap was inset using 3-0 Vicryl suture in a simple interrupted fashion, paying careful attention to inset the flap to all of the edges of the mucosa. In order to widen the cervical esophageal anastomosis, the distal anastomosis was incised longitudinally for 1.5 cm to spatulate the anastomosis. Once the flap was entirely inset, the mouth is flushed to check for any major leakage.

Microvascular anastomosis was performed using the operative microscope. Once completed, perforator Doppler on the skin was confirmed. Anastomosis was checked. Inset completion was done by wrapping the fascia to the surrounding soft tissue providing a second layer for closure of the pharyngoesophageal defect. The neck was copiously irrigated with antibiotic solution. Two 15-French drains were placed and secured in place with 2-0 nylon sutures.

The second skin paddle was inset at the neck skin defect. The skin paddle was oriented to make certain there was no twist or kink in the perforator. A dopplerable signal is checked prior to inset. Skin was closed in layers using 3-0 Monocryl in the deep dermal layer and a 4-0 Prolene running suture on the skin. During this time, the donor site was closed simultaneously. The thigh donor site was irrigated with normal saline. Hemostasis was achieved. A single 19-French drain was placed and secured in place with a 2-0 nylon suture. Scarpa's layer was closed with 2-0 Vicryl suture, and the deep dermal layer is closed with a 3-0 Monocryl buried suture. A 4-0 Monocryl subcuticular stitch was used on the skin. The incision was dressed with antibiotic based dressing. The thigh was then wrapped in an elastic bandage. Dopplerable arterial and venous signal were checked in the flap prior to patient transfer to PACU or ICU.

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Supercharged Jejunum for Esophageal Reconstruction

91

Amir Ibrahim, Pierre Sfeir, and Roman Skoracki

Indications

1. Immediate or delayed reconstruction of total esophageal defect or esophagogastric discontinuity (post oncologic resection, caustic ingestion, recurrence or complications after esophagectomy, esophageal obstruction post esophagectomy, tracheo-esophageal fistula, defects to base of tongue, or other reasons) in the following clinical scenarios:
   (a) Unavailable stomach (failed Ivor Lewis pull-up surgery, prior gastric surgery or gastrectomy required, gastric necrosis, tumor involving stomach, gastric radiation, tumor recurrence following gastric interposition).
   (b) Severe reflux symptoms.
   (c) Unavailable colon (previous surgery, intrinsic disease, diverticulitis, diverticulosis, polyps, cancer).
   (d) Colon use disadvantages: redundancy and troublesome food transit, variable vascular anatomy, atherosclerosis with consequent colonic necrosis.
   (e) Prior omental flap.

Possible Complications

1. Respiratory failure, pneumonia.
2. Fistula, radiographic leak, stricture.
3. Arrhythmia, pericardial effusion, congestive heart failure.
4. Abdominal wound infection, entral hernia.
5. Ileus, visceral perforation.
6. *C. difficile* colitis.
7. Flap arterial ischemia or venous congestion.

Essential Steps

Preoperative Markings

No markings are needed.

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Intraoperative Details

1. Esophagectomy with or without gastrectomy (when necessary) completed by thoracic and/or general surgery teams.
2. Esophageal defect is measured.
3. Choice and preparation of donor vessels in the neck or upper thoracic area.
4. In delayed cases and substernal delivery, hemi-manubrium, clavicular head, and first rib resection are performed.
5. Intra-abdominal mobilization and harvest of jejunal conduit.
6. Identification of the ligament of Treitz.
7. Using fiberoptic light, mesentery is transilluminated and the vascular anatomy is elucidated.
8. The first mesenteric vascular branch is preserved.
9. The second mesenteric branch is dissected, divided and preserved for supercharging.
10. Unfurling and straightening of the jejunal conduit is performed by dividing the mesentery between the second and third branches up to the serosal border. If more length is needed, the third branch can be ligated and divided. Tertiary arcade vessels between the third and fourth mesenteric branches are preserved.
11. Choice and preparation of conduit route (retrocardiac or substernal).
12. Flap delivery is performed.
13. Microsurgical anastomoses are performed. Implantable Doppler is placed.
14. Any excess length in the proximal revascularized jejunum is removed to minimize redundancy.
15. A monitor segment is created and exteriorized through the neck wound.
16. Esophagojejunal anastomosis is performed in the neck. A nasogastric tube is placed under direct vision.
17. Intra-abdominal intestinal continuity is reestablished by general or thoracic surgery team.
18. A feeding jejunostomy tube is placed.
19. Closure of wounds under suction drains.

Postoperative Care

1. ICU patient monitoring is continued until the patient is stable enough for transfer to the ward.
2. Flap is checked through the monitoring segment (color and peristalsis) and Doppler signal. Monitoring is performed every 1 h for the first 48 h followed by check every 2 h for the consecutive 48 h then check every 4 h until the monitoring segment is removed.
3. 7 to 10 days later, the mesentery of the monitoring segment is ligated bedside and the segment is removed.
4. A modified barium swallow is performed 2 weeks post-surgery; if no leak is detected, clear liquid diet is allowed and slowly advanced to a postgastrectomy diet.

Operative Dictation

Diagnosis: Esophago-gastric discontinuity.

Procedure: Supercharged jejunum for esophageal reconstruction.

Indications

This is an X-year-old male/female presenting with total esophageal defect and esophago-gastric discontinuity and one of the above mentioned indications/conditions. Benefits and risks of the procedure including the rates of morbidity and mortality as well as alternatives are discussed in detail with the patient who would like to proceed.

Description of the Procedure

After obtaining an informed consent the patient was taken to the operating room. He was placed in supine position. A proper time out was performed. Sequential compression devices were placed. General anesthesia was instituted. Perioperative antibiotics were administered.

Pressure points were padded. Foley catheter was inserted. The patient was prepped and draped in the sterile surgical usual fashion.

Through an abdominal and cervical approaches (as in a transhiatal esophagectomy) with or without a right thoracotomy approach, the thoracic surgery with or without the general surgery team completed the total esophagectomy, when necessary. The plastic surgery was then involved. In collaboration with the thoracic surgery, the esophageal defect was measured. The internal mammary donor vessels were chosen, dissected and prepared for microsurgical anastomoses. *(Other donor vessels can be transverse cervical vessels, external carotid artery and its branches, Internal or External jugular vein and their branches.)* The hemi-manubrium, clavicular head, and first rib were resected to enlarge the thoracic inlet and avoid constriction, and to allow better donor vessels exposure and anastomoses.

Attention was directed to the abdomen for harvesting and mobilization of the jejunal conduit flap. The ligament of Treitz was first identified. The proximal small bowel was explored to ensure that no intrinsic disease or iatrogenic injury existed. Using fiber-optic light, the proximal and mid-jejunum mesentery was examined through transillumination and the vascular anatomy is elucidated. The first mesenteric vascular branch was identified and preserved to maintain blood supply to the distal duodenum and proximal jejunal segment.

The second mesenteric branch was dissected down to its origin form the superior mesenteric artery, divided and preserved for supercharging of the proximal flap segment. This was followed by unfurling and straightening of the jejunal conduit that was achieved by dividing the mesentery between the second and third branches up to the serosal border, where the antimesenteric border was maintained intact. This aided in reducing the natural sinusoidal properties of the small bowel and its redundancy *(If more length was needed, the third branch can be ligated and divided.)*. Tertiary arcade vessels between the third and fourth mesenteric branches were preserved to maintain the blood supply of that bowel segment based on the fourth vascular branch. Whenever the required length was obtained, the jejunum was divided proximally with a linear GI stapler. 30–40 cm of bowel distal to the ligament of Treitz was usually preserved.

Choice and preparation of conduit route for flap transfer were performed. In immediate reconstruction, a retrocardiac (orthotopic) route was chosen *[while in delayed and more complex reconstruction, a substernal (heterotopic) route was considered more suitable.]* In either case, flap delivery was performed through a sterile camera drape to protect the conduit and its delicate arcade vessels. Before dividing the vascular pedicle and delivering the jejunal flap, the donor neck or upper thoracic vessel were checked for adequate preparation and flow. Microsurgical anastomoses were performed. After ensuring adequate viability of the jejunal conduit, any excess length in the proximal re-vascularized jejunum was removed to minimize redundancy. A monitoring segment was creating by using the proximal 3–5 cm of jejunum based on one or two terminal arcade branches and exteriorized through the neck wound. Esophagojejunal anastomosis was performed in the neck using a single layer of 3-0 vicryl or polydioxanone suture in an end-to-end fashion. In less frequent occasions of total laryngopharyngectomy, defects, an end-to-side anastomosis was required due to size discrepancy between the jejunal conduit and the pharynx or base of tongue. Before completing the bowel anastomosis and under direct vision, a nasogastric tube was inserted through the conduit into the gastric remnant.

Attention was directed back to the abdomen by the general or thoracic surgery. Intra-abdominal intestinal continuity was reestablished through a gastro-jejunal anastomosis or through a Roux-en-Y jejuno-jejunal anastomosis if a gastrectomy was performed. A feeding jejunostomy tube was placed.

19-French abdominal and 15-French neck suction drains were placed. All wounds were closed in layers. Interrupted purse-string sutures were placed into the mesentery of the monitoring segment of the jejunal conduit and left untied for future tying and removal of that segment bedside whenever no monitoring was required anymore.

After the procedure the patient was transferred intubated to ICU in stable conditions.

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Part VI

Hand

Cross-Finger Flap

92

Nicholas Galardi and Morad Askari

Indications

1. Volar defect of the finger or thumb.

Possible Complications

1. Flap necrosis.
2. Skin graft failure.
3. Joint stiffness.
4. Undesirable scarring.

Essential Steps

Preoperative Markings

1. Dimensions of the defect to be covered are determined and transposed onto dorsum of adjacent finger where donor flap will be raised.
2. The flap is based on the side of the donor finger nearest the defect and extends on the dorsal aspect of the donor finger toward the far midaxial line.

Intraoperative Details

1. Patient is sedated and regional/peripheral nerve block is administered.
2. Patient is sterilely prepped and draped.
3. Tourniquet is applied to the involved upper arm, with pressure that allows for exsanguination and a bloodless operating field.
4. The wound is debrided and irrigated.
5. Incision is made along the markings carried down to the level of paratenon.
6. Flap is then undermined toward its base with release of Cleland's ligaments for extra mobility.
7. The tourniquet is deflated and hemostasis achieved with bipolar cautery.
8. Full-thickness skin graft is then harvested (usually obtained from antecubital fossa or the groin).

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9. The flap is inset into the palmar wound defect using 5-0 or 6-0 nylon sutures.
10. Skin graft is used to cover the flap donor site using 5-0 plain gut sutures.
11. The skin graft and sutures sites are covered with a nonadherent dressing and sterile gauze.
12. The donor and recipient fingers are secured against each other using a splint and non-compressive wrap.

Postoperative Care

1. First dressing change is performed at 7 days to assess flap and graft viability.
2. The flap can be safely divided after 14–21 days followed by daily dressing changes until wounds heal by secondary intention (other option is to inset the divided portion of flap).

Operative Dictation

Diagnosis: soft tissue defect of volar aspect of ring finger middle phalanx.
Procedure: cross-finger flap.

Indication

This is a ____ right hand dominant female with degloving injury of the volar aspect of the right ring finger middle phalanx necessitating soft tissue coverage. A cross finger flap from the dorsal aspect of the right middle finger at the same level is selected for the reconstruction. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

The patient was brought to the operating room where time-out was performed to identify the patient and the appropriate procedure. Monitored sedation and a regional/peripheral nerve block were administered by the anesthesia team. The right upper extremity was prepped and draped in the usual sterile fashion after a tourniquet was applied to the upper arm. Surgical time-out was done. The tourniquet was inflated after exsanguination. Irrigation and debridement of the wound was performed. An incision was made along the predesignated markings on the dorsal aspect of the right middle finger and was carried down to the level of paratenon. The flap was then undermined toward its base with release of Cleland's ligaments to give extra mobility. The tourniquet was deflated and hemostasis achieved with bipolar cautery.

A full-thickness skin graft (FTSG) was then harvested from the patient's right antecubital fossa using a 15 blade scalpel. The flap was inset into the palmar wound defect of the right ring finger using 5-0 nylon sutures. The FTSG was then sutured at the flap donor site using 5-0 plain gut sutures. The skin graft donor site was closed using 4-0 nylon sutures. The skin graft and sutures sites were covered with a non-adherent dressing and sterile gauze. The two involved fingers were then immobilized in a palmar splint extending across the hand and wrist.

First Dorsal Metacarpal Artery Flap 93

Nicholas Galardi and Zubin J. Panthaki

Indications

1. Used as sensory flap for coverage of skin defects over the palmar surface of the thumb.
2. Reconstruction of dorsal thumb defects.
3. Reconstruction of the 1st web space (i.e., Contracture).

Possible Complications

1. Flap vascular compromise.
2. Index finger donor site morbidity such as stiffness, cold intolerance, unfavorable scarring, or neuroma.

Essential Steps

Preoperative Markings

1. The normal course of the first dorsal metacarpal artery is marked out along the dorsal aspect of hand along the first intermetacarpal space such that the skin of the MP joint is preserved; a lazy "S" incision is then drawn on the dorsum of the second metacarpal.
2. The flap is then drawn at the dorsum of the index finger over the proximal phalanx according to the size of the defect to cover; the width of the flap should not extend beyond the radial and ulnar mid-axial lines.

Intraoperative Details

1. Patient is sedated and regional/peripheral nerve block is administered.
2. Patient is sterilely prepped and draped.
3. Tourniquet is applied to the involved upper arm, with pressure that allows for exsanguination and a bloodless operating field.
4. Irrigation and debridement of the wound is performed.
5. Incision along the predesignated markings is made.

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6. The flap is then harvested from distal to proximal and radially to ulnarly preserving the paratenon overlying the extensor apparatus including the first dorsal metacarpal artery and a branch of the sensory radial nerve.
7. The pedicle flap is carried out proximally until reaching the most proximal point which lies between the bases of the first and second metacarpals (this also signifies the pivot point of the flap).
8. Safe dissection is achieved by including the radial shaft periosteum of the second MC bone along with the fascia of the first dorsal interosseous muscle.
9. Once the pedicle is mobilized the tourniquet is deflated to assess vascular flow of the flap.
10. The flap is then inset into the defect with 4-0 nylon sutures.
11. A full-thickness or split-thickness skin graft is then obtained from the patient's antecubital fossa or the groin and placed at the donor site; sutured with 4-0 chromic sutures.
12. The skin graft is covered with a tie-over bolster dressing, a non-adherent dressing is placed over the flap and the entire hand is covered with fluffed gauze dressing; a small window is made distally to allow assessment of the flap.

Postoperative Care

1. Complete dressing change done at 7–10 days post-op.
2. Start range-of-motion at this time as well.

Operative Dictation

Diagnosis: thumb pulp defect.
Procedure: first dorsal metacarpal artery flap.

Indication

This is a ____ right hand dominant male with significant defect 2×2 cm of the thumb pulp necessitating soft tissue coverage. The sensate first dorsal metacarpal artery flap is chosen for the reconstruction. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

The patient was brought to the operating room where time-out was performed to identify the patient and the appropriate procedure. Monitored sedation and a regional/peripheral nerve block were administered by the anesthesia team. The left/right upper extremity was prepped and draped in the usual sterile fashion after a tourniquet was applied to the upper arm. Tourniquet was inflated after exsanguination. Irrigation and debridement of the wound was performed. An incision was made along the predesignated markings. The flap was then raised in a distal to proximal fashion down to a level preserving the paratenon overlying the extensor apparatus and including the first dorsal metacarpal artery and a branch of the sensory radial nerve. The pedicle flap was carried out proximally making sure to include the radial shaft periosteum of the 2nd MC bone along with the fascia of the first dorsal interosseous muscle. Once the pedicle was mobilized the tourniquet was deflated to assess vascular flow of the flap. The flap was tunneled, transposed, and inset into the thumb defect with 4-0 nylon sutures.

A full-thickness skin graft was then harvested from the patient's antecubital fossa and placed over the donor site wound and secured with 4-0 chromic sutures. The skin graft defect was closed with 4-0 nylon sutures. The skin graft was then covered with a tie-over bolster dressing and a non-adherent dressing was placed over the flap. The entire hand was covered with fluffed gauze dressing leaving a small window distally to allow for assessment of flap viability.

Open Triangular Fibrocartilage Complex Repair

94

Keith Aldrich Jr. and Harris Gellman

Indications

1. Triangular fibrocartilage complex (TFCC) tear that fails to respond to conservative treatment.
2. Open repair of peripheral tear is recommended when there is distal radioulnar joint (DRUJ) instability and TFC tear from ulnar fovea.

Essential Steps

Preoperative Markings

1. Identify the interval between the fifth and sixth dorsal compartments.
2. Mark a 5 cm longitudinal line over the distal ulna along this interval.

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Intraoperative Details

Peripheral Tear

1. Placed in supine position with upper extremity on hand table. Tourniquet on upper arm.
2. General anesthesia or Monitor Anesthesia Care.
3. Diagnostic arthroscopy performed to diagnose tear.
4. Incision made over distal ulna over extensor digiti minimi (EDM).
5. L-shaped capsulotomy performed.
6. TFCC repaired through bone tunnels using 3-0 PDS suture.

Peripheral Tear with Ulnar Styloid Fracture

1. Placed in supine position with upper extremity on hand table. Tourniquet on upper arm.
2. General anesthesia or Monitor Anesthesia Care.
3. Diagnostic arthroscopy performed to diagnose tear.
4. Incision made over distal ulna between the EDM and the extensor carpi ulnaris (ECU).
5. Styloid repaired with choice of fixation based on fragment size.

Postoperative Care

1. Sugar tong splint applied at the completion of surgery with forearm in neutral position.

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2. After 2 weeks, sutures are removed and patient placed into long-arm cast for another 2 weeks then 2 additional weeks in a short arm cast.
3. Cast is removed at 6 weeks, patient is placed in protective forearm splint, and gentle range of motions exercises are started with restriction of radial–ulnar deviation for 3 months after surgery. Radial–ulnar deviation will be restored as the patient works on pronation–supination and wrist flexion–extension. Radial–ulnar deviation will place stress on the TFCC repair and may result in rupture of the repair.

Possible Complications

1. Failure to diagnose and treat concomitant injuries.
2. Injury to dorsal sensory nerves.
3. Loss of wrist motion.
4. Failure of repair/nonunion of ulnar styloid.

Operative Dictation

Diagnosis: TFCC ulnar peripheral tear (associated ulnar styloid fracture).
Procedure: open TFCC repair.

Indication

This is a _____ with peripheral TFCC tear that has failed conservative treatment. MRI was obtained documenting _____. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time out among operating room staff was taken. Monitor Anesthesia Care as instituted. Preoperative antibiotics were given. The limb was prepped and draped in the standard sterile fashion. The limb was exsanguinated and tourniquet was inflated.

The 5 cm skin incision was made between the fifth and sixth extensor compartments over the dorsal ulnar head. The subcutaneous tissue was bluntly dissected taking care to carefully mobilize the dorsal ulnar sensory nerve branches. The extensor digiti minimi (EDM) sheath was incised and the EDM was mobilized. An "L"-shaped capsulotomy was made. The longitudinal limb began at the ulnar neck and extended to the edge of the sigmoid notch. The origin of the dorsal radioulnar ligament from the sigmoid notch was preserved. The transverse limb was then made along the proximal edge of the dorsal radioulnar ligament and extended to the radial margin of the extensor carpi ulnaris sheath. The capsule was elevated to expose the ulnar head and neck. The triangular fibrocartilage complex (TFCC) tear was visualized. The TFCC distal surface was exposed by creating a transverse ulnocarpal capsulotomy along the distal edge of the dorsal radioulnar ligament. The insertion site of the TFCC into the fovea was debrided to bleeding bone. 0.045-in. Kirschner wire was used to create 3 bone tunnels in the distal ulna extending from the dorsal aspect of the ulnar neck to the fovea. Two horizontal mattress sutures using 3-0 PDS were passed from distal to proximal through the ulnar aspect of the TFCC periphery. These sutures were then passed through the three bone tunnels from inside out and tied over the ulnar neck with the joint reduced and the forearm in neutral rotation. The dorsal distal radioulnar joint (DRUJ) capsule and retinaculum were closed together as a single layer with a 3-0 vicryl sutures. The skin was closed with a 4-0 nylon suture in an interrupted fashion. The wound was dressed in the usual manner. A sugar tong splint was applied with the forearm in neutral position [1, 2].

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Extensor Retinaculum Capsulorrhaphy (Herbert Sling)

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Keith Aldrich Jr. and Zubin J. Panthaki

Indications

1. Ulnocarpal instability with symptoms such as ulnar-sided pain, weakness, and supination deformity.
2. Failed conservative treatment, such as supportive braces and strengthening except for individuals with high demand on strong wrist function in weight-bearing supination (golfers, tennis players, certain skilled labor professions).

Essential Steps

Preoperative Marking

1. Identify the fifth dorsal compartment of the wrist.
2. Identify the tip of the ulnar styloid, and the triquetrum.
3. Mark a longitudinal incision over the fifth dorsal compartment from the distal ulna proximally to the triquetrum distally.

Intraoperative Details

1. Placed in supine position with arm on arm table.
2. Tourniquet applied to upper arm.
3. General anesthesia or Monitor Anesthesia Care.
4. Will need arthroscopy setup if planning for arthroscopic examination of the wrist.
5. Perform diagnostic maneuvers to assess for concomitant wrist pathology along with ulnocarpal instability.
6. Incise skin and bluntly dissect to extensor retinaculum of fifth dorsal compartment.
7. Incise extensor retinaculum between the fourth and fifth compartment without entering fourth compartment.
8. Ulnar based flap of 2/3 of retinaculum is created.
9. Extensor digiti quinti (EDQ) is to remain dorsal to retinacular flap.
10. Wrist placed in neutral position and distal radial ulnar joint (DRUJ) reduced with downward pressure on ulna.
11. Retinacular flaps transposed proximally and sutured to the periosteum of the ulnar border of the distal radius.

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12. Retinaculum is carefully imbricated in an oblique fashion from distal-ulnar to radial-proximal.
13. EDQ is relocated dorsally to the flap.

Postoperative Care

1. Patient immobilized in a sugar tong splint then converted to thumb spica muenster-style cast for a total of 6 weeks at first postoperative visit.
2. After the first 6 weeks, the patient is converted to a removable wrist-based thumb spica splint.
3. Gentle motion is begun after 6 weeks of immobilization.
4. No heavy lifting for 3 months after surgery.

Possible Complications

1. Early heavy lifting may loosen Herbert sling.
2. Failure to imbricate retinacular flap can lead to loosening and loss of ulnocarpal stability.
3. Dorsal branch of ulnar nerve may be irritated.
4. EDQ tendonitis may occur from manipulation.

Operative Dictation

Diagnosis: ulnocarpal instability.
Procedure: extensor retinaculum capsulorrhaphy (Herbert sling).

Indication

This is a _____ with ulnocarpal instability. No other pathology of the wrist was identified by provocative maneuvers or imaging studies. The symptoms of instability failed to respond to conservative treatment. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position with the arm on the hand table. A tourniquet was placed on the upper arm. Time out among operating room staffs was taken. Monitored Anesthesia Care was instituted. Preoperative antibiotics were given. The patient was prepped and draped in standard sterile surgical fashion.

The extremity was exsanguinated using the Esmarch bandage and tourniquet was inflated to 250 mmHg. The area over the fifth dorsal compartment of the wrist was identified as well as the tip of the ulnar styloid. A longitudinal incision was made over the fifth dorsal compartment from the distal ulna proximally to the triquetrum distally. The subcutaneous tissue was mobilized in a blunt fashion to expose the extensor retinaculum and protect the dorsal sensory branches of the ulnar nerve. The extensor retinaculum was incised between the fourth and fifth compartments without entering the fourth compartment. The retinaculum was incised from the distal extent to proximally 2/3 of its length creating a flap. The Extensor Digiti Quinti was transposed dorsally to the flap. The wrist was placed in the neutral position and DRUJ was reduced by placing downward pressure in the distal ulna. The retinacular flap was transposed proximally and sutured to the periosteum of the ulnar border of the distal radius using 2-0 PDS absorbable sutures. Alternatively suture anchors may be placed if there is not sufficient periosteum on the radius. The extensor retinaculum was carefully imbricated in an oblique fashion from distal-ulnar to radial-proximal. The EDQ was then relocated dorsally to the retinacular flap. The tourniquet was released and meticulous hemostasis was achieved. The skin was closed using a 4-0 nylon suture in interrupted horizontal mattress fashion. The wound was dressed in the standard fashion. A sugar tong thumb SPICA splint was applied [1, 2].

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Volar Distal Radius Plating

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John R. Craw and Patrick Owens

Indications

1. Displaced extra-articular distal radius fractures.
2. Displaced intra-articular distal radius fracture.

Essential Steps

Preoperative Marking

1. Identify the flexor carpi radialis (FCR).
2. Palpate for the radial artery at the wrist.
3. Mark a longitudinal incision over the FCR tendon.

Intraoperative Details

1. Position supine with radiolucent arm table and have mini C-arm available.
2. Place padded tourniquet around upper arm.
3. Make an incision over flexor carpi radialis (FCR) tendon starting near wrist crease.
4. Perform FCR approach.
5. Elevate pronator quadratus from distal radius.
6. Open and debride fracture.
7. Reduce fracture and provisionally fixate with K-wires.
8. Size volar distal radius plate using mini C-arm.
9. Provisionally fixate plate to distal radius with multiple K-wires.
10. Confirm reduction on multiple views and adjust as indicated.
11. Fixate plate to distal radius with screws.
12. Close pronator quadratus over plate.
13. Close skin.

Postoperative Care

1. Sugar tong splint versus volar slab splint.
2. Initiate immediate finger and thumb ROM in splint.
3. Remove stitches at post-op 10–14 days.
4. Short arm versus anti-pronosupination (if DRUJ involved) cast 4–6 weeks.
5. Transition to removable wrist splint and ROM exercises for wrist and forearm.

Possible Complications

1. Acute carpal tunnel syndrome or median nerve contusion.
2. Nerve, vessel, or tendon damage.
3. Infection.

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4. Nonunion or malunion.
5. Stiffness, loss of ROM.
6. Complex regional pain syndrome.
7. Hardware associated pain or flexor tendon rupture.

Operative Dictation

Diagnosis: right/left closed/open intra-articular/extra-articular distal radius fracture.
Procedure: open reduction internal fixation.

Indication

This is a _____ who sustains a distal radius fracture from _____ on _____. The treatment options for this fracture were discussed with the patient in detail, and she/he wishes to proceed with an open reduction internal fixation. The patient understands the risks, rationale, benefits, and alternatives associated with this procedure, all of his/her questions about the procedure have been answered and she/he wishes to proceed with the procedure.

Description of the Procedure

After verifying informed consent, the patient was brought to the operating suit and placed in the supine position. Bony prominences were padded and the upper extremity was placed on a padded arm board. A tourniquet was placed about the patient's upper arm padded with a stockinet. A time out was held where the patient identification, surgeon to perform the surgery, surgery to be performed, surgical sites and laterality, instrument sterility, antibiotic status were all verified.

An incision was drawn out over the patient's FCR tendon from about the proximal wrist crease extending proximally for 5–8 cm. The patient's upper extremity was exsanguinated with an Esmarch bandage and the tourniquet was inflated to 200–250 mmHg.

The skin was incised sharply. Bipolar cautery was used to control superficial skin vessels. Care was taken to avoid the palmar cutaneous branch of the median nerve by remaining on the radial aspect of the FCR. Dissection was carried down to the FCR and its sheath was released. The FCR tendon was bluntly retracted ulnarly to protect the palmar cutaneous branch of the median nerve and the subsheath of the FCR was incised to the distal and proximal extents of the incision. The flexor pollicis longus (FPL) musculotendinous unit was bluntly swept ulnarly with the finger flexors and the median nerve using it as a cushion for the nerve. Proximally a small amount, 1-2cm, of the FPL was released from the radius. The radial artery was protected. The pronator quadratus was visualized overlying the radius in the wound. A small branch of the radial artery to the pronator was visualized and coagulated with bipolar cautery. The pronator was incised along its radial boarder leaving a small cuff of tissue for later repair. The incision was turned acutely at the radial styloid and proceeds transversely across the distal radius at the watershed line. The pronator was sharply subperiosteally elevated off the distal radius from radial to ulnar until the fracture was completely visualized including the ulnar corner and enough proximal radius was visible for plate placement.

The fracture was gently opened with a freer elevator ensuring that all fragments were mobile. Callous and/or hematoma was debrided from the fracture completely so that bony edges were easily visible for cortical read during reduction.

The fracture was reduced by placing longitudinal traction through the thumb and index fingers with slight ulnar deviation. The distal fragments were reduced over the shaft and tilted into appropriate volar inclination while ulnarly deviating the wrist to attain appropriate radial inclination. Reduction was verified with mini C-arm and adjusted as necessary. Provisional fixation was placed by driving a 0.062 in. K-wire through the radial styloid across the distal fragment and into the shaft ulnarly taking care to protect the radial sensory nerve branch. Final fixation

was then obtained by placing a volar distal radius locking plate on the provisionally reduced fracture. The plate was held in position provisionally with K-wires through the K-wire holes in the plate, and the position and size were double checked on mini C-arm with orthogonal views. The plate was then fixated to the bone with locking unicortical screws abutting the dorsal cortex distally and bicortical locking and/or non-locking screws proximally in the shaft. Reduction and screw length were verified on orthogonal views with mini C-arm. The DRUJ was tested for stability in supination, neutral and pronation. If indicated any DRUJ instability was addressed at this point.

The wound was irrigated with sterile saline. The pronator quadratus was repaired over the plate with absorbable braided suture. The flexor tendons were allowed to rest back over the top of the pronator quadratus. The tourniquet was released and hemostasis was obtained. The skin was closed with nonabsorbable monofilament suture.

The wound was dressed with non-adherent porous gauze followed by dry gauze pads. The wrist and forearm were then placed in a well-padded sugar tong or volar slab splint.

Variations

1. In non-acute fractures where a larger exposure is needed, the incision can begin at the palpable distal scaphoid pole, run obliquely radially and proximally to the distal wrist crease and then angle acutely, run obliquely ulnarly and proximally to the FCR and then extend proximally along the FCR(1). The extensile skin incision above will facilitate releasing the FCR subsheath distally into the distal antebrachial fascia as it transitions into the transverse carpal ligament [1].
2. In non-acute or difficult intra-articular fractures the radial septum can be divided. The brachioradialis tendon is identified and dissected out verifying its attachment to the radial styloid. The abductor pollicis longus and extensor pollicis brevis can be identified and released from the first dorsal compartment. The brachioradialis is cut in stepwise fashion so it can be repaired later in lengthened form [1].
3. In non-acute or difficult intra-articular fractures the dissection can be carried circumferentially around the radial border of the radius and around the ulnar boarder so that the shaft can be pronated out of the wound with a bone clamp leaving the distal fragment(s) within the wound. This allows complete debridement of callous and reduction of articular fragments. The dorsal periosteum in the base of the wound can be divided while taking care to protect extensor tendons. This will allow the distal fragment(s) to be brought back out to length and appropriate volar inclination [1]).
4. More comminuted intra-articular fractures may require additional provisional K-wire fixation. An alternative method of reduction in difficult fractures is to use the plate as a reduction tool by obtaining the articular reduction and then securing the volar plate to the distal fragment(s) with locking screws while holding the proximal aspect of the plate off the shaft with a spacer or a very short screw in the most proximal locking hole. Once the distal fragment(s) is secured to the plate in locking mode, the proximal aspect of the plate is reduced to the shaft thereby restoring volar inclination to that prefabricated within the plate [2].
5. The final proximal to distal placement can be adjusted if a screw is placed in the oblong shaft hole leaving the other shaft holes free. In difficult fractures and those with radial/ulnar convergence radial inclination and radius to ulna shaft distance can be restored after fixating the distal fragment(s) in locking mode to the plate while fixing the plate to the shaft through the oblong hole loosely, purposefully tilting the proximal plate tip to the ulnar aspect of the radius. A blunt retractor is then placed over the ulnar boarder of the radius shaft just

proximal to the fracture and the shaft is pulled under the distal fragment while allowing the plate to rotate until centered on the bone restoring radial inclination and radius to ulna distance [3]. The shaft screw is then tightened and another shaft screw added after appropriate reduction is confirmed in orthogonal mini C-arm views.

6. If the brachioradialis was cut for reduction it is repaired in lengthened fashion at the time of the pronator quadratus repair.

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Dorsal Approach to the Distal Radius

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Maximino J. Brambila and Patrick Owens

Indications

1. Treatment of displaced, comminuted, intra-articular or extra-articular distal radius fractures.

Possible Complications

1. Dorsal wrist numbness.
2. EPL tendon subluxation.
3. Hardware irritation.
4. Extensor tendon rupture.

Essential Steps

Preoperative

1. Place patient in supine position with upper extremity on a radiolucent hand table.
2. General anesthesia or regional block with sedation is performed.
3. Non-sterile tourniquet placed on upper arm.
4. Mark a 6–8 cm longitudinal incision centered over Lister's tubercle.

Intraoperative Details

1. Dorsal approach to distal radius as described in detail below.
2. Fixation of distal radius fracture with fluoroscopic guidance.
3. Repair of wrist joint capsule, extensor retinaculum, and standard soft tissue closure.
4. Application of a volar resting splint.

Postoperative Care

1. Adequate pain control.
2. Begin immediate range of motion exercises of fingers.
3. Non-weight bearing to upper extremity.
4. Removal of sutures in 10–14 days postoperatively and Steri-Strips applied.
5. Begin active range of motion exercises for wrist and hand.
6. At 6 weeks from surgery can begin light strengthening for wrist.

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Operative Dictation

Diagnosis: distal radius fracture.
Procedure: dorsal approach to open treatment of distal radius fracture.

Indication

This is a __ year old patient who sustained a __ (right/left) distal radius fracture. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position with the upper extremity placed on a radiolucent hand table. Appropriate anesthesia was performed on patient. Preoperative antibiotics were given within 1 h prior to incision. A non-sterile tourniquet was applied to the upper arm. The operative upper extremity was prepped and draped in the usual sterile fashion. A time out was done confirming the correct patient, medical record number and operative site. A sterile Esmarch was used to exsanguinate the upper extremity and tourniquet was inflated to 250 mmHg. The skin was sharply incised 6-8 cm along a longitudinal line centered over the tubercle of Lister. Careful dissection was done through the subcutaneous tissues down to the extensor retinaculum taking care to preserve any sensory nerve branches while achieving adequate hemostasis. The extensor pollicis longus (EPL) tendon was identified distally and the extensor retinaculum was released over the tendon just ulnar to the tubercle of Lister. The septae of the 3rd dorsal compartment were sharply incised and once the EPL tendon was free, it was retracted and protected during the rest of the procedure. A periosteal elevator was used to sub-periosteally reflect the second and fourth extensor compartments as needed to expose the dorsal cortex of the distal radius. Careful sub-periosteal elevation with full thickness flaps was important to protect the extensor tendons from direct contact with the implants [1]. *(In some patients, a posterior interosseous nerve (PIN) neurectomy may be desired and once it is identified on the floor of the fourth extensor compartment, the neurectomy can be performed by removing a 1–2 cm longitudinal portion of the nerve)*. The proximal limb of the dorsal ligament sparing capsulotomy was made at the radiocarpal joint leaving a small cuff the capsule attached to the distal radius to facilitate repair of the capsulotomy at the end the procedure [2]. This provided an adequate view to accurately reduce the articular surface of the distal radius fracture. A freer elevator and a small curette were used to expose and clean the fracture site. Reduction of the fracture was obtained using longitudinal traction and manipulation under fluoroscopic guidance. The reduction of the articular surface was confirmed both under direct visualization and fluoroscopy. Kirschner wires (K-wires) were used as needed to maintain our preliminary fracture reduction. Lister's tubercle was removed using a rongeur in order for proper seating of the correct sized dorsal distal radius plate. This was then secured to the bone initially using K-wires and after confirmation of satisfactory plate position and fracture reduction, it was fixed to the bone with the appropriate sized screws. The K-wires were then removed and the stability of the construct was assessed using fluoroscopy as well as ensuring that the screws remained extra-articular. At this point, normal saline was used to irrigate the operative site. The wrist joint capsule was then repaired using non-absorbable suture and the periosteum of the extensor compartments was repaired over the plate to protect the extensor tendons from the hardware. The extensor retinaculum was repaired using non-absorbable suture leaving the EPL tendon transposed dorsal to the retinaculum. The tourniquet was deflated and adequate hemostasis was achieved prior

to closing the skin with nylon sutures in a horizontal mattress type fashion. A non-occlusive dressing was applied over the dorsal incision and a volar resting splint was applied. The patient was then transferred to the PACU in stable condition.

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Proximal Row Carpectomy

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Maximino J. Brambila and Patrick Owens

Indications

1. Motion-preserving salvage procedure for primary wrist arthritis or secondary to multiple conditions including: Scaphoid nonunion advanced collapse (SNAC), Scapholunate advanced collapse (SLAC), Scaphoid avascular necrosis, Kienbock's disease, perilunate dislocation [1].

Possible Complications

1. Wrist pain.
2. Wrist instability.
3. Decreased range of motion.

Essential Steps

Preoperative

1. Place patient in supine position with upper extremity on a radiolucent hand table.
2. General anesthesia or regional block with sedation is performed.
3. Non-sterile tourniquet placed on upper arm.
4. Mark a 4–6 cm longitudinal incision distal to Lister's tubercle.

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Intraoperative Details

1. Dorsal approach to the proximal carpal row as described in detail below.
2. Excision of the proximal carpal row: scaphoid, lunate, triquetrum.
3. Posterior interosseous nerve (PIN) and Anterior interosseous nerve (AIN) neurectomies.
4. Repair of wrist joint capsule and standard soft tissue closure.
5. Application of a volar resting splint.

Postoperative Care

1. Adequate pain control.
2. Begin immediate range of motion exercises of fingers.
3. Non-weight bearing to upper extremity.
4. Removal of sutures in 10–14 days postoperatively and Steri-Strips applied.
5. At week 4 can begin protected range of motion exercises for wrist and hand.
6. At 6 weeks from surgery all immobilization is discontinued.

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Operative Dictation

Diagnosis: wrist arthritis.
Procedure: proximal row carpectomy.

Indication

This is a __ year old patient with _ (right/left) degenerative wrist arthritis. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position with the upper extremity placed on a radiolucent hand table. Appropriate anesthesia was performed on patient. Preoperative antibiotics were given within 1 h prior to incision. A non-sterile tourniquet was applied to the upper arm. The operative upper extremity was prepped and draped in the usual sterile fashion. A time out was done confirming the correct patient, medical record number and operative site. A sterile Esmarch was used to exsanguinate the upper extremity and tourniquet was inflated to 250 mmHg. The skin was sharply incised 4-6 cm along a longitudinal line distal to the tubercle of Lister. Careful dissection was done through the subcutaneous tissues down to the extensor retinaculum, taking care to preserve any sensory nerve branches while achieving adequate hemostasis. The extensor pollicis longus (EPL) tendon was identified distally and the extensor retinaculum was released over the tendon just ulnar to the tubercle of Lister only to the dorsal rim of the distal radius in order to retract the tendon away from our capsulotomy site. The second and fourth extensor compartments were carefully dissected off the dorsal wrist capsule distal to the extensor retinaculum as needed to expose the capsule and dorsal rim of the distal radius. Prior to making the capsulotomy, a separate longitudinal incision was made starting 2 cm proximal to the ulnar head extending 3–5 cm proximally in line with the third and fourth extensor tendon compartments [2]. The posterior interosseous nerve (PIN) was identified on the floor of the 4th extensor compartment and a neurectomy was performed by removing a 1–2 cm longitudinal portion of the nerve. The interosseous membrane was then exposed, identifying the anterior interosseous artery volar to it. A longitudinal split was then made in the membrane and the anterior interosseous nerve (AIN) was identified and a neurectomy was performed by removing a 1–2 cm longitudinal portion of the nerve. At this point we turned our attention back to the wrist joint. The proximal limb of the dorsal ligament sparing capsulotomy was made at the radiocarpal joint leaving a small cuff the capsule attached to the distal radius to facilitate repair of the capsulotomy at the end the procedure [3]. This provided an adequate view of the proximal and distal carpal rows. The articular surface of the capitate was inspected as well as the lunate facet of the distal radius and they were found to be intact with no wear. The scapholunate interosseous ligament (SLIL) and the lunotriquetral interosseous ligament (LTIL) were then both sharply transected at this point. Next we proceeded to use a freer elevator, rongeur and a scalpel to remove the scaphoid, lunate, and triquetrum bones in their entirety. A 2 mm pin was driven into the bones to facilitate manipulation. We were careful not to injure the extrinsic volar ligaments, especially the radioscaphocapitate (RSC) ligament to prevent any wrist instability. The wrist was then put through a range of motion to see if there was any impingement on the radial styloid. (A maximum of 4 mm of the radial styloid was then resected to prevent impingement of the distal row on the radius with radial deviation) [4]. At this point, normal saline was used to irrigate the operative site. The wrist joint capsule was then repaired using nonabsorbable suture by placing the distal limb of the capsule volar to the proximal limb to serve as a type of interpositional arthroplasty between the head of the capitate and the lunate facet. (In order to do

a true interpositional arthroplasty, the distal limb of the ligament sparing capsulotomy was made and then rotated on its distal insertion, interposing the capsule between the capitate and radius and then it was sutured to the volar wrist ligaments). The tourniquet was deflated and adequate hemostasis was achieved prior to closing both the skin incisions with nylon sutures in a horizontal mattress type fashion. A non-occlusive dressing was applied over the dorsal incision and a volar resting splint was applied. The patient was then transferred to the PACU in stable condition.

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Four-Corner Fusion

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Maximino J. Brambila and Patrick Owens

Indications

1. Motion-preserving salvage procedure for primary wrist arthritis or secondary to multiple conditions including: scaphoid nonunion advanced collapse (SNAC), scapholunate advanced collapse (SLAC), scaphoid avascular necrosis [1].

Possible Complications

1. Wrist pain.
2. Wrist instability.
3. Decreased range of motion.

Essential Steps

Preoperative

1. Place patient in supine position with upper extremity on a radiolucent hand table.
2. General anesthesia or regional block with sedation is performed.
3. Non-sterile tourniquet placed on upper arm.
4. Mark a 4–6 cm longitudinal incision distal to Lister's tubercle.

Intraoperative Details

1. Dorsal approach to the proximal and distal carpal rows as described in detail below.
2. Excision of the scaphoid bone.
3. Decortication of capitolunate and triquetrohamate articulations.
4. Fixation of lunate to capitate and triquetrum to hamate with headless compression screws.
5. Repair of wrist joint capsule and standard soft tissue closure.
6. Application of a volar resting splint.

Postoperative Care

1. Adequate pain control.
2. Begin immediate range of motion exercises of fingers.
3. Non-weight bearing to upper extremity.
4. Removal of sutures in 10–14 days postoperatively and Steri-Strips applied.
5. At week 4 can begin protected range of motion exercises for the hand.
6. At 6–8 weeks from surgery immobilization is discontinued once bony union confirmed.

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Operative Dictation

Diagnosis: wrist arthritis.
Procedure: four-corner fusion.

Indication

This is a __ year old patient with _ (right/left) degenerative wrist arthritis. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position with the upper extremity placed on a radiolucent hand table. Appropriate anesthesia was performed on patient. Preoperative antibiotics were given within 1 h prior to incision. A non-sterile tourniquet was applied to the upper arm. The operative upper extremity was prepped and draped in the usual sterile fashion. A time out was done confirming the correct patient, medical record number and operative site. A sterile Esmarch was used to exsanguinate the upper extremity and tourniquet was inflated to 250 mmHg. The skin was sharply incised 4–6 cm along a longitudinal line distal to the tubercle of Lister. Careful dissection was done through the subcutaneous tissues down to the extensor retinaculum, taking care to preserve any sensory nerve branches while achieving adequate hemostasis. The extensor pollicis longus (EPL) tendon was identified distally and the extensor retinaculum was released over the tendon just ulnar to the tubercle of Lister only to the dorsal rim of the distal radius in order to retract the tendon away from our capsulotomy site. The second and fourth extensor compartments were carefully dissected off the dorsal wrist capsule distal to the extensor retinaculum as needed to expose the capsule and dorsal rim of the distal radius. A radially based dorsal ligament sparing capsulotomy was made leaving a small cuff the capsule attached to the distal radius to facilitate repair of the capsulotomy at the end the procedure [2]. This provided an adequate view of the proximal and distal carpal rows. The articular surface of the lunate was inspected as well as the lunate facet of the distal radius and they were found to be intact with no wear. Next we proceeded to use a freer elevator, rongeur and a scalpel to remove the scaphoid bone in its entirety. We were careful not to injure the extrinsic volar ligaments, especially the radioscaphocapitate (RSC) ligament to prevent any wrist instability. At this point, we used a high speed burr to decorticate the capitolunate and triquetrohamate articulations, being careful to preserve the capitohamate interosseous ligament (CHIL) and the lunotriquetral interosseous ligament (LTIL). Before continuing with the fixation, normal saline was used to irrigate the operative site. Autologous bone graft was used by morcelizing the cancellous portion of the removed scaphoid and augmented with allograft as needed and packed at the capitolunate and triquetrohamate articulations. The capitolunate fixation was done using a headless compression screw from distal to proximal by making a 1.5 cm incision dorsally at the second web space [3]. The guide wire for the screw was inserted centrally in the capitate and was driven into lunate once the dorsal intercalated segment instability was corrected [3]. The appropriate sized cannulated drill was then used over the guide wire and the appropriate sized screw was inserted being careful to ensure the screw was entirely buried under the cartilage on both ends. The triquetrohamate fixation was done in a similar manner although this screw was inserted from proximal to distal after making a small 1 cm incision just distal to the ulnar styloid [3]. Blunt dissection was carefully done to prevent injury to the dorsal ulnar sensory nerve. At this

point, the wrist joint capsule was then repaired using nonabsorbable suture. The tourniquet was deflated and adequate hemostasis was achieved prior to closing the skin incision with nylon sutures in a horizontal mattress type fashion. A non-occlusive dressing was applied over the dorsal incision and a volar resting splint was applied. The patient was then transferred to the PACU in stable condition.

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Reconstruction of Flexor Tendon 100

Nicholas Galardi and Harvey W. Chim

Indications

1. Laceration or rupture of flexor tendon.

Possible Complications

1. Failure of tendon repair with subsequent tendon rupture.
2. Limited flexion range of motion due to scarring/adhesions.

Essential Steps

Preoperative Markings

1. A Bruner (zigzag) fashion incision is drawn distally and proximally from the wound present.

Intraoperative Details

1. Patient is sedated and regional/peripheral nerve block is administered.
2. Patient is sterilely prepped and draped.
3. Tourniquet is applied to the involved upper arm, with pressure that allows for exsanguination and a bloodless operating field.
4. The wounds are extended both proximally and distally in a zigzag fashion (Bruner).
5. Identify and preserve neurovascular bundles.
6. Thoroughly irrigate wound.
7. Blunt dissection to expose the flexor tendon sheath.
8. Identification and retrieval of cut tendon both distally and proximally, using hemostat.
9. Preserve A2 and A4 pulleys.
10. Tendon edges are debrided to eliminate frayed edges.
11. A 6-0 nylon or polyethylene suture is used to suture the posterior aspect of the coapted tendon ends, incorporating only the epitenon.
12. A core suture of 4-0 Ethibond or Prolene is used in a modified Kessler fashion or cruciate fashion, at least four core sutures should be placed if planning for early active range of motion rehabilitation.
13. The tendon should not be bunched together when tied.

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14. The epitenon suture is then continued around the anterior surface of the tendon.
15. Wound closure with sutures.
16. Release of tourniquet pressure, noting total tourniquet time.
17. Nonadherent dressing is placed followed by placement of a dorsal blocking splint.

Postoperative Care

1. Patients are started on early controlled range-of-motion therapy protocols 48–72 h after surgery.

Operative Dictation

Diagnosis: flexor tendon rupture.
Procedure: reconstruction of flexor tendon.

Indication

This is a ____ right hand dominant male with zone 2 flexor tendon injury requiring flexor tendon repair. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

The patient was brought to the operating room where time-out was performed to identify the patient and the appropriate procedure. Monitored sedation and a regional/peripheral nerve block were administered by the anesthesia team. The left/right upper extremity was prepped and draped in the usual sterile fashion after a tourniquet was applied to the upper arm. Tourniquet was inflated after exsanguination. The wound was extended both proximally and distally in a Bruner fashion. Care was taken to identify and preserve neurovascular bundles. The wound was then thoroughly irrigated with saline. Blunt dissection was performed to expose the flexor tendon sheath. The distal and proximal ends of the cut flexor tendon were then identified and retrieved. The A2 and A4 pulleys were identified and preserved. The tendon edges were debrided. A 6-0 polyethylene suture was used to suture the posterior aspect of the coapted tendon ends, incorporating only the epitenon. Core sutures of 4-0 Prolene in a modified Kessler fashion were placed taking care not to bunch up the ends of the tendon when tied down. The epitenon suture was then continued around the anterior surface of the tendon. The wound was again irrigated and then closed using 5-0 nylon sutures. The tourniquet was released and total tourniquet time was noted. A non-adherent dressing was placed followed by placement of a dorsal blocking splint.

Tendon Graft

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Nicholas Galardi and Harvey W. Chim

Indications

1. Injuries resulting in segmental tendon loss.
2. Delay in repair precludes primary repair.
3. Lacerations that have been neglected for more than 3–6 weeks with tendon degeneration and scarring.

Possible Complications

1. Tendon repair rupture.
2. Adhesion formation with range-of-motion restriction.
3. Pulley disruption.
4. Quadrigia.
5. Lumbrical-plus finger.

Essential Steps

Preoperative Markings

N/A.

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Intraoperative Details

1. Patient is sedated and regional/peripheral nerve block is administered.
2. Patient is sterilely prepped and draped.
3. Tourniquet is applied to the involved upper arm, with pressure that allows for exsanguination and a bloodless operating field.
4. Bruner-type incision is made on the volar surface of the affected finger to expose tendon system (incision may vary).
5. Note area of damaged tendon sheath and perform minimal resection (preserve as much uninjured sheath as possible).
6. Preserve at least 1 cm of distal tendon stump.
7. Wound is covered with moist dressing.
8. Attention then turned to harvesting tendon graft (usually palmaris longus tendon) (present in 75–85 % of patients).
9. A 1–2 cm incision made at wrist crease, identifying the palmaris tendon.
10. Tendon is transected at its distal end and held with a Kocher clamp.
11. Tendon is mobilized proximally under direct visualization for 6–8 cm and threaded through a circular tendon stripper and then is divided proximally.
12. A second proximal transverse incision can be made if further exposure needed.
13. The graft length needed is estimated by the relaxed position of the fingers with the wrist in neutral position; each finger should fall

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into semiflexion, check posture of fingers using tenodesis effect.
14. A grasping type suture is placed to secure the distal end of the graft and then threaded under the pulleys using a flexible rubber catheter (may use pediatric feeding tube or red rubber catheter), in distal-to-proximal direction.
15. Clamp is placed at proximal end to prevent inadvertent withdrawal.
16. The distal portion of the graft is fastened with sutures using an "around the bone" technique; reinforcing sutures can be placed as needed using 4-0 FiberWire.
17. The graft is then fastened to the proximal end of the tendon with 3 weaves using a tendon weaver.
18. A slit is made in the tendon with a scalpel, then using a tendon weaver the graft is threaded transversely into the slit.
19. Buried 4-0 FiberWire sutures are used to join the tendons at the interweave and a "fish mouth" created is closed to embrace the graft.
20. Skin incisions are closed using suture.

Postoperative Care

1. Controlled passive range-of-motion exercises begun 2–3 days following surgery with therapist.
2. Patient kept in wrist-neutral dorsal blocking splint for 4–6 weeks.

Operative Dictation

Diagnosis: tendon rupture.
Procedure: flexor tendon reconstruction with palmaris longus tendon graft.

Indications

This is a ____ right hand dominant female with a significant segmental loss of flexor tendon secondary to injury precluding primary tendon repair. A tendon graft using palmaris longus is employed to restore flexor tendon function. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

The patient was brought to the operating room where time-out was performed to identify the patient and the appropriate procedure. Monitored sedation and a regional/peripheral nerve block were administered by the anesthesia team. The left/right upper extremity was prepped and draped in the usual sterile fashion after a tourniquet was applied to the upper arm. Tourniquet was inflated after exsanguination. Bruner-type incision was marked out on the volar surface of the affected finger to expose flexor tendon system. The area of damaged tendon sheath was noted and excised using a #15 scalpel. We made sure to preserve at least 1 cm of distal tendon stump. The proximal portion of tendon was debrided as well to healthy appearing tendon. Wound was then covered with moist dressing.

Then we turned our attention to harvesting the palmaris longus tendon graft. A 1–2 cm incision was made at wrist crease, identifying the palmaris tendon. Taking care not to injure the underlying median nerve, the tendon was transected at its distal end and held with a Kocher clamp. The tendon was then mobilized proximally under direct visualization for 6–8 cm using a circular tendon stripper and then was divided proximally at the musculotendinous junction.

Once the graft was harvested we then began with the insetting of our tendon graft. The graft length needed was estimated by measuring the defect while the fingers were in the relaxed position with the wrist in neutral position. The graft was then cut to appropriate size. A suture was then placed to secure the distal end of the graft and then secured to a flexible rubber catheter and threaded under the pulleys in a distal-to-proximal direction. A clamp was then placed at proximal end to prevent inadvertent withdrawal. The distal portion of the graft was fastened with 3-0 Prolene

sutures using an “around the bone” technique. Reinforcing sutures wire placed using 4-0 FiberWire. The graft was then fastened to the proximal end of the tendon by making a slit in the tendon with a scalpel, and then using a tendon weaver the graft was threaded transversely into the slit. Three weaves were performed and secured with horizontal mattress sutures using 4-0 FiberWire. Skin incisions were closed using suture. The tourniquet was deflated. Non-adherent dressing was used and the hand was placed in a dorsal blocking splint.

Replantation

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Arij El Khatib and Joseph Y. Bakhach

Indications

1. Amputation of thumb.
2. Amputation of multiple digits.
3. Hand amputation through palm.
4. Distal wrist amputation.
5. Sharp amputation of proximal arm.
6. Amputation of a single digit distal to flexor digitorum profundus tendon insertion.
7. Amputations in a child.

Possible Complications

1. Failure of replantation.
2. Functional deficit in replanted part.
3. Bone nonunion.
4. Cold intolerance.

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Essential Steps

Preoperative Planning

1. Amputated part must be wrapped in wet gauze, placed in a specimen bag, and placed on ice.
2. Surgery must be performed as soon as is feasible taking into account patient's overall condition.
3. Patient must receive adequate hydration and pain control as well as be kept from becoming cold as colder temperatures may result in vasoconstriction of the affected vessels.

Intraoperative Details

1. Patient should be placed in the supine position with the involved extremity in abduction on an arm table.
2. General anesthesia should be instituted.
3. Tourniquet applied to involved extremity if feasible, to be inflated as needed.
4. Involved extremity and stump are prepped and draped.
5. Amputated part is cleansed with normal saline solution on the sterile field and is kept on ice until apposition with the amputation stump.

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6. Bone edges, tendons, arteries, veins, nerves of both amputation stump and amputated part are dissected and debrided, loupe or microscope magnification should be used when needed. In digital amputations, Bruner incisions can be used in both stump and amputated part to provide for better visualization of structures.
7. Open reduction and internal fixation is performed first to provide a scaffold for replantation.
8. Periosteum is repaired where feasible to allow for easier tendon excursion.
9. Tendons are repaired next.
10. Arteries are repaired next after careful debridement of damaged edges, 9-0 nylon suture and loupe magnification is used for ulnar/radial arteries while 10-0 or 11-0 nylon suture and microscope magnification is used for digital arteries. Vascular anastomoses are performed using interrupted simple sutures. In case of inability to approximate arterial stumps without tension, a venous graft of suitable size can be harvested from the forearm or lower extremity and used as an interposition graft.
11. After successful arterial repair is performed and amputated stump vascularization is reinstated, venous outflow from the amputated stump is examined and briskly bleeding veins are anastomosed to their proximal segments using the same sutures and techniques used for arterial anastomosis.
12. Nerve repair is performed using the same techniques and suture caliber as vessel repair.
13. Skin is reapproximated and closed without tension using 3-0 or 4-0 caliber sutures. Care is taken to cover vessels and nerves with soft tissue/skin flaps to prevent desiccation.
14. Splint may be applied to replanted part to provide stability and limit movement.
15. Loose Vaseline gauze and gauze roll dressings are applied to surgical sites. Areas of replanted part are kept exposed for frequent postoperative monitoring.

Postoperative Care

1. Patient should be kept warm, well hydrated, with systolic blood pressure >100 mmHg, off caffeinated beverages and off tobacco for optimal perfusion of replanted part.
2. Clinical checks for good capillary refill, color, temperature, and Doppler signal of replanted part should be performed frequently in the first 48 h so as to identify and treat potential complications in a timely manner.

Operative Dictation

Diagnosis: amputation of _____.
Procedure: replantation of _____.

Indication

This is a ___ yr old patient with amputation of _____ necessitating replantation. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operative room and placed in the supine position. Time out among operating room staff was performed. Patient was placed under general anesthesia and preoperative antibiotics were given.

The involved extremity was placed in an abducted position on an arm table, a tourniquet was applied to the arm and left on standby (if feasible) and the extremity was then prepped and draped circumferentially in the usual manner. Copious irrigation of the amputation stump was performed with normal saline solution.

The amputated part was removed from its container and placed onto the field. It was irrigated

copiously with normal saline solution and debridement of any nonviable tissue was performed. Under loupe/microscope magnification, exploration of bone, tendon, artery, vein, and nerve stumps was performed to assess feasibility of replantation, and edges of all these tissues were freshened using bone rongeur for bony debridement, Stevens scissors for tendons, and microvascular scissors for artery/vein/nerve edges freshening. The amputated part was placed on ice while debridement, exploration and edge freshening were performed on the amputation stump. In digital amputations where extension of the surgical field was needed, Bruner incisions were made in both amputated digit and amputation stump using 15 blade and Steven's scissors.

Bony open reduction and internal fixation was performed using Kirschner wires or plates and screws under fluoroscopy to assure adequate reduction and fixation. Where possible, periosteal repair was performed using 4-0 or 5-0 Vicryl sutures to allow for easier tendon gliding.

Flexor and extensor tendon edges were apposed to their respective proximal ends and sutured using 3-0 or 4-0 Prolene/Polyester sutures. 5-0 Prolene was also used for epitendinous sutures along the flexor tendons to allow for easier mobility.

Arterial anastomosis was performed using 9-0 to 11-0 nylon sutures in interrupted simple suturing technique to reestablish blood flow to the amputated part. Once flow has been reestablished, ischemia time was considered ended. *(In cases where there was insufficient arterial length to allow for tension-free anastomosis, a vein graft of appropriate caliber was harvested from the forearm, lower extremity or an adjacent area in the upper extremity and used as an interposition graft, where it was anastomosed to proximal and distal arterial stumps using microsurgical techniques to provide vessel length needed for tension-free closure.)*

Once blood flow was reestablished to the amputated part through a patent arterial anastomosis, venous outflow from the amputated part's venous edges was observed and the most briskly bleeding venous ends were anastomosed to their respective proximal ends using the same suture calibers and techniques as those used for the arterial anastomosis. Filling of the proximal vein end was observed after successful venous anastomoses were performed. While one venous anastomosis per amputated part was sufficient for outflow, better survival has been documented by having two venous anastomoses.

(Papaverine or Xylocaine solutions may be used to irrigate vessels during and after anastomosis to relieve vasoconstriction.)

Nerve edges were apposed and epineurial repair was performed using similar sutures and techniques to those applied on vessels.

Skin wounds were loosely closed using 3-0 or 4-0 nylon or Vicryl Rapide sutures, care was taken to keep skin closure tension free, and to provide soft tissue or skin coverage to bones/vessels/nerves.

Vaseline gauze and loose gauze roll dressings were applied to the surgical site, keeping part of the replanted part exposed to as to allow for frequent clinical monitoring.

(Splint may be applied to the extremity and replanted part to limit movement and unsuitable positioning which may interfere with flow through vascular anastomoses.)

Suggested Reading

Replantations. In: Wolfe SW editor, Green's operative hand surgery, 7th edn. Churchill Livingstone.

Management of finger amputations. In: Chung KC editor, Essentials of hand surgery.

Replantation of amputated fingers. In: Beasley RW editor, Beasley's surgery of the hand. Thieme.

Phalangization of the First Metacarpal with Dorsal Rotational Flap Coverage

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Joseph Y. Bakhach and Odette Abou Ghanem

Indications

1. Subtotal thumb amputation with at least half the proximal phalanx remaining.
2. Excessive scarring of the first web skin.
3. Severe adduction contracture of the first metacarpal.

Essential Steps

Intraoperative Details

1. The incision is started dorsally at the level of the trapeziometacarpal joint, extended along the ulnar border of the first metacarpal and continued through the thumb web and volarly into the palm at the base of the thenar eminence.
2. Dissection is started ulnar to the extensor pollicis longus.
3. The origin of the first dorsal interosseous muscle is divided.
4. The radial artery is identified between the two heads of the first dorsal interosseous muscle.
5. The princeps pollicis artery is identified and protected.
6. The oblique and transverse heads of the adductor pollicis muscle are divided.
7. Stripping of the opponens pollicis muscle is done if the first metacarpal is severely contracted.
8. Capsulotomy of the trapeziometacarpal joint is sometimes required.
9. Two non-parallel Kirschner wires are used to transfix the first and second metacarpals through their proximal segments.
10. An external fixator can be used instead of Kirschner wires.
11. The tourniquet is released.
12. The vascularity of the thumb is checked.
13. The tourniquet is re-inflated.
14. A paper can be used over the dorsum of the hand for a rotation trial to help determine the size and configuration of the flap.
15. The incision is continued dorsally across the radial side of the second metacarpophalangeal joint and onto the dorsum of the proximal phalanx of the index.
16. The incision is continued until the base of the fourth metacarpal.
17. The dorsal flap is dissected free from the paratenon overlying the finger extensors.

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18. A few veins should be ligated distally and brought with the flap.
19. Gentle undermining is done.
20. The flap is sutured in place.
21. A split thickness skin graft using a dermatome or a nearly full thickness skin graft from the groin can then be used to cover the resultant remaining triangular defect.
22. The tourniquet is released.
23. All incisions are closed.
24. Dressing is applied over the graft.
25. Kirschner wires are bent and trimmed.
26. A compressive dressing is applied to the hand, wrist, and forearm.

Postoperative Care

1. The flap and grafts are checked at 7–10 days.
2. The sutures are removed at 2 weeks.
3. Physical therapy as active and passive range of motion for the digits begins at 2–3 weeks.
4. A custom-made first web splint is used to maintain the first web space during the initial physical therapy phase.
5. The pins are removed at 4–6 weeks.
6. After pins removal, weaning from the web splint is initiated.
7. A web spacer used at night while sleeping is usually necessary up to 1 year.
8. The status of the web space is monitored up to 1 year.

Operative Dictation

Diagnosis: subtotal right/left thumb amputation involving bony structures.
Procedure: phalangization with dorsal flap rotation flap.

Indication

This is a ____-year-old female/male with right/left thumb subtotal amputation with bony involvement and difficulty grasping objects and inability to pinch. Benefits, risks, and alternatives associated with the procedure are explained to the patient and he/she understands and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time out among operating room staff was performed. Patient was placed under general anesthesia (or plexus regional block) and preoperative antibiotics were given.

The involved upper extremity was placed in an abducted position on an arm table and a tourniquet was applied to the arm and left on standby. The upper extremity was then prepared in a sterile manner and the arm was draped. The groin or thigh was prepared too depending on whether a groin full thickness skin graft or thigh split thickness skin graft will be used to close the remaining hand dorsal defect. Tourniquet was inflated.

Dorsally at the level of the trapeziometacarpal joint, the incision was started and extended along the ulnar border of the first metacarpal. The incision was then continued through the thumb web and extended volarly into the palm at the base of the thenar eminence. Dissection was started ulnar to the extensor pollicis longus. Then the origin of the first dorsal interosseous muscle was divided from the metacarpal. This was done while taking care to protect the sensory branches of the radial nerve. The radial artery was identified between the two heads of the first dorsal interosseous muscle and followed distally, until the princeps pollicis artery was identified and protected. This allowed defining the border of the adductor pollicis muscle and division of both its oblique and transverse heads. The adequacy of mobilization of the first metacarpal was tested by applying gentle abduction traction on it. The first metacarpal was severely contracted and not completely mobilized, stripping of the opponens pollicis muscle was done *(sometimes the release of the carpometacarpal joint capsule would be required.)* A palmar incision was done to gain access to the trapeziometacarpal joint and

perform a capsulectomy. Two non-parallel Kirschner wires were used to transfix the first and second metacarpals through their proximal segments. This stabilized of the mobilized thumb. *(This would also be done by an external fixator.)* The tourniquet was released. Bleeding vessels were controlled and the vascularity of the thumb was checked. The tourniquet was re-inflated. A paper was used over the dorsum of the hand for a rotation template to help determine the size and configuration of the flap. The incision was continued dorsally across the radial side of the second metacarpophalangeal joint and onto the dorsum of the proximal phalanx of the index. Proximally, the incision was continued until the base of the fourth metacarpal. Then dissection of the dorsal flap was done to free it from the paratenon overlying the finger extensors. A few veins were ligated distally and brought with the flap. Then gentle undermining was done. Additional skin release was needed to get the flap into the proper position for optimal defect coverage. The flap was sutured in place. A split thickness skin graft using a dermatome or a nearly full thickness skin graft from the groin was used to cover the resultant remaining triangular defect over the dorsum of the hand. The tourniquet was released, hemostasis was secured, and all incisions were closed.

Dressing was applied over the graft. Kirschner wires were bent and trimmed. A compressive dressing was applied to the hand, wrist, and forearm.

Suggested Reading

Thumb reconstruction. In: Wolfe SW editor. Green's operative hand surgery, 7TH edn. Churchill Livingstone.

Reconstruction of the thumb. In: Chung KC editor. Essential of hand surgery.

Thumb and fingers reconstruction. In: Beasley RW editor. Beasley's surgery of the hand. Thieme.

Pollicization

104

Fadl Chahine and Joseph Y. Bakhach

Indications

1. Type IIIB, IV, and V congenital thumb hypoplasia.
2. Acquired absence of thumb.

Possible Complications

1. Early.
   (a) Arterial compromise.
   (b) Venous compromise.
2. Late.
   (a) First web space contracture.
   (b) Stiffness.
   (c) Excessive length.
   (d) Malrotation.
   (e) Lack of opposition.
   (f) Bone nonunion.

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Essential Steps

Preoperative Markings

1. According to Ezaki–Carter modification of the Buck-Gramcko design (to recruit glabrous skin over palmar aspect after pollicization).

Intraoperative Details

1. Tourniquet inflation.
2. Skin incision.
3. Identification and isolation of the palmar neurovascular bundle.
4. Dissection of the common digital nerve.
5. Release of the first annular pulley to the index finger.
6. Elevation of the dorsal skin from the volar incision with preservation of the dorsal veins.
7. Incision of the dorsal skin.
8. Free extensor tendons from the adjacent fingers.
9. Incision of the inter-metacarpal ligament.
10. Elevation of the first dorsal and palmar interossei muscles from the index metacarpal and MCP joints.
11. Release of the first dorsal and palmar muscles with a strip of the extensor hood.

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12. Identification and tagging of the radial and ulnar lateral bands of the PIP joint.
13. Shortening of the index finger.
14. Repositioning of the index MCP joint into hyperextension.
15. A double-end Kirschner wire is driven through the metacarpal physis and out the PIP joint or end of the thumb.
16. Alignment of the index finger into the thumb position.
17. Tendon transfer to restore intrinsic function to the pollicization.
18. Insetting of the skin.
19. Deflation of the tourniquet.
20. Dressing.

Postoperative Care

1. Dressing change and wound care.
2. Long ante-brachial splint with the wrist in extended position up to 40°.
3. Arm elevation to promote venous drainage.
4. Monitoring.

Operative Dictation

Diagnosis: hypoplastic thumb.
Procedure: pollicization.

Indication

This is a _____ with an absent/hypoplastic thumb, who requires reconstruction of thumb function. Patient/Guardian understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time out among operating room staff was taken. General anesthesia was instituted. Preoperative antibiotics were given.

The skin was marked according to the Ezaki and Carter modification of the Buck-Gramcko design technique. The tourniquet was inflated to 250 mmHg around the upper extremity.

We then proceeded by incising the radial skin with a #15 scalpel, and identified the neurovascular bundle, and the radial digital artery. Our dissection proceeded in an ulnar direction to identify the neurovascular bundle of the second web space. Microdissection of the nerve was undertaken. The digital artery proper to the long finger was ligated with a 4-0 Vicryl tie, and clipped.

Afterwards, we incised the first annular pulley to the index finger. Elevation of the dorsal skin was done, and the index extensor tendon was inspected, with release of the juncturae tendinum.

We elevated the first palmar and dorsal muscles from the metacarpal and metacarpophalangeal joints of the index finger. The tendons were traced to their insertion along the extensor hood and released with a portion of the hood. We exposed the extensor hood over the PIP joint. The radial and ulnar lateral bands were tagged with a suture.

Using a fine-bladed saw, the metacarpal bone was cut perpendicular to the shaft at the metaphysis. Using a knife, a distal cut was made through the physis.

The MCP joint was subsequently sutured in hyperextension using a 5-0 Prolene through the epiphysis and dorsal capsule.

Next, a double-ended Kirschner wire was passed through the metacarpal head and proximal phalanx, and advanced until a small amount protruded from the metacarpal epiphysis.

The index finger was then manually shortened and rotated into position. The epiphysis was placed slightly volar to the metacarpal base. The index finger was positioned in 45° of abduction and 100° of pronation. The Kirschner wire is driven retrograde across the metacarpal base and into the carpus. The tendon of first dorsal interosseous was transferred and sutured to the radial band, and the first palmar interosseous to ulnar band using 3-0 Ethibond sutures.

The skin was closed using 4-0 Vicryl Rapide sutures in a horizontal mattress fashion.

The wound was dressed with gauzes and bacitracin, leaving the tip of the fingers exposed. A long forearm splint with the wrist extended to 40° was placed. The tourniquet was deflated with normal restoration of the circulation.

Suggested Reading

Thumb reconstruction. In: Wolfe SW, editor. Green's operative hand surgery, 7TH edn. Churchill Livingstone.
Reconstruction of the thumb. In: Chung KC, editor. Essential of hand surgery.
Thumb and fingers reconstruction. In: Beasley RW, editor. Beasley's Surgery of the hand. Thieme.

Great Toe to Thumb Transplantation

105

Gregory M. Buncke

Indications

1. Loss of Thumb from the distal half of the metacarpal to the IP joint.

Possible Complications

1. Vascular compromise immediately post op.
2. Flexor and extensor tendon adhesions.
3. Foot donor site neuroma.

Essential Steps

Preoperative Marking

1. Mark the thumb at the level of transplantation.
2. Mark the veins of the dorsal wrist.
3. Using a hand-held Doppler, the digital artery in the first web space of the foot is traced in a retrograde fashion. This pedicle is mapped out and marked.
4. The veins draining the toe are marked.
5. Preoperative markings of the toe are made to correspond to the thumb markings.

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Intraoperative Details

1. Two operative teams working simultaneously.
2. Two scrub techs and full setup including two bipolar cauteries.
3. Preoperative angiogram of the hand and the foot if there has been prior foot trauma.
4. Maintain adequate skin at the foot to provide loose closure.
5. STSG will heal more easily on the hand than the foot.
6. Pre-op markings on the foot need to correspond with markings on the hand.
7. Two teams need to have ongoing discussion of length needed from the toe harvest regarding nerves, vessels, tendons, etc.
8. Four cortical osteosynthesis with 90 degree four cortical screw, proximal phalanx of the toe over the proximal phalanx of the thumb stump allows for immediate mobilization of the transplanted toe. Alternatively, K-wire fixation.
9. Pulvertaft weave or four strand tendon repair allows for early active motion.
10. Microvascular repairs should be performed proximal to the zone of injury.
11. Digital nerve neuromas on the thumb side should be resected far enough proximally to repair to normal appearing digital nerves.
12. Every attempt should be made to do an end to end micro-neurorrhaphy but if not possible

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a short nerve autograft or allograft can be successful.
13. Skin grafts should be used liberally on the hand to avoid tight closure and vascular compromise.
14. Venous Doppler probe is very useful for monitoring not only post operatively but for intra op vascular problems, i.e., tight closure, microvascular thrombosis at the anastomosis, proximal inflow or outflow problems.
15. Shaving down the dorsal 75 % of the metatarsal head without any changes to the plantar surface of the metatarsal head can help with loose closure over of the foot.
16. Posterior splint for 2 weeks with post op suction drain at the foot is advised.
17. Patient may ambulate on his heel and no pressure on the operative site for 2 weeks and may fully ambulate at 6 weeks. Light compressive wrap (Ace bandage) for 6 weeks.
18. Patients are hospitalized 5 days and monitored closely for vascular compromise.
19. ASA 350 mg/day and Dextran 40 at 25 cc/h for 5 days. Heparin is used only in situations of vascular compromise or take backs.
20. Hand therapy should fabricate a custom thumb spica splint and begin motion on the day of discharge.

Postoperative Care

1. Admit to SICU for vigilant monitoring of flap for 48 h.
2. Aspirin 325 mg is administered on post-op day 1 and continued for at least 2 weeks
3. Hand therapy starts 5 days postoperatively which follows the same protocols as replantation
4. Passive full range of motion for 4 weeks.
5. Active range of motion starts on week 5 followed blocking flexion/extension exercises.
6. Sensory rehabilitation is initiated as early as patient is able to feel vibrations with the transplanted toe tip.

Operative Dictation

At the Hand

Diagnosis: L thumb amputation
Procedure: left great toe to left thumb transplant.

Indications

The patient is a 25-year-old right-hand dominant man who suffered an amputation of his left thumb while using a skill saw 4 months ago. Unfortunately the amputated part was too badly damaged and cannot be replanted. The amputation level was through the proximal third of the proximal phalanx. The metacarpophalangeal joint was still in continuity and has not been damaged. Two operative teams will work simultaneously. The description of the operation at the hand will be dictated first followed by the operation at the foot.

Description of the Procedure

After general anesthesia was obtained the left arm was placed on an arm board. The left hand and arm were prepped and draped. At the hand, appropriate marks were made to allow for the toe transplant. Prior to prepping, the veins of the dorsal wrist were marked out for dissection later.

A well-padded tourniquet on the left arm was elevated to 250 mmHg of pressure after exsanguination with an Esmarch bandage. Longitudinal incision was made from the dorsum of the thumb proximally to the metacarpophalangeal joint. It was extended distally over the stump of the thumb and onto the volar aspect. Extension proximally was done in a Bruner incision fashion. Dissection was taken down through skin and subcutaneous tissue over the dorsum of the thumb. The incision was continued proximally identifying terminal branches of the Cephalic vein which were tagged for use later. The branch of the dorsal radial nerve supplying the dorsum of the thumb was identified and tagged. Dissection was carried out in the anatomical snuff box to identify the dorsal radial artery, which was tagged. The extensor tendon to

the thumb was also identified and tagged just proximal to the MCP joint.

The skin and subcutaneous tissue of the thumb was then peeled away from the bony skeleton of the proximal phalanx and MCP joint. The digital nerves on both the radial and ulnar side were identified and tagged. The flexor tendon was also identified and freed of adhesion so that there was good excursion of the tendon. The end of the proximal phalanx amputation stump of the thumb was freed of soft tissue and scar for better bone contact. The tourniquet was released.

We then measured the lengths needed for the nerves, vessels and tendons and gave this information to the toe harvesting team.

Once the great toe was harvested it was brought into the hand field. Using a high-speed burr, we create an intramedullary cup at the end of the proximal phalanx of the toe also shave down the prominent proximal portion of the proximal phalanx of the toe. The toe proximal phalanx was then placed over the thumb proximal phalanx and a press fit osteosynthesis was created. A 25 mm cannulated 2.5 mm screw was placed across all four cortices for very rigid fixation. This was confirmed by the intraoperative x-ray.

The extensor tendon was repaired using a Pulvertaft weave and 4-0 FiberWire mattress suture. The flexor tendon was repaired end to end using 4-0 FiberWire and four strand technique. The operating microscope was brought into the field and end to end repair of the dorsal radial artery to the great toe artery was performed using 9-0 nylon. Prior Allen's test showed good flow to the entire hand through the ulnar artery. The cephalic vein was repaired end to end to the Great toe vein. Dextran 40 at 25 cc/h was started intravenously. The distal end of the dorsal radial nerve supplying the dorsum of the thumb was repaired using 9-0 nylon to the distal branches of the deep peroneal and superficial peroneal nerve supplied the dorsum of the toe.

The hand was now turned over and using the operating microscope, the ulnar and radial digital nerves were repaired end to end to the corresponding nerves of the Great toe. All clamps were removed and the toe pinks up immediately with good outflow through the vein. A Cook vascular venous Doppler probe was placed on the vein proximal to the vein repair site. A good signal can be heard.

The skin was closed with 4-0 nylon over a small Penrose drain. Dressings were placed and thumb spica postoperative splint was fabricated. The patient was taken to the recovery room after successful resuscitation from anesthesia.

At the Foot

Description of the Procedure

Prior to prepping, the veins draining the toe were marked. Preoperative markings of the toe were made to correspond to the thumb markings. After the foot and leg were prepped and draped in the usual fashion incisions were made through skin and subcutaneous tissue. We found the distal branches of the saphenous vein and tagged this for later use. The deep peroneal nerve supplying the dorsum of the great toe was tagged. The long extensor to great toe was identified and tagged. The short extensor was cut and would not be repaired at the hand.

The incision was carried out distally to the first web space. Care was taken to identify the digital nerve to the great toe on the lateral side. Just dorsal to the nerve was where we find the digital artery and trace this proximally, either in a plantar fashion or dorsal fashion, depending on the dominance of the toe flow. Small branches to the second toe were identified and divided. We traced the artery to the toe proximally to the length that was necessary to anastomose to the vessel in the hand. *(If the system was plantar dominant, and tracing the vessel on the plantar aspect of the foot becomes tedious, a vein graft to the artery may be used in the hand.)*

Our attention then turned to the medial side of the Great toe where the incision continued around the medial aspect of the toe and plantar to identify

the medial plantar nerve and flexor tendon. The flexor tendon sheath was opened and the flexor tendon was dissected out proximally and transected the length described by the hand team. Both plantar digital nerves were also transected at the appropriate level. The metatarsophalangeal joint capsule was then transected circumferentially making sure to leave the sesamoids with the foot.

The toe was now nearly off the foot, being held by the extensor tendons and artery and vein.

The tourniquet was released and the toe reperfused. Papaverine was used as well as clipping and tying off unsatisfied side branches to reverse the vasospasm. With warm irrigation the toe became pink.

We allowed the toe to perfuse for 15 min and then transected the vessels, dorsal nerve and extensor tendon and gave the toe to the surgeons at the hand.

Hemostasis was obtained. Using an oscillating saw we remove off the dorsal surface of the metatarsal head. The incisions were closed loosely over a small suction drain using 4-0 Monocryl and 4-0 nylon.

Dressings were placed and posterior splint is used to hold the ankle at 90°.

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Ulnar Collateral Ligament (UCL) Repair

106

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Indications

1. Ulnar collateral ligament (UCL) rupture with failure of conservative management (Immobilization).
2. Interposition of the adductor pollicis aponeurosis between the extremities of the ligamentous fragments (Stener lesion).
3. Displaced fracture diagnosed by radiographs.
4. Spontaneous radiological palmar or lateral joint subluxation.
5. Supination deformity with or without fracture.

Possible Complications

1. Dorsal thumb transient paresthesia secondary to prolonged intraoperative traction on the dorsal branch of the radial nerve.
2. Recurrent rupture of the UCL.
3. Osteoarthritis.
4. Scar contracture.

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Essential Steps

Preoperative Markings

Draw a longitudinal curved (S-shaped) line on the dorso-ulnar aspect of the joint with the patient's hand positioned prone.

Intraoperative Details

1. Placed in supine position.
2. Tourniquet is applied to the arm.
3. General anesthesia or nerve block.
4. Hair at the site of the procedure is shaved, if present and the hand is prepped.
5. The upper extremity is draped and the concerned thumb is exposed.
6. The tourniquet is inflated at 200 mmHg.
7. The skin and the subcutaneous tissue are incised along the S-shaped marking site on the dorso-ulnar side of the joint.
8. The rupture site is identified.
9. Care is taken not to damage the cutaneous dorso-ulnar branch of the radial nerve.
10. The adductor pollicis aponeurosis is identified.
11. The proximal end of the ulnar collateral ligament is identified.
12. Additional exposure to the ruptured ligament is achieved through a longitudinal incision of the aponeurosis.

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13. Bone fracture is identified.
14. The fracture is reduced and stabilized with a Kirschner wire.
15. Repair of the UCL rupture is performed in a modified-Kessler fashion or by the pull-out technique (in case of distal avulsion).
16. Suture of an associated dorsal capsular tear is performed if needed.
17. The aponeurosis is repaired and the skin is closed.
18. Percutaneous fixation or splint immobilization of the MCP joint is done.
19. Dressing is applied.

Postoperative Care

1. Pain control.
2. Antibiotics therapy with first generation cephalosporin or clindamycin (in case of allergy to penicillin).
3. Patient is seen in 1 week to check the wound and change the dressing.
4. Start physical therapy after removal of splint.

Operative Dictation

Diagnosis: ulnar collateral ligament rupture of the thumb.
Procedure: ulnar collateral ligament (UCL) repair.

Indications

This is a _____ with ulnar collateral ligament rupture with presence of Stener lesion, displaced fracture, palmar/lateral joint subluxation or supination deformity. The risks and the benefits of the procedure have been discussed with the patient who agrees with the plan of care.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating theater and placed in supine position. Time out among the operating theater staff was taken.

Preoperative antibiotics were given. Tourniquet was applied to the extremity on which the procedure to be performed. General Anesthesia or nerve block was instituted. Hair located at the site of the procedure was clipped. With patient's hand positioned prone, the preoperative markings were drawn with a longitudinal S-shaped line on the dorso-ulnar aspect of the joint. Prepping of the hand was done distally from the tip of the fingers to the elbow proximally and allowed to dry completely. The patient was then draped in the standard sterile surgical manner and the thumb was exposed. The tourniquet was inflated at 200 mmHg. The skin and the subcutaneous tissue were incised along the S-shaped marking site. This allowed access to the volar base of the proximal phalanx where the disruption occurred. Care was taken to avoid injury of the cutaneous dorsoulnar branch of the radial nerve. The adductor pollicis aponeurosis was identified blending with extensor pollicis longus tendon. Over the proximal border of the aponeurosis, the proximal end of the ulnar collateral ligament was identified. The aponeurosis was incised along its longitudinal axis on the ulnar side of the metacarpophalangeal joint allowing further exposure of the ruptured ligament. Bone fracture was identified. The fracture-associated hematoma was washed and the MCP joint was irrigated. The fracture was anatomically reduced and stabilized with a 1.2 mm Kirschner wire placed obliquely from the ulnar base of the 1st phalanx to its lateral cortex. Using 6-0 Prolene sutures, the ulnar collateral ligament was repaired in a modified-Kessler fashion. In the presence of distal avulsion of the UCL, the pull-out technique was adopted using 4-0 Prolene sutures through the base of the proximal phalanx. This was followed by suturing of the associated dorsal capsular tear with 6-0 Prolene sutures. The aponeurosis was then repaired before primary closure of skin in a horizontal mattress fashion using 5-0 Vicryl Rapide. Finally, the metacarpophalangeal joint was percutaneously fixed with Kirschner wire and immobilized against abduction by a splint for 4 weeks. Dressing was applied at the end of the procedure.

Suggested Reading

Management of joints and ligaments injuries. In: Wolfe SW, editor. Green's operative hand surgery, 6th edn. Churchill Livingstone.

Reconstruction of the joints ligaments. In: Chung KC, editor. Essential of hand surgery.

Management of joints dislocations. In: Beasley RW, editor. Beasley's Surgery of the Hand. Thieme.

Syndactyly Release

107

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Defenition

1. Congenital hand deformity comprising of adherence of one or more digits in hands or feet.

Possible Complications

1. Recurrence of deformity.
2. Web space creep.
3. Scar contracture at surgical site and subsequent finger deformity.
4. Devascularization.

Essential Steps

Preoperative

1. X-ray of involved hand should be done to rule out bony syndactyly and fusion which will necessitate additional procedures to the ones described below.
2. Marking of opposing zigzag incisions on volar and dorsal aspects of joint skin at the site of syndactyly, as well as marking of a dorsal proximally based triangular flap at the site of the web-space commissure to be created (site is approximated from adjacent, normal web spaces).
3. In multiple-digit syndactyly, syndactyly of thumb with index fingers, as well as ring with small fingers are released first due to length discrepancy of these digits which may cause functional and growth impairment in cases of delayed reconstruction.
4. In case of multiple-digit syndactyly, release of both sides of a single digit is generally not performed so as to minimize chances of vascular impairment of the digit.

Intraoperative Details

1. Patient is placed in the supine position with the involved extremity in abduction on an arm table.
2. General anesthesia is instituted.

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3. Tourniquet is applied to involved extremity if feasible, to be inflated as needed.
4. Involved extremity is prepped and draped.
5. Arm tourniquet is inflated after extravasation of arm by applying pressure.
6. Preoperative markings are followed, and incisions made dorsally to develop a dorsal flap at the site of syndactyly a zigzag incision. Volar zigzag incisions are make also following the preoperative markings, the volar and the dorsal flap incision angles face directly opposite each other.
7. Dissection of the joined soft tissue is performed to separate the two digits, taking care not to injure the digital neurovascular bundle under loop magnification.
8. When the previously joint tissue is completely separated, the dorsal proximally based triangular flap is pulled volarly and sutured to volar skin to form the floor of the web space between the separated digits.
9. Opposing zigzag (angular) volar and dorsal edges of each digit are approximated together respectively at the lateral digital edges and closed using 4-0 or 5-0 Vicryl Rapide sutures, thereby completing the syndactyly separation.
10. In most cases, a shortage of skin prevents complete closure of the lateral digital incisions. Subsequent open wounds should be covered by split of full-thickness skin grafts.
11. Tourniquet is deflated and fingertips are checked for capillary refill.
12. Bacitracin and gauze dressings are applied.
13. Splinting of separated digits is performed in proximal interphalangeal joint and distal interphalangeal joint extension so as to limit scar contracture.

Postoperative Care

1. Hand should be elevated so as to minimize edema and subsequent pain.
2. Vascularity of the fingertips of the separated digits should be checked periodically in first 3 h after surgery to rule out any vascular compromise.

Operative Dictation

Diagnosis: syndactyly of _____ digits.
Procedure: syndactyly release.

Indication

This is a ___-year-old patient with syndactyly of _____ digits necessitating surgical treatment. Patient's parents/guardians understand the benefits, risks, and alternatives associated with the procedure and wish to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operative room and placed in the supine position. Time out among operating room staff was performed. Patient was placed under general anesthesia and preoperative antibiotics were given.

The involved extremity was placed in an abducted position on an arm table, a tourniquet was applied to the arm and left on standby and the extremity was prepped and draped circumferentially in the usual manner.

Tourniquet was inflated after upper extremity was extravasated by application of pressure/elevation and time was taken. A #15 scalpel was used to make incisions following the preoperative markings, thereby incising the proximal part of the joint dorsal skin to form a rectangular proximally based flap, and continuing with a volar zigzag midline incision to the tip of the syndactyly dorsally. In the volar aspect of the syndactyly opposing (mirror-image) to the dorsal zigzag incision.

Steven's scissors were used to dissect the soft tissues underlying the skin incisions, special care was taken to identify and preserve digital neurovascular bundles using loupe/microscope magnification. Dissection was carried out until complete separation of the joint fingers is achieved.

The dorsal, proximally based rectangular flap was undermined and transposed volarly to form the floor of the newly created web-space between

the previously joined digits. It was sutured to the volar skin using 5-0 Vicryl-Rapide sutures. The dorsal and volar edges of each respective digit were approximated at the lateral aspect of the digit and sutured together using 4-0 or 5-0 Vicryl-Rapide sutures.

Note: Ideally, the zigzagged edges should fit each other and provide complete wound closure at the lateral digital aspects. However, shortage of skin is frequently observed, resulting in inability to achieve complete wound closure. The resulting open wounds should then be covered with full-thickness skin grafting.

Tourniquet was deflated at ..... minutes, hemostasis was performed, and fingertips of the newly separated digits were observed for adequate capillary refill. Bacitracin and gauze dressings were applied. Splint in digital extension was applied. After extubation, patient was transferred to the post anesthesia care unit.

Suggested Reading

Fingers and hand malformations. In: Wolfe SW, editor. Green's operative hand surgery, 6th edn. Churchill Livingstone.

Management of fingers syndactyly. In: Chung KC, editor. Essential of hand surgery.

Congenital fingers and hand malformations. In: Beasley RW, editor. Beasley's surgery of the hand. Thieme.

Fillet Flap (Finger)

108

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Indications

Extensive trauma to bone, nerves, or tendons rendering a digit functionally unsalvageable. A viable soft tissue flap is harvested from this traumatized digit to cover an adjacent defect utilizing a "spare parts" approach to reconstruction.

Possible Complications

1. Flap loss.
2. Revision.
3. Infection.
4. Wound dehiscence.
5. Hematoma.

Essential Steps

Preoperative Planning

1. Preparation of wound bed.
2. Total excision of nail complex.
3. Careful dissection to preserve digital neurovascular bundles.
4. Hemostasis before flap inset to prevent postoperative hematoma formation.

Intraoperative Details

1. Debridement of flap recipient site.
2. Y-shaped incision over dorsum of the digit.
3. En bloc excision of the nail complex with periosteal dissection deep to the plane of the nail bed.
4. Raising of subcutaneous tissue flaps laterally on the proximal digit.
5. Extensor tendon mechanism elevation and transection on traction.
6. Skeletonization of phalanges.
7. Transection of flexor tendons and amputation of bony phalanx through the metacarpophalangeal joint.
8. Debridement of cartilaginous metacarpal head with rongeur forceps.
9. Securing of split Penrose drain in wound bed.
10. Proximal inversion and insetting of fillet flap to cover defect.

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Postoperative Care

1. Close monitoring of flap for signs of venous and arterial insufficiency.

Operative Dictation

Diagnosis: complex injury of dorsal hand and fingers.

Procedure: fillet flap coverage.

Indication

This is a _____ with extensive injury to the digit including tendon disruption and defect of the dorsal hand. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After informed consent was obtained, the patient was brought to the operating room where time-out was performed to identify the patient and the appropriate procedure. Monitored sedation and a regional/peripheral nerve block were administered by the anesthesia team. A tourniquet was applied to the upper arm, and the left/right upper extremity was prepped and draped in the usual sterile fashion. Debridement of the wound defect proximal to the proposed fillet flap was performed back to punctate bleeding, removing any devitalized tissue. The wound was then irrigated with copious amounts of sterile saline.

The extremity was exsanguinated by compression wrap, and the tourniquet was inflated to 250 mmHg. The fillet flap dissection was begun utilizing a Y-shaped incision pattern over the dorsum of the digit. The incision was designed to excise completely the nail plate and bed, including excision of soft tissue from distal to the hyponychium to proximal to the germinal matrix. Laterally the excision included the nail folds as well. Proximal to the germinal matrix, the incision was brought to the midline along the remainder of the digit. After en bloc excision of the nail complex with periosteal dissection deep to the plane of the nail bed, subcutaneous tissue flaps were raised laterally on the proximal digit, exposing the extensor tendon mechanism. The extensor tendon mechanism was sharply elevated from the proximal, middle and distal phalanxes and was transected proximally on traction. Periosteal dissection was performed around each phalanx to skeletonize their bony architecture and affiliated flexor tendons for amputation. Care was taken to avoid dissection near the volar-lateral neurovascular bundles to preserve blood supply to the flap. The bony phalanx was amputated through the metacarpophalangeal joint sharply along with the flexor tendons on traction, exposing the cartilaginous metacarpal head. This surface was debrided using rongeur forceps to allow for eventual flap in-growth. A split Penrose drain was secured in the wound bed at its edge. The tourniquet was deflated and the total tourniquet time was noted. After satisfactory hemostasis was obtained using bipolar cautery, the fillet flap was inverted proximally to cover the defect. The flap was trimmed and inset with a combination of buried interrupted absorbable sutures and simple interrupted monofilament nonabsorbable sutures through the skin. Simple absorbent dry dressings were applied to the surgical site with a window cutout to allow for flap examination.

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Groin Flap

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Elias Zgheib and Joseph Y. Bakhach

Indications

1. Primary coverage for the hand and wrist area after acute traumatic injury.
2. Resurfacing large areas of the forearm up to the elbow.
3. Local transposed flap to resurface defects in opposite groin or perineal area.

Advantages

1. Length to base ratio about three times greater than the classic abdominal flap making it more mobile and permits freedom of movement of the fingers in immediate closure of traumatic injury.
2. Unused portion can be tubed to create a closed wound reducing the chance of infection.
3. Location of the flap is inconspicuous giving better donor site aesthetic result than other axial flaps.
4. Distal portion that is inset in recipient site is hairless even in hirsute individuals.
5. Subcutaneous tissue is often thinner in useable part diminishing the unsightly bulk.
6. Bone grafts could be taken from the iliac crest after the flap has been raised.
7. Excellent venous drainage at the base decreasing the postoperative edema.

Disadvantages

1. Flap will bulk up if the patient puts on weight.
2. The bed postoperatively needs to be immobilized.

Possible Complications

1. Partial flap necrosis.
2. Venous congestion.
3. Scar dehiscence.

Essential Steps

Flap Design and Preoperative Markings

1. Flap is based on the course of the superficial circumflex iliac vessels.
2. It is extended from 25 to 30 cm from the origin of these vessels laterally and obliquely upwards.

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3. Width of the flap varies from 7.5 to 10 cm depending on the defect.
4. Inguinal ligament is slightly above the median axis.

Intraoperative Details

1. A pencil Doppler is used to define the distal course of the artery.
2. The superior and medial incisions are made down to the level of the muscular fascia and the flap is then elevated from lateral to medial.
3. When the fascia over the Sartorius muscle is identified, it is incised and entered.
4. The dissection proceeds medially deep to this fascial layer, elevating the pedicle from lateral to medial.
5. When the origin of the artery and vein are identified, the flap is isolated on the vascular pedicle.
6. The flap is inset into the recipient defect.
7. The unused pedicle is tubed to avoid an open wound.
8. The grafted limb is immobilized to the abdomen.
9. After 3 weeks, the flap is detached from the abdomen as a second stage.

Postoperative Care

1. Patients should be referred early to a hand physiotherapist for early active and passive range of motion.
2. Bulky appearing groin flaps are managed with compression bandages.
3. Surgery for thinning/defatting can be done after a delay of at least 3–6 months.

Operative Dictation

Diagnosis: traumatic upper limb injury.
Procedure: groin flap soft tissue coverage.

Indication

This is a ____-year-old patient presenting for traumatic (avulsion, laceration, amputation, …) injury of the upper extremity.

Description of the Procedure

The patient was brought to the operating room after being marked and signing the informed consent.

General anesthesia was ensued by the anesthesia team and the patient was positioned supine on the table to expose well the groin area ipsilateral to the injured limb. The patient was prepped and draped in the usual sterile fashion. A well padded bump was placed under the ipsilateral hip to help ease exposure of the lateral aspect of the flap.

The Sartorius muscle, inguinal ligament, and iliac crest were all identified and marked to determine the flap design. A pencil Doppler was used to determine the location of the arterial pedicle (approximately a finger breadth below the inguinal ligament). The maximum width of the design was determined by pinching the skin assessing the potential tension of the closure after flap harvest. A superior incision was made, and the flap was elevated from the distal superior aspect medially towards its origin.

The incision was carried down to the deep fascia and the dissection continued over it, identifying and ligating perforating vessels while proceeding medially. The lateral aspect of the Sartorius muscle was identified after viewing the interval between it and the tensor fascia lata at the level of the anterior superior iliac spine.

The lateral femoral cutaneous nerve of the thigh was identified as it exited the deep fascia (*it may need to be transected*). The muscular fascia was incised along its lateral aspect and the flap was elevated at a plane deep to the fascia. The superficial circumflex iliac vessels became visible, with medial procession, in the plane above the Sartorius muscle. Skin incisions were made inferiorly and medially relieving the tension as the dissection proceeded.

Branches to the muscle were ligated; the fascial plane around the pedicle was incised at the medial aspect of the Sartorius; the artery and vein were dissected free to their origin. The flap was mobilized on the vascular pedicle.

The donor area was closed over suction drains from medial to lateral direction in layers using 2-0 Vicryl and 2-0 Nylon sutures. The flap was thinned lateral to the anterior superior iliac spine. The flap was inset into the recipient site using small interrupted 3-0 Nylon sutures. The involved upper limb was immobilized to the abdomen with adhesive tape. The patient was dressed and awakened from anesthesia holding the groin flap arm securely. The patient was transferred to the recovery room.

Further Steps

The flap will be divided and closed primarily 3 weeks post the first procedure.

Suggested Reading

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Reverse Radial Forearm Flap

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Indications

1. Pedicled reverse flap based on reverse flow from the radial artery derived from the ulnar artery through the palmar arch.
2. Coverage of soft tissue defects in the hand and thumb.
3. Coverage of wrist, forearm defects.

Possible Complications

1. Donor site poor cosmesis.
2. Acute ischemia of the hand in case of radial artery dominancy.
3. Radial nerve injury.
4. Flap failure due to arterial ischemia or venous congestion.
5. Stiffness due to immobilization either in hand reconstruction or for donor site graft to take.
6. Loss of the donor site graft.

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Essential Steps

Preoperative

1. Allen test should be done to make sure of a patent collateral system from the ulnar artery.
2. Flap marking and design should be done preoperatively according to soft tissue defect.

Intraoperative Details

1. Tourniquet use is advised for better hemostasis and clear exposure.
2. Harvest the skin, subcutaneous tissue, and fascia off the muscle along with the intermuscular septum to preserve the septo-cutaneous perforators.
3. Before dividing the radial artery, it should be clamped with a vascular clamp and tourniquet released to make sure of sufficient blood supply to the hand through the ulnar artery.
4. Great care must be taken to elevate the flap off the brachioradialis tendon to avoid injury to the perforators.
5. Identify and protect the radial nerve under the brachioradialis and distally.
6. Avoid separation of the artery and venae comitantes.

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7. With exposure of the FCR tendon, suture the superficialis muscle over this to improve skin graft take at the donor site.
8. Avoid kinking the pedicle with distal rotation.
9. If tunneling the flap under an intact skin bridge, make sure that it is wide enough to avoid compression on the pedicle.

Postoperative Care

1. The upper extremity was kept in a volar splint and elevated over a pillow for 5 days until dressing changed and the graft take was insured.
2. Dressing window was kept over the flap for daily check. Flap color and capillary refill should be monitored frequently to spot any ischemia or congestion immediately.
3. The patient should be supplied with incentive spirometer and depending on the age and comorbidities, DVT prophylaxis should be contemplated.
4. The patient should be encouraged to ambulate as soon as possible.

Operative Dictation

Diagnosis: soft tissue defect of the hand due to trauma or tumor excision.
Procedure: reverse radial forearm flap.

Indication

Soft tissue defect of the hand or fingers with exposed tendons.

Description of the Procedure

Under general anesthesia with the patient in the supine position, the patient's name, hospital number, procedure and surgical site were verified during a time out. A Doppler assisted Allen's test was performed to the patient that assured and adequate pulse through the radial artery and the deep palmar arch. The upper extremity was prepped and draped in the usual manner. A tourniquet was applied at the arm and inflated to 250 mmHg after exsanguinations of the hand and forearm.

Attention was directed to the forearm. After designing the trajectory of the radial artery and after designing a rectangular flap on the proximal and ulnar aspect of the forearm, using a #15 scalpel, an incision was performed. Dissection was started on the ulnar aspect and deepened down to the subcutaneous tissues until reaching the muscle fascia. Dissection was continued in the subfascial plane until reaching the intermuscular septum. The fascia was then secured to the skin using 4-0 Polyglactin interrupted sutures for avoiding shear forces. The flap was then approached from the radial side and dissected subfascially reaching the radial side of the intermuscular septum.

The flexor carpi radialis and the brachioradialis were identified and retracted on both sides exposing the lateral intermuscular septum where the radial artery and two venae comitantes were visualized, and the inferior portion of the septum deep to the artery was sharply divided to elevate the flap completely from its bed. The radial artery and its venae comitantes were then identified and isolated proximal to the flap and clamped with a microvascular clamp and the tourniquet was released. After securing adequate blood supply to the hand and the flap were adequate, the pedicle was then ligated and divided and then the flap elevation was completed in a proximal to distal direction.

A longitudinal incision ending at the radial styloid with the most proximal and radial corner of the defect was performed. Dissection of the deep septum was continued distally clipping all the muscular perforators. The vascular pedicle was visualized directly to avoid any kinking, twisting, or compression. The flap was transferred to the previously prepared bed at the hand without any kinking of the pedicle, and was anchored to the edges of the defect using 3-0 Nylon sutures under no tension.

If the flap donor site defect was difficult to close primarily, then attention was directed to the prepped thigh. Using pneumatic dermatome a split thickness skin graft was harvested applied to

the forearm donor site defect and fixed using skin staples. Loose dressing was applied over the flap and bolster dressing over the grafted area. Doppler pulse was checked finally after applying the dressing. The hand and forearm were placed in a splint to prevent movement and for protection.

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Ulnar Artery Perforator Flap

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Indications

Any distant traumatic or post-oncologic surgery mild or moderate soft tissue defect especially the in head and neck region.

Complications

1. Donor site complications (usually minor and they resolve spontaneously): Partial skin graft loss, Mild hypothenar paresthesia, pain, fourth and fifth finger stiffness, grip weakness.
2. Absence of ulnar artery perforator or iatrogenic perforator damage.
3. Flap partial or total ischemia.
4. Bleeding and/or infection.

Essential Steps

Preoperative Markings

1. The nondominant arm is chosen.
2. A line connecting the pisiform bone at the wrist crease and the volar aspect of the lateral epicondyle is drawn.
3. Perforator A is marked 7 cm proximal to the pisiform, or one-fourth of the forearm length from the pisiform.
4. Perforator B is marked 4 cm proximal to perforator A.
5. Perforator C is marked 4.5 cm proximal to B.
6. The long axis of the flap is centered on perforator B and the width should be centered over the pisiform-to-elbow line.
7. The distal border of the flap is placed 5 cm proximal to the pisiform to minimize tendon exposure.

Intraoperative Details

1. Patient is placed in supine position and general anesthesia is instituted.
2. The donor and the recipient sites are prepped and draped in the usual manner.
3. The soft tissue defect is assessed and measured.
4. The nondominant arm is chosen and preoperative markings are re-marked.

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5. A tourniquet is placed and inflated without exsanguination.
6. An incision is made on the radial aspect of the flap.
7. Suprafascial dissection is performed ulnarly until reaching the septum between the flexor carpi ulnaris and flexor digitorum superficialis.
8. Perforators are identified and marked on the skin with permanent sutures.
9. The flap design is recentered around the final location of the perforators as necessary.
10. The distal border of the flap is incised including the most distal perforator.
11. Slightly radial to the perforators, subfascial dissection is performed.
12. The ulnar vessels and nerve are exposed and the perforators are dissected to their origin.
13. The ulnar vessels are ligated and divided distally.
14. Ulnar incision and subfascial dissection, ulnar to radial, toward the vascular pedicle is performed.
15. The ulnar vessels are carefully separated from the ulnar nerve that is protected.
16. Proximal dissection is completed by extending the incisions and exposing the origin of the ulnar artery at the bifurcation with the common interosseous artery.
17. Tourniquet is released, flap is reperfused.
18. Donor vessels at the recipient soft tissue defect are dissected and prepared for microvascular anastomoses.
19. The vascular pedicle is divided and the flap is rendered ischemic ready for microvascular anastomoses.
20. Flap inset and microvascular anastomoses.
21. Wounds are closed over suction drains. Donor site is skin grafted if needed.

Postoperative Care

1. Monitor vitals, urine output and drainage.
2. Flap monitoring as per institution or surgeon's protocol.
3. Adequate control of blood pressure and body temperature.
4. Pain control.

Operative Dictation

Diagnosis: Moderate size soft tissue defect (any location) with no local options available.
Procedure: Ulnar artery perforator free flap

Indications

This is an X year-old patient presenting with the above mentioned soft tissue defect that needs reconstruction with a thin and pliable flap. An ulnar forearm flap would be ideal for such a reconstruction in the presence of intact bilateral forearms of the patient. The risks and the benefits of the procedure have been discussed with the patient who agreed with the plan of care.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating theater and placed in supine position with the upper extremity to be operated placed on an arm table. Time out among the operating theater staffs was taken. Preoperative antibiotics were given. General anesthesia was instituted. Hair located at the sites of the procedure was clipped. Foley catheter was inserted. The preoperative markings were drawn. Prepping of the donor and recipient sites was done and allowed to dry completely. The patient was then draped in the standard sterile surgical manner. The soft tissue defect was assessed and measured.

A sterile tourniquet was applied to the arm and inflated to 100 mmHg above the patient's systolic blood pressure, without exsanguination. An incision was performed on the radial aspect of the flap according to preoperative marking. Dissection was deepened and continued in a suprafascial plane towards the ulnar side until the perforators located in the septum between the flexor carpi ulnaris and flexor digitorum superficialis were identified. The perforators' locations were marked on the skin surface with 6-0 permanent sutures. The flap design was revised and centered, as necessary, based on the actual location of the needed perforators and their sizes.

Distal flap skin incision was performed, if possible, distal to the distal perforator to include within the flap. Few millimeters radial to the perforators, the fascia was incised and subfascial dissection into the septum was performed where the ulnar artery, vein and nerve were dissected. The perforators were then traced and dissected carefully through their septocutaneous or musculocutaneous course down to their origin of the ulnar artery. The ulnar vessels pedicle was dissected, ligated and divided distally where the ulnar nerve was preserved.

The ulnar incision was made. Subfascial dissection was performed in an ulnar to radial direction toward the vascular pedicle. For musculocutaneous perforators, either a true perforator dissection where the flexor carpi ulnaris muscle fibers were divided or a small cuff of muscle was included around the perforator within the flap. Without any use of electrocautery, the ulnar nerve was then carefully separated off the flap pedicle where any small muscular branches were ligated with clips. Dissection of the pedicle was continued proximally until its origin at the bifurcation with the common interosseous artery.

After completion of the dissection and skeletonization of the artery and vein, tourniquet was released and the flap was reperfused before division of the vascular pedicle. *(If two skin paddles are needed where two skin perforators are available, the flap can be split into two halves where one perforator is included for each skin paddle.)*

Attention was directed to the recipient area of soft tissue defect to prepare the donor vessels. Whenever an adequate artery and vein were dissected and rendered ready for microvascular anastomosis, attention was directed again to the forearm and the flap was rendered ischemic for transfer. The flap was exsanguinated with gravity and flushed with heparinized saline. The flap was inset partially to immobilize it using 3-0 Vicryl suture in a simple interrupted fashion.

Microvascular anastomosis was performed using the operative microscope. Once completed, perforator Doppler on the skin was checked. Anastomosis was checked. The recipient area was copiously irrigated with antibiotic solution. Suction 15-French Blake drains were placed and secured in place with 2-0 nylon sutures.

Skin was closed in layers using 3-0 Monocryl in the deep dermal layer and a 4-0 Prolene running suture on the skin. During this time, the donor site was closed simultaneously. The forearm donor site was irrigated with normal saline. Hemostasis was achieved. A single 15-French drain was placed and secured in place with a 2-0 nylon suture. Fasciocutaneous flaps were undermined on both sides and advanced towards each other for minimal undue tension closure. *(If the defect is sizeable and primary closure cannot be achieved then a split or full thickness skin graft is applied.)* The incision was dressed with antibiotic based dressing. A volar splint was applied to the forearm. Doppler arterial and venous signals were checked in the flap prior to patient transfer to PACU or ICU.

Postoperative Care

1. Patient general monitoring.
2. Flap monitoring every 1 h for the first 48 h followed by flap check every 2 h for another 48 h and the flap check every 4 h until discharge.
3. DVT prophylaxis 12 h after surgery if no bleeding exists.
4. Pain control.

Suggested Reading

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Lateral Arm Flap

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Indications

1. Pedicled use: traumatic or post-oncologic surgery soft tissue coverage of the proximal upper extremity and shoulder.
2. Free tissue transfer use: any distant traumatic or post-oncologic surgery moderate soft tissue especially the head and neck region that has best color match with the lateral arm region.
3. Release of burn and radiation scar contractures in the axillary region.

Complications

1. Longitudinal scar along the lateral arm.
2. Paresthesia at the posterolateral aspect of the proximal forearm.

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Essential Steps

Preoperative Markings

1. With 90° elbow flexion, mark the insertion of the deltoid and the lateral epicondyle.
2. Draw a dotted line connecting the insertion of the deltoid muscle to the lateral epicondyle. The line corresponds to the lateral intermuscular septum.

Intraoperative Details

1. Placed in supine position.
2. General anesthesia is instituted.
3. Hair at the sites of the procedure is clipped (if present).
4. The donor and the recipient sites are prepped and draped in the usual manner.
5. Skin paddle is centered over the posterior septum line and the width of the skin paddle is estimated by pinching test for primary closure of the flap donor area.
6. Posterior incision of the skin is done down to the subfascial layer.
7. The lateral intermuscular septum is exposed.
8. Perforators are identified and marked on the skin.

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9. The main vascular pedicle is identified and separated from the radial nerve and the posterior cutaneous nerve of the arm.
10. The anterior skin is incised down to the deep fascia and the subfascial dissection proceeds posteriorly towards the septum.
11. The septum is separated from the humerus bone.
12. The dissection proceeds proximally.
13. Proximally, the anterior radial collateral artery is sacrificed.
14. The veins and the artery of the flap pedicle are ligated followed by division of the flap.
15. The wound is closed primarily over a drain.
16. Dressing is applied.

Postoperative Care

1. Monitor vitals, urine output and drainage.
2. Flap monitoring as per institution or surgeon's protocol.
3. Adequate control of blood pressure and body temperature.
4. Pain control.

Operative Dictation

Diagnosis:
Pedicled use: soft tissue defect of proximal arm, deltoid or axillary region.
Free tissue transfer use: soft tissue defect in any location.

Procedure:
Pedicled lateral arm flap.
Free lateral arm flap.

Indications

This is an X-year-old patient presenting with the above mentioned soft tissue defect. The risks and the benefits of the procedure are discussed with the patient who agrees with the plan of care.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating theater and placed in supine position with the upper extremity to be operated in a 90-degree elbow flexion position. Time out among the operating theater staffs was taken.

Preoperative antibiotics were given. General anesthesia was instituted. Hair located at the sites of the procedure was clipped. Foley catheter was inserted. The preoperative markings were drawn: a straight line from the deltoid insertion to the lateral epicondyle is drawn indicating the posterior septum. The flap skin paddle marking was drawn and centered over the septum marking with a width that was estimated by the pinching test for primary closure of the donor area. Prepping of the donor and recipient sites was done and allowed to dry completely. The patient was then draped in the standard sterile surgical manner.

Common Path

First, a posterior incision was made to the skin and subcutaneous tissues down to the deep facial layer that was, in turn, incised to reach the subfascial plane. The subfascial dissection proceeded anteriorly exposing the lateral intermuscular septum. Perforators were identified and marked on the skin. Following coagulation of the small vessels entering the triceps muscle, the main vascular pedicle was identified within the distal two-thirds of the septum. The radial nerve and the posterior cutaneous nerve of the arm were carefully separated from the vascular pedicle and well protected. The anterior skin was then incised down to the deep fascia and the subfascial dissection was initiated posteriorly towards the septum. Care was taken when dissecting and elevating the deep fascia as some of the brachioradialis muscle fibers originated from the septum. As the main pedicle was again identified, isolation of the septum from the humerus bone was done. While the dissection proceeded proximally, care was taken where the pedicle left the septum as the common

radial collateral artery, from which the vessel of the flap arose, and the anterior radial collateral artery lied in close proximity to the radial nerve. In order to get a longer flap pedicle, the anterior radial collateral artery was sacrificed.

Pedicled Use

The flap was transposed to the soft tissue defect of the deltoid or the axillary region and inset in layers with absorbable sutures. A drain was inserted into the donor as well as the recipient area. Wounds were closed primarily in layers.

Free Tissue Transfer Use

Dissection of the pedicle was done and ligation of both veins and the artery was done followed by division of the flap. The flap was irrigated with physiologic solution and transfer for microvascular anastomosis to the donor vessels. A drain was inserted into the wound and exteriorized from the skin. The wound was closed primarily in multiple layers. Dressing was applied.

Postoperative Care

1. Flap monitoring every one hour for the first 48 h followed by flap check every 2 h for another 48 h and the flap check every 4 h until discharge.
2. DVT prophylaxis 12 h after surgery if no bleeding exists.

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113 Medial Femoral Condyle Corticocancellous Flap for Treatment of Scaphoid Nonunion

Tuan Anh Tran and Christopher O. Bayne

Introduction

Free vascularized corticocancellous flap from the medial femoral condyle based on the descending genicular artery was described by Sakai, and Doi et al., and separately by Masquelet in 1991 [1, 2]. Since then, the application of this free flap has broadened the surgeon's armamentarium to successfully treat nonunions of the clavicle, tibia, humerus, mandible, and scaphoid [3]. The success of this flap has been attributed to its robust blood supply [4]. Originally described as a small corticoperiosteal tubular bone flap, it has been frequently employed as a living patch to recalcitrant nonunions and necrosis of larger bones because it provides adequate living cells and growth factors. This chapter describes the use to the free corticocancellous bone flap for the reconstruction of scaphoid nonunion associated with avascular necrosis and humpback deformity. Indications, preoperative markings, surgical steps, postoperative care, complications, operative dictation, and suggested readings are included.

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Indications

1. Scaphoid nonunion associated with humpback deformity and proximal segment avascular necrosis.
2. Evidence of dorsal intercalated segment instability.
3. Non-united scaphoid with bad geometry which precludes the use of wedge bone graft and/or 1, 2 intercompartmental supraretinacular vascularized distal radius graft.
4. No evidence of scaphoid nonunion advanced collapse, wherein a salvage procedure is more appropriate.

Essential Steps

Preoperative Markings

1. Identify the landmarks including the flexor carpi radialis (FCR), the radial artery, the scaphoid and the radial styloid process.
2. Mark the volar scaphoid incision. This incision begins just radial to the FCR tendon from 8 cm proximal to the wrist crease. It continues

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distally across the crease to the level of the scaphoid tuberosity. At this point the incision is angled distally and radially in line with the thumb metacarpal for 1.5–2 cm.
3. Identify the donor site landmarks, including the medial joint line of the knee and the posterior border of vastus medialis.
4. Mark an incision parallel to the posterior border of the vastus medialis extending 15–20 cm proximal to the joint line.

Intraoperative Details

1. Place pneumatic compression device prior to anesthesia induction.
2. Exsanguinate the upper extremity and inflate the tourniquet.
3. Use the extended volar approach to the scaphoid.
4. Expose the scaphoid and inspect carefully.
5. Debridement of pseudoarthrosis.
6. Correct DISI deformity and hold reduction with K wires.
7. Determine the size of the bony defect.
8. Prepare the recipient vessels (radial artery, venous comitantes, and cephalic vein)
9. May choose to inflate the thigh tourniquet.
10. Incise the skin and fascia of the vastus medialis.
11. Expose the osteoarticular branch of the descending genicular artery on the compartment floor.
12. Dissect the pedicle and its two venous comitantes proximally to its origin from the superficial femoral vessels.
13. Identify, protect, and preserve the medial superior genicular artery, saphenous branch and cutaneous branch, and saphenous nerve, and medial collateral ligament.
14. Choose a rectangular area of sufficient size appropriate for patching the scaphoid defect.
15. Procure the bone flap with its periosteum with a sagittal saw followed by an osteotome.
16. Shape and inset the corticocancellous bone flap into the recipient scaphoid gap.
17. Under fluoroscopic guidance, place a guide wire across the proximal fragment, the bone flap, and the distal fragment of the scaphoid, followed by a cannulated screw.
18. Create an arteriotomy in the radial artery. An end-to-side anastomosis is performed with 10-0 Nylon suture.
19. End-to-end venovenous anastomoses are hand sewn with 10-0 Nylon (alternatively, venous coupler devices are used).
20. Apply a bulky, compressive dressing with a thumb spica long arm splint with the wrist in neutral position.
21. Close the donor site.

Postoperative Care

1. Employ knee immobilizer for 7 days. Full weight bearing on the leg is allowed.
2. Remove permanent sutures in 1 week.
3. Switch the operative splint out to a long-arm thumb spica cast for 4 additional weeks.
4. Follow the patient with out of cast exam and radiograph until the healing is confirmed.

Possible Complications

1. Relapse of scaphoid nonunions.
2. Superficial skin infection.
3. Osteomyelitis.
4. Supracondylar fracture [5].

Operative Dictation

Diagnosis: scaphoid nonunion fracture.
Procedure: open treatment of scaphoid nonunion with medial femoral condyle corticocancellous flap.

Indication

This is a _____ with scaphoid nonunion associated with proximal segment avascular necrosis and humpback deformity. There is also evidence

of dorsal intercalary segment instability (DISI) deformity on radiographs. It determines that the deformity and compromised proximal pole vascularity would benefit from a vascularized medial femoral condyle flap to restore the geometry and mechanical property of the scaphoid. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time out among operating room staff was taken. Pneumatic compression device was placed on patient's nonoperative lower extremity. Preoperative antibiotics were given. General anesthesia was induced. A Foley catheter was place. All pressure points were padded. Well-padded tourniquets were applied to the upper arm and operative upper thigh. The patient's operative upper and lower extremities were prepped and draped in standard sterile surgical fashion.

The upper extremity was exsanguinated with an Esmarch bandage and the tourniquet was inflated to 250 mmHg. An extended volar approach to the scaphoid was used. An incision began proximal to the wrist crease and radial to the flexor carpi radialis (FCR) tendon. At the wrist crease, the incision was curved slightly radially toward the thumb ending at the trapezium. The flexor sheath was opened. An umbilical tape was used to retract the FCR tendon ulnarly. The floor of the FCR tunnel was entered over the radiocarpal joint at the level of the scaphoid. A volar capsulotomy was made in the radioscaphoid joint exposing the scaphoid. The scaphoid was inspected carefully and the vascular integrity of the proximal segment was examined. The fracture nonunion site was carefully prepared with curettes and rongeur forceps. A sagittal saw was used to freshen the edges of the proximal and distal scaphoid fragment in preparation for the vascularized bone flap. The remaining bony defect at the fracture site was measured and recorded.

The dorsal intercalated segment instability deformity was corrected to obtain a neutral radiolunate angle. Kirschner wires were employed to hold reduction. The size of the bony defect was measured. The radial artery, venae comitantes, and cephalic vein were dissected and exposed in preparation for microsurgical vascular anastomoses. These vessels were encircled with Vessel loops. Moist pressure dressing was packed into the wrist. The tourniquet to the upper extremity was deflated. The tourniquet time was recorded. It was noted that the proximal pole of the scaphoid did not demonstrate bony bleeding when the tourniquet was deflated.

The attention was shifted to the medial knee and thigh of the donor site. The leg was elevated and the thigh tourniquet was inflated. Tourniquet time was noted. The knee was slightly bent. An 18 cm incision from the knee joint line proximally was made posterior to the vastus medialis. The subcutaneous tissue was deepened using the bovie electrocautery. The fascia of the vastus medialis was identified and entered. The muscle was retracted anteriorly exposing the osteoarticular branch of the descending genicular artery on the compartment floor. The pedicle and its two venae comitantes were dissected proximally to its origin from the superficial femoral vessels. The medial superior genicular artery, saphenous branch and cutaneous branch, and saphenous nerve were identified and preserved. Next, the distal posterior quadrant of the medial condylar surface was inspected identifying nutrient branches disappearing into the bone. The medial collateral ligament of the knee adjacent to this area was protected [6]. A rectangular area of sufficient size appropriate for patching the scaphoid defect was selected. The periosteum on the perimeter was incised. The bone was cut with a sagittal saw followed by an osteotome. Care was taken to protect and preserve the pedicle and its perforating branches. Once the corticocancellous flap was elevated, the pedicle was clamped and ligated. Ischemic time was recorded. Gelfoam soaked in 1% Lidocaine and 1:100,000 Epinephrine was packed into the donor medial femoral condyle bone gap. The thigh tourniquet was deflated and the total tourniquet time was noted.

The flap was taken to the wrist, shaped and fitted into the defect. Under fluoroscopic guidance, a guide wire was placed across the proximal fragment, the bone flap, and the distal fragment of the scaphoid. A cannulated screw was followed to secure the scaphoid and flap in appropriate alignment. An operative microscope was draped and brought into the field. The vascular pedicle was trimmed to appropriate length. An arteriotomy was made in the radial artery. An end-to-side anastomosis was performed with 10-0 Nylon suture. End-to-end venovenous anastomoses were hand sewn with 10-0 Nylon (alternatively, venous coupler devices were used). Patency of the vessels and perfusion of the flap were visually confirmed prior to closure. The volar capsule was closed with interrupted 3-0 Ethibond sutures. The area over the pedicle was loosely re-approximated. The skin was re-approximated with 4-0 Nylon suture in horizontal mattress fashion. The thigh was closed in layers over a drain. Compression dressing was applied. A bulky, compressive dressing with a thumb spica long arm splint was applied with the wrist in neutral position. The instrument and sponge counts were correct. The patient was extubated successfully, and taken to the post-anesthesia care unit in satisfactory condition.

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Flexor Sheath Irrigation for Flexor Tenosynovitis

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Jimmy H. Chim, Emily Ann Borsting, and Harvey W. Chim

Indications

1. Suppurative flexor tenosynovitis.

Possible Complications

1. Compartment syndrome (resulting from catheter placement outside of flexor sheath).
2. Repeat operation via open technique.
3. Loss of active or passive range of motion of digit.

Essential Steps

Preoperative Marking

1. Mark the base of A1 pulley in the palm.
2. Draw a Brunner type incision centered over the volar distal interphalangeal joint.
3. *Mark mid-axial line of affected digit distal to the extent of infection.*

Intraoperative Details

1. Transverse incision distal to the distal palmar crease in line with the _____ finger.
2. Blunt dissection to expose the A1 pulley over the corresponding metacarpal head.
3. Incision of A1 pulley to access the flexor tendon sheath.
4. Drainage fluid swabbed and sent for culture.
5. Incision irrigated with copious amounts of sterile saline.
6. Brunner type/midlateral incision over the distal digit centered around the volar interphalangeal digital crease.
7. Blunt dissection to expose and incise the distal flexor tendon sheath.
8. Drainage fluid swabbed and sent for culture.
9. Irrigation of distal incision with copious amounts of sterile saline.
10. Cannulation of an 18-G angiocatheter with IV-tubing extension into the flexor tendon sheath through the A1 release.
11. Tubing secured with 2-0 nylon sutures, and palmar incision partially closed on either side with 4-0 simple interrupted nylon sutures.
12. Flexor tendon sheath irrigation with copious amounts of sterile saline through apparatus.
13. Digital nerve block for postoperative pain control.
14. Packing of distal incision with sterile gauze; hand dressed with soft padding and placed in

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removable volar slab approximating intrinsic plus position.
15. Irrigation catheter padded and tunneled exterior to the splint to allow for hourly irrigations.

Postoperative Care

1. Hourly sterile saline irrigations for 48 h; catheter may be removed at this time if pain and edema are improved.
2. Maintain volar splint in safety position with arm elevated.
3. Continue empiric IV antibiotics pending cultures.
4. Course of outpatient oral antibiotics (14 days).
5. Begin range of motion exercises at the time of catheter removal.

Operative Dictation

Diagnosis: flexor tenosynovitis.
Procedure: flexor sheath irrigation.

Indication

This is a _____ with acute suppurative flexor tenosynovitis. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

The patient was brought to the operating room where time-out was performed to identify the patient and the appropriate procedure. Monitored sedation and a regional/peripheral nerve block were administered by the anesthesia team. A tourniquet was applied to the left/right upper extremity and the arm was prepped and draped in the usual sterile fashion. Tourniquet was inflated after exsanguination. With the hand in supination, a transverse incision was made just distal to the distal palmar crease in line with the _____ finger. Blunt dissection through this incision exposed the A1 pulley over the corresponding metacarpal head. With proximal and distal retraction, the A1 pulley was incised sharply to allow access into the flexor tendon sheath. Care was taken not to incise through the flexor tendon itself. The character of the drainage was noted, and a swab of the fluid was sent for culture. The incision was irrigated with copious amounts of sterile saline.

Attention was next paid to the distal digit. In order to incorporate the site of initial trauma, a Brunner type/midlateral incision was performed sharply over the distal digit centered around the volar interphalangeal digital crease. Blunt dissection was carried down through the subcutaneous tissue to expose and incise the distal flexor tendon sheath. Care was taken to identify and preserve the neurovascular bundle(s). The character of the drainage was noted, a swab was sent for culture, and the incision was irrigated with copious amounts of sterile saline.

Returning to the proximal incision, an 18-gauge angiocatheter with IV-tubing extension was cannulated into the flexor tendon sheath through our A1 release. The catheter and the extension tubing were secured with 2-0 nylon sutures to the palmar skin just proximal to the incision. The palmar incision was partially closed on either side with 4-0 simple interrupted nylon sutures. The flexor tendon sheath was then irrigated through this apparatus with copious amounts of sterile saline until the effluent at the distal incision was clear. A digital nerve block was performed for postoperative pain control. The distal incision was packed with sterile gauze and the hand was dressed with soft padding and placed in a removable volar slab approximating the intrinsic plus position for immobilization. The irrigation catheter was appropriately padded and tunneled exterior to the splint to allow for hourly irrigations in the postoperative setting. Tourniquet was released and the total tourniquet time was noted.

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Dorsal Wrist Ganglion Cyst Excision

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Jimmy H. Chim, Emily Ann Borsting, and Harvey W. Chim

Indications

1. Failure of conservative management/cyst unamenable to aspiration.
2. Functional impairment.
3. Pain.
4. Unsightly.

Possible Complications

1. Recurrence.
2. Wrist stiffness.
3. Scar formation.
4. Injury to radial sensory nerve branches.

Essential Steps

Preoperative Marking

1. Identify the scapholunate interval.
2. Draw a transverse line over the center of the dorsal wrist ganglion.

Intraoperative Details

1. Transverse incision over center of ganglion.
2. Blunt dissection around the cyst walls down to level of the stalk.
3. Dissection of cyst stalk from extensor retinaculum to identify its origin in the joint space, most often scapholunate joint.
4. Cauterization of base of cyst stalk.
5. Re-approximation of deep fascia and skin closure.

Postoperative Care

1. Hand elevation, anti-inflammatories, and icing with care to keep the dressing dry.
2. Removal of dressing and running sutures on postoperative day 10–14.
3. Encourage gentle flexion and extension of fingers after suture removal.
4. Avoid heavy lifting or vigorous motions for 6 weeks as this may increase recurrence.

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Operative Dictation

Diagnosis: dorsal wrist ganglion cyst.
Procedure: dorsal wrist ganglion cyst excision.

Indication

This is a _____ with significant pain and functional impairment due to a ganglion cyst that is unamenable to aspiration. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was brought to the operating room where time-out was performed to identify the patient and the appropriate procedure. Monitored sedation and a regional/peripheral nerve block were administered by the anesthesia team. A tourniquet was applied to the upper arm, and the left/right upper extremity was prepped and draped in the usual sterile fashion. The cyst was identified via visual inspection and palpation of the dorsum of the wrist. Tourniquet pressure was applied with exsanguination and a transverse incision was made directly over the cyst with a scalpel. Blunt dissection was carried down through the subcutaneous layer past the antebrachial fascia, down to and around the cyst wall. Care was taken to identify and preserve sensory branch nerves and avoid rupture of the cyst. Dissection proceeded down to the level of the extensor retinaculum where the exit point of cyst stalk was identified. The extensor retinaculum was opened partially to facilitate dissection of the cyst. We teased the stalk circumferentially away from the extensor retinaculum until the connection of the cyst and its joint space was identified. The cyst was coagulated at the base of the stalk using the bipolar electrocautery. The cyst and its synovial attachment were removed and sent to pathology for analysis. The wound was then copiously irrigated with normal saline. Hemostasis was meticulously acquired with further bipolar cauterization. Closure was performed by re-approximating the deep fascia with buried interrupted sutures, and skin was closed with absorbable interrupted and running subcutaneous sutures. Tourniquet pressure was released and the total tourniquet time was noted. A simple dry dressing was applied to the surgical site.

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Collagenase Injection and Closed Release for Dupuytren's Contracture

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Indications

1. Dupuytren's contracture with palpable cord.
2. PIP contracture of any degree.
3. MCP contracture of 20°.
4. Positive table top test.

Possible Complications

1. Arthralgia.
2. Local swelling and bruising.
3. Lymphadenopathy and node pain.
4. Paresthesia.
5. Hypoesthesia.
6. Tendon rupture.
7. Flexion pulley rupture.
8. Recurrence.

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Essential Steps

Preoperative Marking

1. Palpate and identify the extent of the Dupuytren's cord(s).

Intraoperative Details

Collagenase Injection

1. Medication should be available to treat potential hypersensitivity reactions.
2. Reconstitution of lyophilized collagenase.
3. Volar injection of cord at point of maximal bowstringing.
4. Two more injections proximal and distal to initial injection site.

Release Procedure

1. Return to clinic 24 h post collagenase injection.
2. Median and ulnar nerve blocks at the wrist with local anesthetic.
3. With the hand in supination and flexed at the wrist, application of moderate pressure to extend the injected digit for 20 s.
4. Repeat extensions twice for a total of three extensions with 5–10 min intervals

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Postoperative Care

Post-Injection

1. Wrap hand in bulky dressings.
2. Elevate hand.

Post-Release Procedure

1. Daily dressing changes with petroleum based antibacterial gauze.
2. Finger extension splint to be worn at bedtime every night for 4 months.
3. Avoid strenuous activity with the hand.

Operative Dictation

Diagnosis: Dupuytren's contracture.
Procedure: collagenase injection and closed release of Dupuytren's contracture.

Indication

This is a _____ with Dupuytren's contracture with palpable cord. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After appropriate consent and confirmed discontinuation of any systemic, the patient was brought to the procedure area. Timeout was taken to identify the patient and appropriate procedure with laterality. Any and all jewelry was removed from the right/left hand. The patient's right/left hand was prepped in the usual aseptic manner.

Metacarpophalangeal Contracture Treatment

Using a tuberculin 1 cc syringe with integrated needle, 0.9 mg of the lyophilized collagenase was reconstituted with 0.39 mL of diluent for the cord at the metacarpophalangeal contracture. Reconstitution was performed via swirling, avoiding shaking of the solution to minimize protein denaturation. A total of 0.25 mL of the reconstituted volume was withdrawn for injection.

Volar injection of the cord affecting the metacarpophalangeal site of the right/left _____ finger was performed with approximately 1/3 of the volume each into three different sites along the cord. With gentle passive extension of the digit, the first third of the withdrawn volume was injected at the site exhibiting maximal bowstringing, approximately midway between the distal palmar crease and the palmodigital crease. Passive extension of the distal interphalangeal joint was performed to ensure the needle tip was not placed in the underlying flexor tendon prior to infiltration. The needle was stabilized to avoid injection through the cord. Infiltration of the cord 2–3 mm proximal and distal to the initial injection site was repeated with the same protocol with the remaining thirds of the withdrawn volume.

Proximal Interphalangeal Contracture Treatment

0.9 mg of lyophilized collagenase was reconstituted with 0.31 mL of diluent for the cord at the proximal interphalangeal contracture. A total of 0.20 mL of the reconstituted volume was withdrawn for injection.

Volar injection of the cord affecting the interphalangeal site of the right/left _____ finger was performed with approximately 1/3 of the volume each into three different sites along the cord. With gentle passive extension of the digit, the first third of the withdrawn volume was injected at the site just distal to the palmodigital crease. Passive extension of the distal interphalangeal joint was performed to ensure the needle tip was not placed in the underlying flexor tendon prior to infiltration. The depth of needle insertion did not exceed 3 mm. The needle was stabilized to avoid injection through the cord. Infiltration of the cord 2–3 mm proximal and distal to the initial injection site was repeated with the same protocol with the remaining thirds of the withdrawn volume. Care was taken not to inject the cord any further distal than 4 mm past the palmodigital crease.

The hand was then wrapped in a soft bulky dressing. Instructions were given to the patient to keep the hand elevated. Arrangements were made for the patient to return in 24 h for the release procedure.

Release Procedure

The patient returns to clinic 24 h after his/her collagenase injection of Dupuytren's contracture affecting the right/left _____ finger MCP and PIP joints. Timeout was performed to identify the patient and the appropriate procedure. Wrist median and ulnar nerve blocks were performed with local anesthetic in a standard fashion. With the hand in supination and flexed at the wrist, the injected digit was flexed at the metacarpophalangeal joint as well. Moderate pressure was applied to extend the injected digit for 20 s. This was repeated twice for a total of three extensions with 5–10 min intervals. Care was taken to avoid any jerking maneuvers during the release. Skin splitting and bleeding was treated with direct pressure until hemostasis was satisfactory.

Daily dressing changes with petroleum based antibacterial gauze were prescribed for skin splitting. The patient was fitted for a finger extension splint to be worn at bedtime every night for 4 months. The patient was instructed to avoid strenuous activity with the hand until subsequent follow-up.

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Dermatofasciectomy

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and Harvey W. Chim

Indications

1. Dupuytren's contracture with significant skin involvement.
2. Recurrent or early onset Dupuytren's disease.
3. PIP contracture of any degree.
4. Severe contracture of MCP joint (greater than 30°).

Possible Complications

1. Post operative swelling and stiffness.
2. Injury to digital nerve or artery.
3. Infection.
4. Hematoma.
5. Complex regional pain syndrome.

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Essential Steps

Preoperative Marking

1. Palpate and identify the extent of the Dupuytren's cords.

Intraoperative Details

1. Exsanguination and tourniquet inflation.
2. Dermal excisional incision over the volar digital and palmar surfaces of the contracted _____ finger.
3. Excision of fibrotic dermis and epidermis.
4. Blunt dissection to identify neurovascular bundles at the level of the MCP joint.
5. Skeletonization of the anterior surface of the cords proximal to this region via adjacent longitudinal dissection.
6. Circumferential dissection at the most proximal extent of the cord to transect fascial attachments and release the MCP contracture.
7. Cord excision.
8. Passive extension of the digit to ensure adequate fasciectomy and contracture release.
9. Tourniquet release and hemostasis with low power bipolar cauterization.
10. Full thickness skin graft harvest from the ipsilateral medial upper arm, with defatting,

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pie crusting, and application of the graft to the wound over the fasciectomy site.
11. Harvest site closure with 3-0 absorbable interrupted buried subdermal sutures followed by a 4-0 running subcuticular suture and skin graft insetting with 3-0 chromic.
12. Application of dermal surgical glue to the skin harvest site. Petroleum-based dressing over the skin graft, followed by gauze and a volar slab splint molded to an intrinsic plus position.

Postoperative Care

1. Elevate hand to prevent edema, and keep hand dry to avoid infection and protect skin graft.
2. Continuous volar splinting in intrinsic plus position for two weeks (longer splinting may be required if PIP joint involved); transition to static night time extension splinting at two weeks and continue for up to six months postoperatively.
3. First follow up appointment and active and passive range of motion exercises at one week postoperatively.
4. Suture removal 14 days postoperatively.
5. Strengthening exercises to begin six weeks postoperatively.

Operative Dictation

Diagnosis: severe Dupuytren's disease.
Procedure: dermatofasciectomy.

Indication

This is a _____ with Dupuytren's disease with significant skin involvement precluding partial palmar fasciectomy. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

The patient was brought to the operating room where time-out was performed to identify the patient and the appropriate procedure. Monitored sedation and a regional/peripheral nerve block was administered by the anesthesia team. A tourniquet was applied to the left/right upper extremity, which was then prepped and draped in the usual sterile fashion. The arm was exsanguinated and tourniquet inflated. With the hand in supination and placed in a digital hand retractor system, a dermal excisional incision was designed over the volar digital and palmar surfaces of the contracted _____ finger. The excision was designed to include any fibrotic and/or scarred skin overlying the contracture cord from just proximal to just distal to the palpable diseased areas. The excisional incision was performed sharply with a scalpel just deep to the dermis, exposing the diseased fascia and surrounding subcutaneous fat. The scarred and fibrotic dermis and epidermis were excised sharply in a plane just deep to the dermis in a proximal to distal fashion. With loupe magnification and tenotomy scissors, careful blunt dissection was performed to identify the neurovascular bundles at the level of the metacarpophalangeal joint. Once both the radial and ulnar neurovascular bundles were identified and protected, the anterior surface of the cords was skeletonized proximal to this region via adjacent longitudinal dissection. Circumferential dissection was then performed at the most proximal extent of the cord so that it's fascial attachments could be transected sharply; this allowed release of the metacarpophalangeal contracture. Finger extension was performed to promote visualization of the cord and any structures adherent to it. Control of the transected cord was obtained with a clamp and proximal to distal traction was performed to allow exposure of the dorsal fascial attachments. The cord was excised in a proximal to distal fashion with blunt dissecting exposure and sharp transection using tenotomy scissors.

Care was taken to isolate and preserve any adherent neurovascular structures. Passive extension of the digit was performed to ensure adequate fasciectomy and contracture release of the digit. Hemostasis was obtained with low power bipolar cauterization once the tourniquet was released and the total tourniquet time was noted.

A full thickness skin graft was harvested from the ipsilateral medial upper arm in an elliptical pattern which was based on a pinch technique to ensure adequate post-harvest primary closure. The harvested skin was de-fatted, pie-crusted and applied to the wound over the fasciectomy with no tension or tenting. The harvest site was closed with 3-0 absorbable interrupted buried subdermal sutures followed by a 4-0 running subcuticular suture. The full thickness skin graft was custom cut to the defect and secured with 3-0 chromic sutures in a combination of interrupted tacking and simple running sutures all along its periphery.

A petroleum-based dressing was placed over the skin graft. Gauze was used to dress the hand loosely between the digital web spaces and an abundant amount of fluffy soft dressing was applied over the palmar surface of the hand. A volar slab splint was applied to the hand molded to an intrinsic plus position. The upper arm skin harvest site was dressed with dermal surgical glue. Close postoperative follow-up will be arranged for the patient to evaluate the skin graft and incisions and to fit the patient with an extension nighttime splint for the released digit.

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Sauvé–Kapandji Procedure

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Tuan Anh Tran and Robert M. Szabo

Indications

1. Rheumatoid Arthritis of the DRUJ.
2. Osteoarthritis of the DRUJ.
3. Painful impingement or impaction of the DRUJ.
4. Instability of the DRUJ.

Essential Steps

Preoperative Markings

1. Mark the ulnar border of the wrist between the ECU and EDQ from ulnar head to 5 cm proximally.

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Intraoperative Details

1. Make a longitudinal incision along the ulnar border between the ECU and EDQ. Avoid injuring the dorsal ulnar sensory nerve.
2. Expose the distal ulna in the interval between the ECU and FCU tendons.
3. Resect 10–14 mm segment of ulnar shaft just proximal to the ulnar head.
4. Expose the DRUJ
5. Decorticate the opposing surfaces of the DRUJ (radial sigmoid fossa and ulnar head).
6. Align the ulnar head at the correct level within the sigmoid fossa under fluoroscopic guidance
7. Drill two guide wires through the ulnar head catching four cortices.
8. Drive two cannulated screws over these two guide wires capturing three cortices.
9. Harvest cancellous bone graft from resected ulna segment.
10. Pack bone graft at the arthrodesis site.
11. Tighten the screws into place.
12. Close the remaining soft tissues and skin.

Postoperative Care

1. Apply a bulky dressing with plaster splints extending above the elbow to keep the forearm and wrist in neutral position for 4 weeks followed by a below elbow cast for 2 weeks.

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Sutures are then removed and the patient is given a removable, lightweight splint to support the wrist.
2. When the arthrodesis appears healed radiographically light strengthening exercises can be started usually at 8 weeks after surgery.
3. No heavy lifting or forearm torque for 3 months after surgery.

Possible Complications

1. Distal ulnar instability if excessive bone was removed.
2. Stump pain.
3. Reactive bone formation.
4. Radio-ulnar impingement.

Operative Dictation

Diagnosis: distal radial ulnar joint instability and pain.
Procedure: Sauvé–Kapandji Procedure

Indication

This is a _____ with pain and instability of distal radial ulnar joint secondary to arthritis. The patient understands the risks, benefits, and alternatives associated with the procedure and wishes to proceed.

Description of Procedure

Patient was placed supine and an upper arm tourniquet was applied. The arm table was positioned to facilitate fluoroscopy use throughout the procedure. The patient's forearm, wrist, and hand were prepped circumferentially. The arm was flexed at the elbow. Using an Esmarch bandage, the arm was exsanguinated. The tourniquet was inflated to the pressure of 250 mmHg. Inflation time was noted.

A longitudinal incision was made along the ulnar border between the extensor carpi ulnaris and extensor digiti quinti. Care was taken to identify and avoid injuring the dorsal ulnar sensory nerve. The distal ulna was exposed in the interval between the extensor carpi ulnaris and flexor carpi ulnaris tendons. An oscillating saw was used to resect a 10–12 mm segment of ulnar shaft just proximal to the ulnar head. Once this was done the dorsal capsule adjacent to the extensor carpi ulnaris was incised to expose the distal radial ulnar joint. The ulnar head was also rotated medially to expose to opposing surfaces of the DRUJ, which were the radial sigmoid fossa and ulnar head. These surfaces were decorticated with a rongeur. Next, the ulnar head was aligned at the correct level within the sigmoid fossa under fluoroscopic guidance. Two .045 in. Kirschner wires were drilled and placed through the ulnar head catching all four cortices. The proper screw length at each site was measured with the depth gauge. A cannulated drill bit was driven over the guide wires. Then, two 3 and/or 4 mm cannulated cancellous screws were driven over these two guide wires capturing three cortices. Before tightening these screws in place, cancellous bone grafts were harvested from previously resected ulna segment. The bone grafts were packed into the arthrodesis site, and the screws were tightened. The pronator quadratus muscle was then interposed at the osteotomy site. The joint capsule and subcutaneous tissues were closed with 3-0 Vicryl sutures in interrupted manner, and skin was closed with interrupted 4-0 Nylon horizontal mattress sutures. The tourniquet was deflated, hemostasis obtained, and the wound irrigated.

A bulky sterile dressing reinforced with plaster splints, maintaining the forearm and elbow in neutral position, was applied.

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Darrach's Procedure

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Keith Aldrich Jr. and Zubin J. Panthaki

Indications

1. Distal radioulnar joint (DRUJ) disruption, usually chronic.
2. DRUJ arthritis.
3. Low demand, usually elderly patient.

Essential Steps

Preoperative Markings

1. Mark the ulnar styloid.
2. Identify the extensor digiti minimi and the extensor carpi ulnaris.
3. Draw a longitudinal line over the fifth dorsal compartment radial to the ulnar styloid.

Intraoperative Details

1. Placed in supine position with upper extremity on hand table. Tourniquet on upper arm.
2. General anesthesia or Monitor Anesthesia Care.
3. Dorsal longitudinal incision made over distal ulnar styloid.
4. Longitudinal capsulotomy performed deep to fifth dorsal compartment.
5. Distal ulna resected just proximal to sigmoid notch 2 cm or less.
6. Close layers separately.
7. Transpose EDQP dorsal to retinaculum

Postoperative Care

1. Long arm splint placed with forearm supinated. Maintained for 3 weeks.
2. Removable long arm splint maintained except when performing gentle range of motion exercises from 3 to 6 weeks.
3. Gradual return to full activity.

Possible Complications

1. Persistent pain.
2. Distal ulna instability.
3. Radioulnar impingement.
4. Loss of forearm rotation.

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5. Extensor tendon disruption.
6. Ulnar cutaneous nerve injury.

Operative Dictation

Diagnosis: painful DRUJ instability with arthrosis.
Procedure: modified Darrach's procedure.

Indication

This is a _____ with disruption of DRUJ with pain and instability not amenable to conservative management. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time out among operating room staff was taken. Monitor Anesthesia Care as instituted. Preoperative antibiotics were given. The limb was prepped and draped in the standard sterile fashion. The upper extremity was exsanguinated and tourniquet was inflated.

A linear incision was made over the dorsal fifth extensor compartment at the distal ulna. The incision was carried through the skin. Blunt dissection was performed through the subcutaneous tissue taking care to protect the dorsal sensory branch of ulnar nerve. The fifth extensor compartment was incised. A linear capsulotomy was performed in the deep fifth extensor compartment. Subperiosteal dissection was carried out over the distal ulna maintaining thick periosteal flaps. The distal ulna was osteotomized sufficiently to decompress the DRUJ, but kept to less than 2 cm proximal from the tip of the styloid. The distal ulna was completely removed, including styloid. The resection was confirmed with fluoroscopy (may stabilize distal ulna with slip of ECU passed through bony tunnel of distal ulna).

The tourniquet was released and meticulous hemostasis was obtained. The periosteal flaps were closed with 3-0 vicryl sutures. Following this the capsule was closed separately using 3-0 vicryl sutures. The extensor digiti quinti proprius (EDQP was transposed dorsally the retinaculum, which was then closed with a 3-0 vicryl suture. The skin was closed with a 4-0-nylon suture. A long arm splint was applied with the forearm fully supinated [1–3].

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Ligament Reconstruction and Tendon Interposition (LRTI)

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Tuan Anh Tran and Robert M. Szabo

Indications

1. Eaton stage 2 to 4 basal joint arthritis.
2. Thumb carpometacarpal (CMC) joint pain and instability.
3. Basal joint arthritic thumb pain unresponsive to nonoperative treatment.

Essential Steps

Preoperative Markings

1. A longitudinal incision, centered over the carpometacarpal joint, was drawn at the junction of the glabrous and non-glabrous skin curving at the proximal wrist crease stopping at the crossing of the flexor carpi radialis (FCR) tendon. A second transverse incision is marked over the FCR tendon 10 cm proximal to the first.

Intraoperative Details

1. Place patient in supine position and arm table is positioned.
2. Arm is prepped and draped; arm tourniquet is inflated.
3. Incise skin down to subcutaneous tissue.
4. Radial sensory nerve and deep branch of radial artery are identified and protected.
5. Incision is made between the extensor pollicis brevis (EPB) and abductor pollicis longus (APL) tendons. Subperiosteal capsulotomy around the trapezium preserving the FCR tendon is performed.
6. Remove trapezium either piecemeal with a rongeur or in whole by inserting a K-wire or tap to use as a joystick.
7. Bone tunnel is drilled through the first metacarpal 1 cm proximal to the joint surface from dorsal-central to volar-ulnar.
8. Ulnar ½ of the FCR tendon is transected at the musculotendinous junction in forearm and divided from the radial ½ with an umbilical tape.
9. The divided tendon is delivered to the arthroplasty space.

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10. Tendon is passed through bone channel from volar to dorsal, tensioned, and tied on itself into a knot.
11. Tendon is sutured to itself in arthroplasty space.
12. Roll remaining tendon length and secure in arthroplasty space.
13. Close the capsule.
14. Close the wound.
15. Apply thumb spica splint.

Postoperative Care

1. Control pain.
2. Immediately begin range-of-motion exercises of the fingers, not the thumb.
3. At 7–10 days remove sutures and replace the splint with a short arm thumb spica cast to be worn for an additional 4–5 weeks.
4. Active range-of-motion exercises of CMC begin after removal of spica cast.
5. Pinch grip strengthening can begin at 8 weeks.

Possible Complications

1. Persistent pain.
2. Pain syndromes due to irritation of the radial sensory nerve branches.
3. Proximal migration of the thumb, causing pain.
4. Wound infection and dehiscence.

Operative Dictation

Diagnosis: Symptomatic basal joint arthritis in the thumb that is unresponsive to conservative treatment.
Procedure: Trapezium excision and Ligament Reconstruction with Tendon Interposition Arthroplasty.

Indication

This is a _____ with persistent pain and progressive limitation due to thumb carpometacarpal joint arthritis. The basal joint arthritic thumb pain has been unresponsive to conservative treatments. The patient understands the risks, benefits, and alternatives associated with the procedure, and wishes to proceed.

Description of Procedure

After the inform consent was verified, the patient was taken to the operating room. General Anesthesia was instituted. The patient was placed in supine position and an upper arm tourniquet was applied. The arm was prepped and draped. After draping the arm, an Esmarch bandage was used to exsanguinate the arm, beginning at the fingertips and extending to the upper border of the sterile field. The tourniquet was then inflated, and the time was recorded.

A longitudinal incision, centered over the carpometacarpal joint, was made at the junction of the glabrous and non-glabrous skin curving at the proximal wrist crease stopping at the crossing of the flexor carpi radialis (FCR) tendon. The incision was completed down to the subcutaneous tissue. The dorsal radial sensory nerve and its branches were identified and protected. The extensor pollicis brevis (EPB) tendon and abductor pollicis longus (APL) tendon were identified, and blunt retractors were placed in a dorsal and ulnar position beneath the EPB tendon and in the radial and volar position beneath the APL tendon. The radial artery was then visualized.

A subperiosteal longitudinal capsulotomy between the EPB and APL tendons extending 1 cm over the proximal metacarpal base was made over the carpometacarpal and scaphotrapezial joint was performed and full-thickness flaps were raised using sharp dissection. This capsular incision extended proximally for visualization of the base of the first metacarpal, full trapezium, and scaphotrapezial joint. Care was taken to preserve the capsule to facilitate later reattachment. The trapezium was then dissected circumferentially. An osteotome and rongeur were used to remove the trapezium in piecemeal fashion. The FCR tendon at the base of the CMC joint was identified and care was taken to avoid possible injury to the tendon. Osteophytic bone between the base of the thumb and index metacarpal was removed using a rongeur and curette.

Next, the metacarpal base was prepared. Subperiosteal dissection exposed the proximal metacarpal base. A 2.5 mm drill was used to create a bone tunnel one centimeter distal to the base of the metacarpal joint surface, from dorsal-central to volar-ulnar at the approximate attachment of the original beak ligament. The bone channel extended through the metacarpal and exited at the volar base. The channel was then enlarged using a 3.5 mm drill.

The flexor carpi radialis position was determined by passive flexion and extension of the wrist joint. The FCR tendon was palpated proximally in the forearm until it becomes noticeably less discrete at the proximal one third of the forearm about 10 cm from the proximal wrist crease. This position was marked and a 2 cm transverse incision was made. The musculotendinous junction was identified and the tendon was lifted into the incision using a right angle clamp. The ulnar half the tendon was then transected proximally, separated from the radial half with an umbilical tape and pulled distally into the trapezial bed using a Carroll tendon passer. Residual muscle belly on the tendon is removed. The proximal forearm incision was closed with 5-0 Nylon sutures. The tip of the transected end of the tendon was tapered to a diameter that allowed passage through the bone channel using a loop of umbilical tape. Two 3-0 interrupted Ethibond sutures were placed in the deep volar capsule for later stabilization of the tendon interposition.

The tendon was delivered through the bone tunnel from volar to dorsal. The tendon was pulled tight after exiting the dorsal aspect of the first metacarpal. With the thumb reduced, the tendon was tied onto itself into a knot and sutured to itself with a Krackow style running-locking technique using 3-0 Ethibond sutures. The remaining length of the tendon was then rolled on itself. The rolled tendon was stabilized using the 3-0 Ethibond sutures previously placed in deep volar capsule. The rolled tendon was then placed into the arthroplasty space on top of the sutures and secured by tying the sutures on top of the tendon.

The capsule was repaired using 3-0 Ethibond sutures. Care was taken to ensure that the radial artery and radial sensory nerves were protected. The tourniquet was deflated. Meticulous hemostasis was achieved. The wound was irrigated and injected with 0.25 % Marcaine for postoperative analgesia. The incision was closed using 5-0 Nylon sutures. Care was taken to avoid radial sensory nerve damage. The thumb was immobilized using a well-padded sterile gauze dressing reinforced with a plaster thumb spica splint.

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Upper Extremity Fasciotomy

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Indications

1. Status post upper extremity revascularization with compartmental hypertension
2. Crush injury with concomitant fracture and severe soft tissue damage
3. Circumferential burn with delayed care and compartment syndrome
4. Warm ischemia secondary to vessel injury for more than 4–6 h
5. Tense compartment/compartment pressures exceeding 40 mmHg

Possible Complications

1. Nerve injury
2. Bleeding
3. Infection and wound healing complications
4. Exposure of vital structures
5. Volkmann's ischemic contracture if performed late after a delayed diagnosis

Essential Steps

Preoperative Marking

1. Upper arm: mark a line between deltoid insertion and the lateral epicondyle.
2. Forearm:
   (a) Volar approach:
      – Mark the crease between the thenar and hypothenar eminence and palmaris longus (if the patient has one) for carpal tunnel decompression.
      – Draw a curvilinear line extending transversely across the wrist flexion crease to the ulnar side of the wrist, then arched across the volar forearm, back to the ulnar side at the elbow just radial to the medial epicondyle, and finally across the antecubital fossa.
   (b) Dorsal approach: Draw a line from the lateral epicondyle between the extensor

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digitorum communis (EDC) and extensor carpi radialis brevis (ECRB), extending distally approximately 10 cm toward the midline of the wrist.

3. Hand:
   (a) Draw a line on the radial side of the thumb metacarpal for the release of the thenar compartment.
   (b) Draw a line over the index finger metacarpal for the release of first and second dorsal interossei.
   (c) Draw a line over the ring finger metacarpal for the release of third and fourth dorsal interossei.
   (d) Draw a line at the ulnar aspect of the small finger metacarpal to release hypothenar muscles.

Intraoperative Details

4. Placed in supine position
5. General anesthesia or monitored anesthesia care
6. Arm:
   (a) Lateral skin incision from deltoid insertion to the lateral epicondyle.
   (b) Spare larger cutaneous nerves.
   (c) At fascial level, the intermuscular septum between the anterior and posterior compartment is identified, and the fascia overlying each compartment is released with longitudinal incisions; protect the radial nerve as it passes through the intermuscular septum from the posterior compartment to anterior compartment just below the fascia.
7. Forearm: longitudinal centrally placed incision over the extensor compartment and curvilinear incision on the flexor aspect beginning at the antecubital fossa
   (a) Apply a tourniquet to the upper arm if ischemia is not threatening the extremity. Fasciotomy can be performed without use of a tourniquet in emergency or if critical ischemia time is being approached.
   (b) Exsanguinate the arm with an Esmarch bandage and inflate tourniquet to 100 mmHg higher than systolic pressure.
   (c) Volar approach for release of flexor compartments:
      – Palmar incision is made between the thenar and hypothenar musculature in palm, releasing carpal tunnel as needed.
      – Incision is extended transversely across the wrist flexion crease to the ulnar side of the wrist, then arched across the volar forearm, and back to the ulnar side at the elbow.
      – At the elbow, just radial to the medial epicondyle, incision is curved across elbow flexion crease; deep fascia is then released.
      – At the antecubital fossa, fibrous band of the lacertus fibrosus overlying the brachial artery and median nerve is carefully released.
      – This incision allows for soft tissue coverage of neurovascular structures at the wrist and elbows and prevents soft tissue contractures from developing at flexion creases.
   (d) Dorsal approach for release of dorsal compartments:
      – Pronate forearm.
      – Make dorsal skin incision beginning distal to the lateral epicondyle between the extensor digitorum communis and extensor carpi radialis brevis, extending distally approximately 10 cm toward midline of the wrist.
      – Gently create skin flaps so that the mobile wad can be identified.
      – Release the fascia overlying the mobile wad of Henry and the extensor retinaculum.
      – Leave skin incision open.
      – Apply sterile moist dressings to volar and dorsal skin incisions.
      – Place the long-arm splint making sure to not flex the elbow beyond 90°.

8. Hands: Four incisions
   (a) Apply tourniquet to the upper arm if ischemia is not threatening the extremity. Fasciotomy can be performed without the use of a tourniquet in emergency or if critical ischemia time is being approached.
   (b) One incision on radial side of the thumb metacarpal releases thenar compartment
   (c) Dorsal incision over the index finger metacarpal used to release first and second dorsal interossei and to reach the ulnar-to-index finger metacarpal and to release the volar interossei and adductor pollicis.
   (d) Dorsal incision over the ring finger metacarpal used to release third and fourth dorsal interossei and to reach down along radial aspect of the ring finger and small finger metatarsal to release the volar interossei.
   (e) Incision placed at the ulnar aspect of the small finger to release hypothenar muscles.
   (f) Wound must be debrided of all devitalized tissue and covered with a sterile dressing without early closure.

Postoperative Care

1. Elevate affected extremity for 24–48 h after surgery.
2. Wound must be regularly debrided of all devitalized tissue including necrotic muscle.
3. Closure options:
   (a) Delayed primary closure when swelling subsides.
   (b) If delayed primary skin closure cannot be performed within 5 days, perform split-thickness skin grafting.
   (c) Healing by secondary intention.
4. Negative pressure wound closure devices may be useful.
5. Overall, the rehabilitation protocol is dependent upon the underlying injury that caused the compartment syndrome and need for fasciotomy.
6. Perform dressing changes at bedside or in OR as deemed appropriate per clinical situation.
7. Perform standard suture or staple removal and postoperative wound checks.

Operative Dictation

Diagnosis: Compartmental hypertension of the upper extremity
Procedure: Upper extremity fasciotomy

Indications

This is an X patient presenting with pain and increasing swelling of the right/left arm/forearm/hand s/p underlying injury/procedure that caused the compartment syndrome. Compartment pressures were obtained and were elevated greater than 35 mmHg. The risks and the benefits of the procedure have been discussed with the patient who agreed with the plan of care.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. The patient's name, hospital number, procedure, and surgical site were verified during a time-out. General anesthesia was instituted. Preoperative antibiotics were given. The *right/left* upper extremity was prepped and draped in the usual manner.

Using a #15 scalpel, a carpal tunnel release incision was performed. Dissection was deepened down to the subcutaneous tissues until reaching the transverse carpal ligament that was opened. The median nerve was identified and protected. The tunnel was opened completely distally until reaching the deep palmar arch that was identified and preserved. Proximally, the incision was extended in a semilunar fashion until reaching the antecubital fossa that was overpassed to the distal

arm as well. Dissection was deepened down using a #15 scalpel and Stevens tenotomy scissors until reaching the deep investing fascia of the volar forearm muscles for complete release of the superficial and deep compartments. The superficial cutaneous nerves were identified and protected. Through the same incision on the radial side, the dorsal compartments were released as well in the proximal aspect. Hemostasis was secured.

Attention was directed to the *right/left* hand; multiple incisions were done at the level of the interossei spaces. Dissection was deepened in a similar fashion as before until complete release of the interossei muscles.

Attention was directed to the arm. A lateral curvilinear skin incision was performed centralized over a line drawn from the deltoid insertion to the lateral epicondyle. Dissection is deepened through subcutaneous tissues where large cutaneous nerves were identified. When deep investing fascia was reached, the intermuscular septum between the anterior and posterior compartment was identified, and the fascia overlying each compartment was released with longitudinal incisions. The radial nerve whenever encountered as it passes through the intermuscular septum from the posterior compartment to anterior compartment just below the fascia was identified and protected.

After completing all fasciotomies, all the compartments were checked to be soft, and the fingers had good capillary refill.

Hemostasis and copious irrigation was done. Dressing was applied. The patient tolerated the procedure and was transferred to the recovery room in stable condition.

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Surgical Release of the Carpal Tunnel

122

Tuan Anh Tran and Robert M. Szabo

Indications

1. Diagnosis of carpal tunnel syndrome with intermittent pain and paresthesias in the median nerve distribution of the hand.
2. No improvement with conservative management with activity modification, wrist splinting, NSAIDs, or corticosteroid injections for 3–6 months.
3. Electrodiagnostic testing shows delays of motor and sensory latencies across the wrist, decreased sensory and motor amplitudes, and in advanced cases positive fibrillations in the abductor pollicis brevis muscle on EMGs consistent with median neuropathy across the carpal tunnel.

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Essential Steps

Preoperative Markings

1. Mark a longitudinal line parallel to the thenar crease beginning at intersection of the radial border of the ring finger and Kaplan's cardinal line that extends 3–4 cm proximally toward the transverse palmar crease just distal to the hook of the hamate.
2. Incision design should avoid injury to deep and superficial arches, recurrent motor branch, palmar cutaneous branch of the median nerve, and the ulnar neurovascular bundle.

Intraoperative Details

1. Place in supine position with forearm supinated and arm outstretched, on a hand table.
2. Axillary block or intravenous regional block or local anesthesia with or without sedation. Preferred technique is to use wide-awake local anesthesia no tourniquet (WALANT). Before surgery, in the recovery room, after an appropriate surgical pause and a sterile prep, block the right palm along the thenar crease and proximal to the wrist crease using a solution of 9 mL 1 % Xylocaine with epinephrine mixed with 1 mL of 8.4 % sodium bicarbonate.

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3. Place well-padded pneumatic tourniquet, inflated to 250 mmHg on upper arm if not using WALANT.
4. Incise the skin 3–4 cm in the thenar crease from the proximal wrist crease just ulnar to the palmaris longus tendon. Carry the incision down to the subcutaneous tissues and raise flaps proximally and distally.
5. Incise the palmar fascia longitudinally.
6. Incise the antebrachial fascia proximally and identify the median nerve. Incise the transverse carpal ligament from proximal to distal until the fat pad of the superficial palmar arch is reached. Incise about 1 cm into the antebrachial fascia.
7. Close the incision with buried subcuticular 4-0 Monocryl sutures. Apply Mastisol and Steri-Strips to the wound followed by a bulky sterile dressing maintaining the thumb in palmar abduction.

Postoperative Care

1. Bulky, well-padded hand dressing without a splint. Keep the wrist slightly extended.
2. Dressing removed 7 days post-operation.
3. Early finger motion initiated on day of surgery to prevent stiffness and tendon adhesion to median nerve.

Possible Complications

1. Infection
2. Palmar cutaneous branch injury
3. Recurrent symptoms with grip weakness, and paresthesia
4. Complex region pain syndrome
5. Tendon bowstringing
6. Painful scar
7. Pillar Pain

Operative Dictation

Diagnosis: carpal tunnel syndrome
Procedure: open carpal tunnel release

Indication

This is a _____ with a diagnosis of carpal tunnel syndrome for 6 months with no response to conservative management. The patient understands the risks, benefits and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After informed consent was verified, the patient was injected with local anesthetic (mixture of 9 mL 1 % Xylocaine with epinephrine: 1 mL of 8.4 % sodium bicarbonate) in the proposed line of incision as marked previously. Patient was taken to the operating room and placed in supine position with the forearm supinated on hand table. Time out among operating room staff was taken to correctly identify the patient and the procedure. Light sedation was instituted by the anesthesia team. The patient was prepped and draped in standard surgical fashion. The arm was placed in a lead hand and slightly elevated with a stack of towels.

The skin was incised with a #15 scalpel about for 4 cm just ulnar to the thenar crease from the intersection of the Kaplan's line and the radial border of the ring finger. The incision was carried proximally to end just distal to the flexion wrist crease. Two skin hooks were used to expose the incision longitudinally enough to allow full access to the transverse carpal ligament. The incision was deepened through subcutaneous fat and through superficial palmar fascia until the transverse carpal ligament was reached.

With the beaver blade, a small incision was made in the antebrachial fascia. The median nerve was identified. Division of the transverse carpal ligament proceeded from proximal to distal up to the adipose tissue of the superficial palmar arch. Care was taken to avoid injuring the superficial palmar arch. Location of the distal median nerve and recurrent motor branch were evaluated. Residual distal fibers of the flexor retinaculum and associated fascia of the motor branch were carefully divided with a tenotomy scissors. A right angle Senn retractor was placed to retract the soft tissue above the proximal portion of the transverse carpal ligament. A mosquito clamp was then placed deep to the transverse carpal tunnel ligament in distal to proximal direction and then spread open in order for visualization of the carpal tunnel structures. The release of the proximal transverse carpal ligament was completed proximally with tenotomy scissors until full opening of the tunnel was observed under direct vision.

The tourniquet was deflated, hemostasis was obtained, and wound was irrigated. The skin incision was sutured with buried 4-0 Monocryl horizontal mattress stitches and Steri-Strips and dressing placed.

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Endoscopic Carpal Tunnel Release 123

John R. Craw and Patrick Owens

Indications

1. Carpal tunnel syndrome

Essential Steps

Intraoperative Details

1. Position supine with arm on padded arm board.
2. Place padded tourniquet around upper arm.
3. Mark out bony and soft tissue landmarks.
4. Perform incision 1 cm proximal to distal wrist crease and starting at ulnar border of palmaris longus.
5. Enter the antebrachial fascia.
6. Dilate the carpal canal.
7. Create a plane between the synovium and underside of the transverse carpal ligament.
8. Insert scope and visualize the transverse carpal ligament.
9. Completely release the ligament.
10. Close the skin.

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Postoperative Care

1. Soft dressing
2. Immediate ROM of hand and digits
3. Return-to-light duty when pain permits
4. Dressing changed to Band-Aid postop day 3
5. Heavy lifting delayed for 6 weeks

Possible Complications

1. Median nerve laceration
2. Recurrent motor branch of median nerve laceration
3. Palmar arch injury
4. Infection

Operative Dictation

Diagnosis: Right/left carpal tunnel syndrome

Procedure: Endoscopic right/left carpal tunnel release

Indication

This is a _____ who has been diagnosed with carpal tunnel syndrome. The treatment options for this were discussed with the patient in detail, and she/he wishes to proceed with an endoscopic release of the transverse carpal ligament.

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The patient understands the risks, rationale, benefits, and alternatives associated with this procedure; all of his/her questions about the procedure have been answered.

Description of the Procedure

After verifying informed consent, the patient was brought to the operating suite and placed in the supine position. Bony prominences were padded and the upper extremity was placed on a padded arm board. A tourniquet was placed about the patient's upper arm padded with stockinette. A time out was held where the patient identification, surgeon to perform the surgery, surgery to be performed, surgical sites and laterality, instrument sterility, and antibiotic status were all verified.

Bony landmarks were drawn out on the hand. The pisiform was marked with a dot. The hook of the hamate was palpated and marked with a dot. A third dot placed equidistant from the hamate dot was from the pisiform dot such that all three dots lied in a straight line. This marked the distal extent of the transverse carpal ligament. The incision was marked out by measuring 1 cm proximal to the distal palmar crease and marking a 1–1.5 cm line starting at the ulnar border of the palmaris longus and extending ulnarly. The extremity was exsanguinated and tourniquet was inflated to 200–250 mmHg.

The skin was incised and blunt dissection was carried down to the antebrachial fascia protecting the subcutaneous veins that were in the field. The antebrachial fascia was bluntly entered transversely, in line with the fibers, and the scissors were used in a spreading motion to open an interval in line with the fibers.

The distal leaflet of the antebrachial fascia was retracted away from the synovium with a narrow double skin hook. The synovial elevator was used to dissect the plane between the synovium and the transverse carpal ligament. The space between the synovium and the transverse carpal ligament was entered with the smaller followed by the larger dilator curving the dilators toward and palpating the hamate hook and dilating the carpal canal. The final dilator in the shape of the endoscope was used to ensure the scope will fit.

The endoscope was inserted under the antebrachial fascia and superficial to the synovium. While inserting the endoscope into the carpal canal, the undersurface of the transverse carpal ligament was visualized ensuring that the median nerve and its distal branches did not cross the field at any point.

The endoscope was inserted to the distance predetermined with skin markings as a guide. The blade was deployed no further distal than the distal extent of the transverse carpal ligament. The ligament was transected by pulling the endoscope proximally in a controlled slow motion for about 1.5–2 cm until just at the point where a fat lobule began to fall into view. The blade was retracted down and the scope can was advanced distally again into the partially released ligament and any residual bands were transected. The endoscope was then brought to the apex of the cut in the ligament and the blade was redeployed. The ligament and antebrachial fascia were transected completely to the level of the skin incision.

The endoscope was reinserted into the wrist and rotated slightly ulnarly or radially so that a leaflet of the cut fascia/ligament was in view over the scope, and this was followed distally to ensure complete release with the blade down. The endoscope was removed. Full release was further verified with the dilator.

The wound was gently irrigated. The skin was closed with nonabsorbable monofilament suture. Nonadherent porous gauze followed by dry gauze was placed over the incision followed by a lightly wrapped ace wrap with some folded gauze over the transverse carpal ligament to apply gentle pressure. The tourniquet was released.

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Cubital Tunnel Release by In Situ Decompression

124

Tuan Anh Tran and Robert M. Szabo

Indications

1. Patient has been diagnosed clinically with moderate to severe symptoms of ulnar neuropathy at the elbow confirmed on electrodiagnostic testing.
2. Patient with very mild symptoms does not respond to conservative management (activity modification, and splinting) for more than 6 months.

Essential Steps

Preoperative Markings

1. Draw a longitudinal line that is equidistant between the tip of the olecranon and the medial epicondyle.
2. The line should extend proximally 3–4 cm and distally 4–6 cm (incision length will be variable depending on anatomy of individual) over the ulnar nerve course.

Intraoperative Details

(a) Place the patient in supine position with elbow bent at 90°, shoulder externally rotated and abducted on arm table.
(b) Apply well-padded tourniquet as high up the axilla as possible, and place folded stack of towels under the elbow.
(c) Incise a longitudinal line as marked.
(d) Identify and protect the medial antebrachial cutaneous nerve.
(e) Release from proximal to distal, starting with the arcade of Struthers, and the medial intermuscular septum followed by the cubital tunnel retinaculum and the flexor carpi ulnaris fascia, and ending with the pronator and flexor digitorum superficialis arch fascia.

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(f) Test for residual compression sites and ulnar nerve subluxation upon elbow flexion and extension at the end of the decompression.

Postoperative Care

1. Bulky, compressive dressing.
2. Dressing removed 7–10 days post-operation.
3. Begin strengthening exercise in 1 month.

Possible Complications

1. Infection
2. Pain at the elbow, painful neuroma of the medial antebrachial cutaneous nerve
3. Decreased sensation around the scar
4. Symptomatic subluxating nerve
5. Incomplete symptom relief
6. Injury to the flexor carpi ulnaris motor branches

Operative Dictation

Diagnosis: Chronic cubital tunnel syndrome with symptoms ulnar nerve entrapment at the elbow

Procedure: Cubital tunnel release via in situ decompression

Indication

This is a _____ with a diagnosis of cubital tunnel syndrome for 6 months. Patient has not responded to conservative management with splinting, activity modification, NSAIDs. The patient is aware of the potential benefits, risks, and alternatives of this surgery and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Preoperative antibiotics were given. Right arm was bent at elbow, externally rotated, abducted, and placed on arm table. Appropriate longitudinal line was drawn between tip of olecranon and medial epicondyle, extending 4 cm proximal and 4 cm distal. Time out among operating room staff was taken to correctly identify the patient. Monitored anesthesia care was instituted. A sterile tourniquet was applied. The limb was exsanguinated with an Esmarch bandage and a pneumatic tourniquet was inflated to 250 mmHg around the upper arm. The inflation time was recorded.

8 cm incision was made along line drawn midway between the medial epicondyle and the olecranon. Dissection through subcutaneous tissues and fat was deepened down to level of medial epicondyle while paying careful attention to preserve the medial antebrachial cutaneous nerve. The ulnar nerve was identified below the intermuscular septum proximal to the medial epicondyle. The septum was entered and retracted, and the ulnar nerve was dissected free proximally up to the point that it pierced the intermuscular septum. The arcade of Struthers was also divided, proximally.

The dissection turned distally. First, the fibroaponeurotic coverings and cubital tunnel retinaculum were divided sequentially. The dissection proceeded deeply through the fascia of superficial and deep flexor carpi ulnaris heads exposing the nerve. Care was taken to prevent injury to the ulnar nerve and the motor branches to the flexor carpi ulnaris and flexor digitorum profundus. The fascia of the flexor carpi ulnaris muscle was released. Distally, the pronator and flexor digitorum superficialis arch fascia were also incised to relieve any compression on the ulnar nerve.

The area was palpated and confirmation was made that ulnar nerve was free from compression with minimal traction. Range of motion of the elbow indicated no snapping over medial epicondyle. The tourniquet was deflated, hemostasis was obtained, and the wound was irrigated. Soft tissue and skin was closed with 3-0 Vicryl and 4-0 Monocryl, respectively, in subcuticular fashion. A sterile bulky soft tissue dressing was placed on the elbow with the elbow flexed at 45°. Postoperative care was given.

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Trigger Thumb Release and Tenosynovectomy

125

Jimmy H. Chim, Donald Groves,
Emily Ann Borsting, and Harvey W. Chim

Indications

1. Failure of conservative management (splinting and/or local steroid injection)
2. Trigger finger which is irreducibly locked

Possible Complications

1. Digital nerve transection (most common reported complication after trigger thumb release; usually involves radial digital nerve)
2. Adhesions (can result in stiffness)
3. Scarring (painful scars more common after TF release than trigger thumb release)

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Essential Steps

Preoperative Markings

1. Mark a sub-centimeter transverse incision just distal to the palmar digital crease at the base of the thumb corresponding to the metacarpophalangeal (MCP) joint

Intraoperative Details

1. Patient is sedated and regional/peripheral nerve block is administered.
2. Patient is sterilely prepped and draped.
3. Tourniquet is applied to the involved upper arm, with pressure that allows for exsanguination and a bloodless operating field.
4. Hyperextension of MCP joint of involved digit to minimize damage to neurovascular structures.
5. Incision along the predesignated marking.
6. Blunt dissection through the soft tissue to the level of the tendon sheath.
7. Identification and preservation of neurovascular bundle.
8. Longitudinal incision of A-1 pulley sheath with a scalpel, starting proximally and working distally, while both proximal and distal retractions were applied. Progressive tension on the distal aspect of the digit allows

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for its full extension, at which point the release is considered completed.
9. Tenosynovectomy is performed for severe tenosynovitis.
10. Wound closure with full-thickness absorbable sutures.
11. Release of tourniquet pressure, noting total tourniquet time.
12. Application of simple dry dressing to the site.

Postoperative Care

1. Early motion of the involved digit/hand encouraged, as soon as procedure ends

Operative Dictation

Diagnosis: trigger thumb

Procedure: trigger thumb release and tenosynovectomy

Indication

This is a _____ with a diagnosis of trigger thumb tenosynovitis. Patient has not responded to conservative management with splinting, activity modification, and steroid injection. The patient is aware of the potential benefits, risks, and alternatives of this surgery and wishes to proceed.

Description of the Procedure

The patient was brought to the operating room where time-out was performed to identify the patient and the appropriate procedure. Monitored sedation and a regional/peripheral nerve block were administered by the anesthesia team. The left/right upper extremity was prepped and draped in the usual sterile fashion after a tourniquet was applied to the upper arm. Tourniquet pressure was applied with exsanguination, and a sub-centimeter transverse incision was made just distal to the palmar digital crease of the thumb directly centered over the palmar aspect of the digit. Blunt dissection was carried out through the soft tissue to the level of tendon sheath. The neurovascular bundle was identified and preserved. With proximal and distal retraction, a scalpel was used to incise the A-1 pulley sheath longitudinally. The incision was started proximally, allowing progressive tension on the distal thumb to gain full extension as we completed our release. A hemostat clamp was used to elevate the flexor pollicis longus tendon out of the wound. Significant tenosynovitis was identified. Tenosynovitis was sharply excised with care, preserving the tendon itself, pulley, and any surrounding neurovascular structures. Thumb extension and flexion was performed to expose the most proximal and distal extents of the tenosynovium for excision. Once excision was completed, the tendon was placed back in its anatomic position. Successful completion of the release was deemed adequate by gaining full extension of the digit. The wound was irrigated. Hemostasis was achieved. The skin was closed using full-thickness absorbable sutures. Tourniquet pressure was released and the total tourniquet time was noted. A simple dry dressing was applied to the surgical site.

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Epineurial Repair

126

Ajani G. Nugent and Morad Askari

Indications

1. Open wound in setting of neurological impairment on examination AND neural discontinuity
2. Closed wounds with progressing signs of neurological impairment AND neural discontinuity

Essential Steps

Preoperative Marking

1. Identify the extent of injury.
2. Draw lines extending proximal and distal to the area of injury.

Intraoperative Details

1. Epineurial placement of sutures.
2. Tension-free neural approximation.
3. Debridement of nonviable tissue.
4. Appropriate positioning dependent upon anatomical location of nerve.
5. May be performed under regional/MAC vs. general anesthesia depending on anatomical location ± tourniquet if indicated. (If intraoperative nerve monitoring is utilized, regional block or tourniquet use should be voided.)
6. Wide exposure to include region outside of zone of injury.
7. Loupe or microscopic magnification (must be able to visualize fascicles).
8. Identification of both proximal and distal nerve stumps.
9. Minimal dissection distally and proximally on both stumps to ensure tension-free coaptation.
10. Placement of contrasting color background material behind nerve stumps.
11. Gentle resection of nerve endings until all fibrotic tissue is removed and healthy fascicles are visualized.
12. Align nerve endings according to fascicular patterns, which may be recognized according to epineurial blood vessel patterns.
13. Use of 9-0 or 10-0 nylon sutures placed in epineurium to coapt nerve endings, using

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simple interrupted technique. Avoid tight repair of the epineurial layer. No protruding fascicles should be present.
14. Minimum number of sutures as necessary should be used to obtain complete coaptation.
15. Soft tissue reapproximation, closure, or flap coverage as indicated to ensure complete neural coverage, without excessive external compression.

Postoperative Care

1. If extremity, consider immobilization with splint for 2–3 weeks for smaller nerves and ~6 weeks for larger nerves.

Possible Complications

1. Devascularized neural stumps from excessive tension or devascularization
2. Rupture of repair from excessive movement
3. Neuroma formation

Operative Dictation

Diagnosis: _____ nerve laceration
Procedure: neural repair under magnification

Indication

This is a _____ with clinical (*or electrophysiological*) signs of sensorimotor nerve dysfunction of the _____ nerve. Surgical exploration and repair are indicated to prevent long-term neuromuscular deficits secondary to untreated neural injury. The risks, benefits, and alternatives have been discussed with the patient, and they desire proceeding.

Description of the Procedure

After the informed consent is verified, the patient is taken to the operating room and placed in supine position. Time-out among operating room staff was taken. General anesthesia was then instituted. Preoperative antibiotics were given. The patient was prepped and draped in standard sterile surgical fashion.

Tourniquet was set to _____, and the inflation time was noted.

_____ incisions were made to fully expose the wound. Careful soft tissue dissection was carried out to expose the proximal and distal stumps of the _____ nerve. Once identified, careful dissection was carried out on the nerves themselves, to allow for more mobilization. Devitalized tissue was carefully debrided, and the wound irrigated with normal saline. Then, under magnification, the nerve endings were carefully manipulated to examine both neural stumps. The nerve stumps were carefully excised with microsurgical scissors until mushrooming of the fascicles was seen. Contrasting background material was then brought in and placed behind the neural stumps. The nerve stumps were then aligned according to the longitudinal pattern of the epineurial blood vessels. Once immobilized, 9-0/10-0 nylon suture was then placed through the epineurium in an interrupted manner, to facilitate neural coaptation. Soft tissue reapproximation was carried out as necessary to ensure complete coverage of the _____nerve. The skin edges were closed using _____suture, in a _____ manner. The tourniquet was then let down. The operative extremity was immobilized after appropriate padding was applied and a custom splint fabricated. This completed the procedure. At the procedures' end, all needle and sponge counts were correct. The patient was then reversed from anesthesia and transported to the recovery area in stable condition.

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Oberlin Transfer

127

Keith Aldrich Jr. and Harris Gellman

Indications

1. Brachial plexus injury of C5–C6 within the first year of injury
2. Maintained function of C8–T1 (ulnar nerve function)

Essential Steps

Preoperative Marking

1. Palpate and identify the brachial artery.
2. Design a longitudinal medial skin incision in the proximal upper part of the arm.

Intraoperative Details

1. Placed in supine position with upper extremity on hand table.
2. General anesthesia.
3. Exposure of musculocutaneous and ulnar nerve in proximal upper arm.
4. Motor branch to biceps is dissected proximally enough to reach ulnar nerve.
5. Ulnar nerve fascicles stimulated to find innervation to flexor carpi ulnaris (FCU).
6. 1–2 fascicles selected from ulnar nerve and transected.
7. Proximal extend of motor branch to biceps is transected.
8. Motor branch to biceps is coapted to ulnar fascicles with epineurial sutures

Postoperative Care

1. Sling to the extremity for 3 weeks
2. Occupational therapy initiated to regain biceps function

Possible Complications

1. Transient numbness in ulnar nerve distribution
2. Transient hand intrinsic weakness
3. Poor function of biceps despite therapy

Operative Dictation

Diagnosis: C5–C6 brachial plexus injury
Procedure: Oberlin transfer

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Indication

This is a _____ with C5–C6 brachial plexus injury within the past year with no expectation of recovery. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time-out among operating room staff was done. General anesthesia was instituted. Preoperative antibiotics were given. The limb was prepped and draped in the standard sterile fashion.

The skin was incised through a longitudinal incision through the medial upper arm. The subcutaneous tissue was bluntly dissected down to the fascia over the biceps. The fascia was incised. The musculocutaneous and ulnar nerves were identified. The branching pattern of the musculocutaneous nerve was identified. Medially, the motor branches to the flexor carpi ulnaris (FCU) was identified with a stimulator and dissected proximally to allow enough slack to reach the ulnar nerve.

The posteromedial ulnar nerve was dissected in an intraperineural manner. The fascicles were stimulated with a nerve stimulator to locate those that innervated the FCU. One of the fascicles of the ulnar nerve, which innervated the FCU, was transected with the scalpel. The proximal extent of the musculocutaneous nerve motor branch to the biceps was transected. The free nerve ends of the motor branch to the biceps were coapted with the proximal end of the transected ulnar nerve fascicles in a tension-free manner with 9-0 nylon sutures under microscope magnification. Meticulous hemostasis was obtained. The subcutaneous layer was closed with 3-0 vicryl. The skin was closed with 4-0 nylon sutures [1–3].

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Flexor Carpi Radialis to Extensor Digitorum Communis Tendon Transfer for Finger Extension

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Keith Aldrich Jr. and Harris Gellman

Indications

1. Radial nerve palsy with loss of digital extension, with failure to recover, does not include thumb extension (separate transfer).
2. Usually plan transfer after 6 months to 1 year.
3. Need full passive flexion and extension of digits.
4. Donor muscle should be MRC 4+ to 5.

Essential Steps

Preoperative Marking

1. Palpate the radial artery.
2. Identify the flexor carpi radialis (FCR).
3. Mark a line over the FCR ulnar to the radial artery.
4. With the wrist extended, identify the extensor digitorum communis (EDC).
5. Mark a line over the central distal forearm over the EDC tendons.

Intraoperative Details

1. Patient supine with upper extremity on hand table. Tourniquet on upper arm. Set the tourniquet at 250–265 mmHg.
2. General anesthesia or monitored anesthesia care (MAC).
3. Volar incision distally over flexor carpi radialis (FCR) insertion.
4. Identify and protect radial artery.
5. FCR transected as distally as possible.
6. Dorsal incision made over central, distal forearm.
7. Extensor digitorum communis (EDC) identified.
8. Radial subcutaneous tunnel created and FCR pass to EDC tendons.
9. EDC tendons connected side to side and tensioned to restore normal cascade of digits with pull on tendons proximal to anastomosis.
10. Wrist held in 30° extension and MCP joint in full extension. FCR is secured using a Pulvertaft weave to the EDC tendons proximal to the side-to-side anastomosis with 3-0 Ethibond suture. (This allows easy tensioning of all four fingers.)
11. Tension is adjusted so that with the wrist in neutral, all fingers are at full extension, with

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wrist flexion extension increased, and with wrist extension the fingers close easily.
12. Tourniquet is deflated and hemostasis is achieved.
13. Skin is closed with 4-0 nylon suture.
14. Sugar-tong splint applied extending to fingertips keeping the wrist in 30° of extension and MCP joints fully extended.

Postoperative Care

1. Patient returns in 2 weeks for suture removal.
2. Can switch to short arm cast, but cast should still keep wrist extended, MCP's extended, and include fingers to tip of finger.
3. Immobilized for 6 weeks total.
4. Occupational therapy started after 6 weeks to regain motion.

Possible Complications

1. Tendon adhesion
2. Attenuation of transferred tendon

Operative Dictation

Diagnosis: Radial nerve injury with loss of digital extension
Procedure: FCR to EDC transfer

Indication

This is a _____ with radial nerve palsy with loss of digital extension that failed to return with conservative management. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was obtained and verified, the patient was taken to the operating room and placed in supine position. Time-out among operating room staff was done. General anesthesia was instituted. Preoperative antibiotics were given. The limb was prepped and draped in the standard sterile fashion. The limb was exsanguinated, and the tourniquet was inflated.

A generous volar incision was made over the flexor carpi radialis (FCR) tendon at the level of the wrist. The skin was incised and tenotomy scissors were used to bluntly dissect through the subcutaneous tissue. The radial artery was identified and protected. The FCR was identified and the sheath was incised. The wrist was flexed, and the FCR was transected distally as possible. The tendon was moistened with a normal saline and sponge.

Next attention was turned to the dorsal forearm. An incision was made at the level of the wrist over the EDC tendons. The skin was incised and subcutaneous tissue was bluntly dissected with the tenotomy scissors. The EDC tendons were identified and isolated.

The EDC tendons were then transferred and sutured side to side such that when tension was applied proximal to the anastomosis, all four fingers extended with a normal cascade.

Next a subcutaneous tunnel was created around the radial side of the forearm from the volar incision using blunt dissection passing deep to the radial sensory nerve and following radially to the EDC tendons. The FCR was passed through this subcutaneous tunnel. Then tension of the EDC tendons was set with the wrist in 30° of extension and MCP joints in full extension. The FCR was transferred to the EDC and sutured in place using a Pulvertaft weave with 3-0 Ethibond suture. The position of the wrist and digits was maintained for the remainder of the case to protect the transfer.

The tourniquet was deflated and meticulous hemostasis was achieved. The deep layer was closed with 3-0 vicryl in an interrupted manner. The skin was closed with simple interrupted 4-0 nylon sutures. The wounds were dressed. The patient was placed in a sugar-tong splint with the wrist in 30° of extension and MCP joints fully extended with proximal interphalangeal (PIP) joints to remain free [1, 2].

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Pronator Teres (PT) to the Extensor Carpi Radialis Brevis (ECRB) Tendon Transfer

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Odette Abou Ghanem and Joseph Y. Bakhach

Indications

High Radial Nerve Palsy

1. Radial nerve palsy results in an inability to extend the wrist and the finger metacarpophalangeal joints and to extend and abduct the thumb, the so-called wrist drop deformity.
2. The loss of wrist extension weakens the power grip.
3. The loss of finger and thumb extension affects the ability to grasp objects.
4. Radial nerve palsy is important to differentiate from posterior interosseous nerve (PIN) palsy because in the latter the extensor carpi radialis longus (ECRL) innervation is spared and patients can still extend the wrist, although with radial deviation and the sensation over the dorsum of the first web space is preserved.
5. The pronator teres (PT) to the extensor carpi radialis brevis (ECRB) transfer is done for wrist extension restoration of function. Patients with PIN palsy do not require this transfer since wrist extension is preserved.
6. Tendon transfers for radial nerve palsy including the PT to ERCB are considered in the following cases:
   (a) Delay in presentation of the radial nerve injury beyond one year
   (b) Failure in motor function recovery after repair/reconstruction of the injured radial nerve
   (c) Failure in motor recovery after decompression of the radial/posterior interosseous nerve

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Possible Complications

1. Persistent wrist drop deformity due to a loose PT tendon transfer
2. Excessive extension and lateral deviation of the wrist due to an excessive tightening of the PT tendon transfer

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Essential Steps

Preoperative Testing

1. Patients must have a good passive range of motion at the wrist to get a good result from the tendon transfer.
2. Clinical muscle testing and careful examination are essential to identify the functional deficits and the available tendons that can be transferred.

Intraoperative Details

1. Procedure is done under tourniquet control.
2. A 6 cm longitudinal incision is made over the volar radial aspect of the mid-forearm.
3. The forearm fascia is divided.
4. The extensor carpi radialis brevis and longus tendons and the brachioradialis muscle are identified.
5. The superficial branch of the radial nerve is identified and protected.
6. The Pronator teres muscle is identified, and its insertion on the radius is detached together with a strip of periosteum around 4 cm distal to the insertion of the PT.
7. PT is mobilized proximally.
8. Care is taken not to injure the superficial branch of the radial nerve, the radial artery, and the innervation to the PT.
9. PT muscle-tendon unit is rerouted to reach the ECRB musculotendinous junction.
10. The PT is sutured end to side to the ECRB using a Pulvertaft weave with multiple 4-0 nonabsorbable sutures.
11. The tourniquet is deflated.
12. Hemostasis is secured.
13. All incisions are closed.
14. A splint is applied.

Postoperative Care

1. A long-arm splint is applied such that the wrist is kept in 60° of extension, the finger MCP joint at 90° of flexion, the thumb in maximum abduction and extension, and the finger interphalangeal joints are left free.
2. On postoperative day 10, the sutures are removed and the wound is inspected, and a removable splint is kept for 4 weeks maintaining the wrist and fingers in the position described above.
3. After 4 weeks tenodesis exercises need to be started with a physical therapist.

Operative Dictation

Diagnosis: right/left radial nerve palsy
Procedure: Pronator teres to ECRB tendon transfer

Indication

This is a ---------- year-old female/male with right/left radial nerve palsy and inability to extend the right/left wrist. Benefits, risks, and alternatives associated with the procedure were explained to the patient, and he/she understands and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. A time-out among operating room staff was performed. Patient was placed under general anesthesia and preoperative antibiotics given.

The involved upper extremity was placed in an abducted position on an arm table, and a tourniquet was applied to the arm and left on standby. The upper extremity was then prepared in a sterile manner and the arm was draped. Tourniquet was inflated.

A longitudinal incision around 6 cm was made over the volar radial aspect of the mid-forearm. Palpation of the ECRB and ECRL (extensor carpi radialis longus) and their musculotendinous junction was done to center the incision over the junction. The forearm fascia

was divided. The ECRB and ECRL tendons were identified. The brachioradialis (BR) muscle was identified radial to the ECRL. Under the BR, the superficial branch of the radial nerve was identified and protected. Then both muscles the BR and ECRL were retracted to the ulnar side. This exposed the insertion of the PT. The PT was detached from its insertion on the radius. A strip of periosteum around 4 cm distal to the insertion of the PT should be harvested because this helped to make a strong PT to ECRB repair since the length of the PT was usually just enough to reach the ECRB. The PT muscle-tendon unit was then mobilized proximally and freed any attachments while care was taken not to injure the superficial branch of the radial nerve, the radial artery, and the innervation to the PT. The PT muscle-tendon unit was rerouted around the radial border of the forearm and superficial to the ECRL and the BR to reach the musculotendinous junction of the ECRB.

The PT was sutured end to side to the ECRB using a Pulvertaft weave with multiple 4-0 nonabsorbable sutures. First, a single preliminary suture was taken and then the assistant released the hand. This allowed checking if tension was good enough to maintain the wrist in 45° extension position. Then the rest of the sutures were taken while the assistant maintained the wrist in 45° extension. When it came to tendon suturing, it was better to err on the side of the suturing being too tight rather than too loose because the extensors tend to stretch out with time especially with physical therapy postoperatively.

The tourniquet was released, hemostasis was achieved, and all incisions were closed. Vaseline gauze and loose gauze roll dressings were applied to the surgical site. A splint was applied and the wound was rechecked in 10 days.

Part VII

Lower Extremity Reconstruction

Medial Gastrocnemius Flap

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Renee J. Gasgarth and Wrood Kassira

Indications

1. Provide coverage of a knee defect
2. Provide coverage of a proximal one-third tibial wound
3. Provide coverage of a distal thigh wound

Essential Steps

Preoperative Markings

1. Typically there are no external markings, but the posterior midline of the calf between the medial and lateral gastrocnemius can be marked vertically.
2. The medial malleolus can also be marked, with a point 5 cm above it. This is typically the distal limit of the flap.

Intraoperative Details

1. The patient is placed in supine position.
2. General anesthesia is induced (although monitored anesthesia care with a nerve block can be used).
3. The lower extremity is prepped circumferentially, and a sterile tourniquet can be applied to the proximal thigh.
4. Position the patient so that the hip is externally rotated and the knee is flexed gently with a bump.
5. Make a longitudinal incision that parallels the posterior surface of the fibula extending from the tibial plateau to a point 5–10 cm above the medial malleolus (alternatively a longitudinal incision along the raphe between the medial and lateral gastrocnemius can be made).
6. Carefully preserve the saphenous vein.
7. Dissect between a plane between the skin/subcutaneous tissue and the gastrocnemius muscle.
8. Develop an avascular plane between the medial head of the gastrocnemius and the soleus (small vessels between the muscles may need to be ligated).
9. Preserve the plantaris tendon, which is found in the mid-calf between the medial gastrocnemius head and the soleus.
10. Separate the medial from the lateral head of the gastrocnemius: identify the median raphe

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and use electrocautery distally to separate the heads. If the raphe is not easily identified, the heads can be separated bluntly near the popliteal fossa to assist with identification.
11. Begin the elevation of the muscle distally to avoid damaging the neurovascular pedicle.
12. Separate the distal medial gastrocnemius from the Achilles tendon: preserve at least 5 cm of tendon proximal to the ankle joint/medial malleolus.
13. Once the distal tendon insertion and muscle have been elevated, identify the neurovascular bundle of the medial sural artery with its accompanying nerve by visualization and/or Doppler.
14. Elevate the medial head of the gastrocnemius and the neurovascular bundle toward the popliteal fossa.
15. If additional length is needed to cover the wound, trace the neurovascular bundle toward the popliteal fossa and carefully skeletonize it.
16. Score the fascial layer longitudinally and horizontally for further expansion of the muscle.
17. Finally, divide the insertion of the medial gastrocnemius muscle to the medial femoral condyle if the muscle is still under tension.
18. Rotate the muscle flap into the defect, and loosely inset it.
19. Place a JP drain in the donor site of the posterior calf, and then close the site in layers.
20. Harvest a split-thickness skin graftand suture it to the flap.
21. Dress the wound according to surgeon's preference (wound VAC vs. Xeroform) and apply a knee immobilizer.

Postoperative Care

1. Admit the patient for bed rest and pain control.
2. Avoid hypotension.
3. Chemical DVT prophylaxis is indicated.
4. Keep the lower extremity elevated and immobilized for 5 days.
5. Assess the skin graft take and appearance of the muscle flap after 5 days. If both appear healthy and viable, dangling can begin and advanced as tolerated.
6. Weight-bearing status is determined in part by the original injury and orthopedic recommendations.

Note These Variations

1. The lateral gastrocnemius can be harvested in place of the medial head. However, the lateral flap is narrower and shorter by approximately 3–5 cm in length, and the dissection risks injury to the peroneal nerve. In addition, the lateral popliteal nerve also passes over the lateral sural artery and limits its arc of rotation. If the lateral head is harvested, a longitudinal incision is typically made 3 cm posterior to the fibula. The peroneal nerve should be identified at the neck of the fibula and protected carefully.
2. The medial gastrocnemius flap can be harvested as a myocutaneous flap, but the donor site will need to be skin grafted.
3. The medial gastrocnemius flap can be combined with a medial hemi-soleus muscle flap.

Possible Complications

1. Infection
2. Bleeding/hematoma
3. Partial or total flap necrosis
4. Failure of skin graft to take
5. Wound dehiscence
6. Poor cosmesis (bulky flap, scarring)
7. Need for further procedures
8. Damage to nearby structures
9. Deep vein thrombosis

Operative Dictation

Diagnosis: Exposed and infected hardware of the left knee

Procedure: Pedicled left medial gastrocnemius flap

Split-thickness skin graft 100 cm squared from the left thigh to the left lower extremity wound

Indication

This is a __-year-old male patient who previously required resection of a left lower extremity sarcoma of the distal femur and total left knee replacement by orthopedic surgery. He developed a chronic draining sinus with exposed hardware. Plastic and reconstructive surgery was consulted for assistance with wound coverage. On physical exam, he had a 6 × 3 cm medial knee wound with exposed hardware. He had palpable DP and PT pulses. He verbalized understanding that flap coverage would be based on the extent of soft tissue and hardware removed by orthopedic surgery, and the use of a local muscle flap including the gastrocnemius was discussed with the patient. He understood the possible need for additional soft tissue mobilization, Integra placement, split-thickness skin graft, and the need for additional surgeries. He also understood the risks of infection, bleeding, damage to nearby structures, scar, poor cosmesis, failure of the graft or flap, blood clot, loss of limb, or otherwise poor outcome.

Description of the Procedure

After informed consent was obtained and the patient's left lower extremity was marked in preoperative holding, the patient was taken to the operating suite and placed in supine position. All pressure points were padded. He had a sequential compression device on his right lower extremity. Anesthesia induced general endotracheal anesthesia uneventfully. His left lower extremity was prepped circumferentially, and the right thigh was prepped and draped in the standard sterile fashion. Based on preoperative wound culture results, he was receiving IV antibiotic, which was dosed appropriately. A time-out verified the patient's name, identity, procedure, and site. Orthopedic surgery commenced with debridement of the wound, removal of the exposed knee prosthesis, extensive irrigation, and placement of an antibiotic spacer. After their portion of the procedure, there was an exposed antibiotic spacer extending from the distal thigh to the proximal 1/3 of the tibial surface. The wound appeared clean, although there was significant edema, inflammation, and some fibrosis. After a time-out again verified the patient's identity, plastic and reconstructive surgery portion of the procedure, and site, a #15 scalpel was used to make an incision along the medial leg extending from the open defect and distally. Electrocautery was then used to incise through the dermis, subcutaneous tissue, and superficial fascia. The medial edge of the gastrocnemius was identified, and the medial gastrocnemius was dissected free from the soleus. The septum was identified between the gastrocnemius and soleus proximally, and electrocautery was used to separate them. Small perforating vessels were clipped and divided sharply. Dissection proceeded distally until the fusion of the soleus and the tendinous area was identified. The Achilles and the median raphe of the gastrocnemius were again identified and marked with a marking pen. Doppler was used to identify the sural artery, which was also palpable. While carefully preserving the sural artery, electrocautery was used to divide along the median raphe. The dissection now started distally and then proceeded proximally. A cuff of the proximal tendinous portion of the medial gastrocnemius muscle was dissected free from the Achilles tendon and released. Again the sural artery was preserved. Once the medial gastrocnemius was released from the lateral gastrocnemius at the raphe, we then rotated the medial gastrocnemius to cover the defect. However, further mobilization was required to avoid a tension free inset. A #15 scalpel was used to incise the fascia in a checkered fashion. Next, the sural artery was skeletonized further to increase the arc of rotation. The tendinous insertion at the medial head of the gastrocnemius was also released with Bovie electrocautery. Care was taken to identify and preserve the sural artery throughout the extensive mobilization. The medial gastrocnemius was then rotated over the knee wound. The muscle was healthy and bleeding; there was no evidence of congestion or ischemia. The pedicle had a pulse and strong Doppler signals. The flap was then inset along the knee area as well as the distal thigh using interrupted 0 Vicryl sutures. The spacer was completely covered without evidence of tension. Once the muscle flap was in place, the

distal leg at the site of the gastrocnemius harvest was closed in layers. A 19 French round JP drain was placed, and then the incision was closed with 2-0 Vicryl buried interrupted sutures, followed by running subcuticular 4-0 Monocryl. The JP drain was secured with a 3-0 Nylon suture and placed to bulb suction. The exposed muscle then required coverage. A dermatome was set to a thickness of 0.012 inch and used to harvest a 3 inch wide skin graft from the right proximal thigh. The skin graft was meshed with a 1:2 mesher and inset over the gastrocnemius flap using 4-0 Chromic suture. The total skin graft size was 100 cm squared. The muscle appeared healthy and viable throughout this process. The wounds were then dressed. Dermabond was placed over the distal leg incision. A large Tegaderm was placed over the skin graft donor site. Finally, Xeroform was placed over the skin graft, followed by fluffs, ABDs, Kerlix, Ace wrap, and then finally a knee immobilizer. At the end of the case, the patient had a warm and well-perfused foot. All instrument, sponge, and needle counts were correct. The patient was extubated and transferred to PACU in stable and satisfactory condition. There were no immediate intra- or postoperative complications.

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Soleus Flap

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Renee J. Gasgarth and Wrood Kassira

Indications

1. Provide coverage of a middle third tibial wound
2. Provide coverage of distal third lower leg wounds that are within the reach of the flap

Essential Steps

Preoperative Markings

1. Typically there are no external markings, but the medial malleolus and Achilles tendon can be marked.

Intraoperative Details

1. The patient is placed in supine position.
2. General anesthesia is induced (*although monitored anesthesia care with a nerve block can be used*).
3. Prep the lower extremity circumferentially, and apply a sterile tourniquet to the proximal thigh.
4. Position the patient so that the hip is externally rotated and the knee is flexed gently with a bump.
5. Typically a longitudinal incision is designed by extending proximally and distally the open wound. The incision is ideally aligned parallel and posterior to the tibia and extends between the medial aspects of the tibial plateau toward the medial malleolus to the level of the Achilles tendon.
6. Carefully preserve the saphenous vein.
7. Dissect at the midpoint of the flap, where the soleus can be easily separated from the medial head of the gastrocnemius.
8. The plane between the soleus and gastrocnemius is described as avascular, but there can be large perforators that require dividing with clips.
9. Carefully separate the soleus from the gastrocnemius and from the flexor digitorum longus (FDL).
10. Avoid entering the intermuscular fascia between two compartments: this will protect the posterior tibial neurovascular bundle.
11. Identify the intermuscular artery, and preserve it carefully.
12. For a medial hemisoleus flap, split the soleus longitudinally just lateral to the midline

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(again this is to preserve the intermuscular artery).
13. Identify and preserve two large proximal posterior pedicles. The flap is type II Mathes and Nahai with many perforators from the posterior tibial and peroneal arteries. If two large proximal pedicles are preserved, the entire flap should survive. However, there is a risk of necrosis of the distal 4–5 cm with extensive ligation of distal perforators, so as many perforators as possible should be preserved.
14. If the entire soleus is being harvested, the dissection proceeds laterally.
15. Once the soleus is released from the gastrocnemius in the midportion and proximally, the distal muscle is released from the Achilles tendon. Retain a thin layer of aponeurosis if possible.
16. If additional length is needed, score the fascia longitudinally and horizontally for further expansion of the muscle.
17. Finally, rotate the muscle flap into the defect and loosely inset it. The distal third will often not tolerate being inset with tension.
18. Place a JP drain in the posterior calf at the donor site, and then close the site in layers.
19. Harvest a split-thickness skin graft, and suture it to the flap.
20. Dress the wound according to surgeon's preference (wound VAC vs. Xeroform) and apply a splint or knee immobilizer as needed.

Postoperative Care

1. Admit the patient for bed rest and pain control.
2. Avoid hypotension.
3. Chemical DVT prophylaxis is indicated.
4. Keep the lower extremity elevated and immobilized for 5 days.
5. Assess the skin graft take and appearance of the muscle flap after 5 days—if both appear healthy and viable, dangling can begin and advanced as tolerated.
6. Weight-bearing status is determined in part by the original injury and orthopedic recommendations.

Note These Variations

1. To preserve ankle stabilization and ankle plantar flexion, a hemisoleus flap, which preserves the lateral soleus, is preferred.
2. The soleus can be harvested with a free fibular osteocutaneous flap to allow for larger soft tissue coverage for oral cancer.
3. A hemisoleus flap can also be harvested with a medial gastrocnemius flap.
4. The soleus can also be distally based off of perforators to allow for coverage of distal one-third tibial defects: two large distal perforators should be identified and preserved.

Possible Complications

1. Infection
2. Bleeding/hematoma
3. Partial or total flap necrosis
4. Failure of skin graft to take
5. Wound dehiscence
6. Poor cosmesis (bulky flap, scarring)
7. Need for further procedures
8. Damage to nearby structures
9. Deep vein thrombosis
10. Lower extremity edema/venous insufficiency due to compromising the calf pump mechanism

Operative Dictation

Diagnosis: Right open tibia/fibular fracture of the middle third of the right lower extremity (Gustilo type IIIB)

Procedure: Pedicled soleus muscle flap

Split-thickness skin graft 100 cm squared from the right thigh to the right lower extremity wound

Indication

This is a _____ year-old male patient status post pedestrian versus automobile collision who sustained an open fracture of the right middle third of his tibia and fibula with soft tissue loss. The wound was debrided multiple times by orthopedic surgery, and the extremity was placed in an external fixator. The wound required soft tissue coverage and plastic surgery was consulted. On physical exam, there was 4.5 cm of exposed tibia at the fracture site. There were palpable dorsalis pedis and posterior tibial pulses. The patient understood the need for soft tissue coverage with a local flap—and that he may need additional soft tissue mobilization, Integra placement, split-thickness skin graft, or even additional surgeries (including free flap coverage if the pedicled muscle flap failed). He also understood the risks include, although not limited to, infection, bleeding, damage to nearby structures, scar, poor cosmesis, failure of the graft or flap, blood clot, and loss of limb.

Description of the Procedure

After informed consent was obtained and the patient's right lower extremity was marked in preoperative holding, the patient was taken to the operating suite and placed in supine position. All pressure points were padded. He had a sequential compression device on his left lower extremity. Anesthesia induced general endotracheal anesthesia uneventfully. His right lower extremity was prepped circumferentially and prepped and draped in the standard sterile fashion. A sterile tourniquet was placed on the proximal thigh. He received intravenous antibiotics prior to skin incision. A time-out verified the patient's name, identity, procedure, and site. The right lower extremity was elevated and the tourniquet was inflated to 300 mmHg. Debridement and irrigation of the wound was performed using curettes and rongeurs. A small amount of additional soft tissue fascia, skin, and fat was debrided. A pineapple burr was also used to debride the exposed tibial surface to healthy pinpoint bleeding. Four liters of antibiotic irrigation was used with a pulse lavage. Gloves were changed and the soleus muscle flap was harvested. The posterior superficial compartment was identified medially through the existing wound. The incision was extended proximally and distally using a #10 scalpel, and then dissection proceeded through the subcutaneous tissue and through the fascia of the superficial posterior compartment using electrocautery. This allowed identification of the length of the soleus and the Achilles tendon. The medial hemisoleus was dissected from the medial gastrocnemius in the middle of the wound—once this avascular plane was identified, dissection proceeded superiorly and inferiorly and laterally. Perforators were carefully identified and preserved proximally. The FDL was identified and carefully preserved. The soleus was carefully separated from the septum separating the deep and superficial compartments; the septum was not violated to protect the posterior tibial neurovascular bundle. Several smaller perforators in the distal one-third were ligated with clips and divided sharply. Careful inspection of the soleus muscle revealed the distal muscle tip was still viable. Once the soleus was immobilized to the level of the Achilles tendon, it was released from the tendon. The flap was rotated to cover the tibial defect and again reexamined. The entire muscle was pink and bleeding and appeared viable. To avoid tension, the fascia was then scored longitudinally. The flap was then inset with 2-0 Vicryl interrupted sutures. A 19 French round JP drain was placed in the superficial posterior compartment and secured in place with 3-0 Nylon suture. The proximal and distal aspects of the incision were then closed in layers with 2-0 interrupted Vicryl sutures and then horizontal mattress sutures with 3-0 Prolene. Finally, a dermatome was set to 0.012 inch thickness and used to harvest a 3 inch. wide skin graft from the right proximal thigh. The skin graft was meshed with a 1:2 mesher and inset over the soleus muscle using 4-0 Chromic suture. The total skin graft size was 100 cm squared. The muscle appeared healthy and viable throughout this process. The wounds were then dressed with Xeroform over the skin graft and incisions. This was followed by fluffs, ABDs, Kerlix, and Ace wraps. The skin graft

donor site was dressed with a large Tegaderm. At the end of the case, the patient had a warm and well-perfused foot. All instrument, sponge, and needle counts were correct. The patient was extubated and transferred to PACU in stable and satisfactory condition. There were no immediate intra-or postoperative complications.

Suggested Reading

1. Guzman-Stein G, Fix RH, Vasconez LO. Muscle flap coverage for the lower extremity. Clin Plast Surg. 1991;18:545–52.
2. Kuo YR, Shih HS, Chen CC, Boca R, Hsu YC, Su CY, Jeng SF, Wei FC. Free fibula osteocutaneous flap with soleus muscle as chimeric flap for reconstructing mandibular defect after oral cancer ablation. Ann Plast Surg. 2010;64(6):738–42.
3. Pu LLQ. Further experience with the medial hemisoleus muscle flap for soft-tissue coverage of a tibial wound in the distal third of the leg. Plast Reconstr Surg. 2008;121(6):2024–8.
4. Pu LLQ. Soft-tissue coverage of an extensive mid-tibial wound with the combined medial gastrocnemius and medial hemisoleus muscle flaps: the role of local muscle flaps revisited. J Plast Reconstr Aesthet Surg. 2010;63:e605–10.
5. Raveendran SS, Kumaragama KG. Arterial supply of the soleus muscle: anatomical study of fifty lower limbs. Clin Anat. 2003;16(30):248–52.

Reverse Sural Artery Flap

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Alexis L. Parcells, Jonathan Keith,
and Mark Granick

Indications

1. Coverage of lower leg, ankle, or heel soft tissue defects

Essential Steps

Pre-operative Markings

1. Measure the wound with patient in prone or lateral decubitus position
2. Doppler ultrasound peroneal artery perforators and lesser saphenous vein (LSV)
3. Identify the flap pivot point posterior and approximately 5 cm superior to the lateral malleolus
4. Outline the skin island to match the recipient site defect according to the length necessary with the pedicle centralized

Intra-operative Details

1. Monitored Care Anesthesia
2. Place patient in prone or lateral decubitus position
3. Incise the lower leg skin and subcutaneous tissue down to fascia
4. Elevate the fascial pedicle including sural nerve and lesser saphenous vein
5. Transpose the pedicle and inset it into the recipient defect site
6. Confirm perfusion with Doppler ultrasound
7. Fixate the flap under no tension and skin graft the donor site defect
8. Place drain and close the wound
9. Place sterile dressing and splint

Post-Operative Care

1. Control pain, blood pressure
2. Do not remove splint, do not place compressive dressings
3. No weight bearing
4. Leg elevation
5. Patient will return to office for flap monitoring
6. If performed as delay in two stages, second stage planned 2 weeks from first surgery

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Note These Variations

1. Gastrocnemius Myocutaneous Adjunct: relies on perforating superficial sural arteries to supply the gastrocnemius muscle. Limited use as most defects do not require bulk provided by a myocutaneous flap
2. Delay procedures: used in attempts to redirect blood flow and decrease the risk of flap necrosis
   (a) Sural Flap Delay Procedure: flap elevated without completely incising the proximal edge of the skin island. Two weeks later, the flap is completely elevated and transferred into the defect site. This adjunct procedure redirects blood flow longitudinally before complete flap elevation.
   (b) Delayed Sural Flap Procedure: flap elevated and LSV and sural artery are ligated.
3. The flap is then immediately sutured back into its donor site. Two weeks later, the flap is transferred into its recipient site. This allows the flap to become viable on its distal vascular pedicle before causing the addition trauma of transferring the flap, which can potentially compromise the pedicle.
4. Supercharging: The proximal end of LSV is anastomosed to any vein in the area of the recipient site defect. This adjunct allows drainage of proximal lesser saphenous vein stump in a physiologic direction and may improve venous outflow.

Possible Complications

1. partial or total flap necrosis
2. hematoma
3. infection
4. delayed wound healing

Operative Dictation

Diagnosis: lower leg, ankle or heel soft tissue defect
Procedure: Reverse Sural Artery Flap

Indication

This is a _____ with a defect of the lower leg, ankle, or heel. The patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. Time out among operating room staff was taken. Monitored Anesthesia Care was instituted. Pre-operative antibiotics were given. The patient was then re-positioned prone or lateral decubitus. Care was taken to pad all the joints properly, and a well-padded tourniquet was placed over the patient's thigh. The patient's lower extremity was prepped and draped in standard sterile surgical fashion.

The wound was inspected and irrigation and debridement of the lower leg wound was performed. Hemostasis was obtained. Next, a handheld Doppler was used to confirm lower leg arterial and vascular perfusion. The tourniquet was inflated and the skin was incised through the subcutaneous tissue down to the fascia. A pedicle fasciocutaneous flap was elevated with a #10 scalpel to about 5 cm above the lateral point of lateral malleolus to avoid damaging the perforating vessels. Care was taken not to injure the pedicle. The pedicle was transposed into the defect without any kinking or tension. Perfusion of the flap was confirmed with

Doppler ultrasound. The flap was inset inferiorly and was sutured into place. Next, a drain was placed in the donor site and is secured with suture. A split-thickness skin graft was harvested and placed over the flap donor site. Hemostasis was achieved, and all remaining areas were sutured closed. A sterile dressing was placed and a splint was made with space around the pedicle area. Perfusion of the flap was again confirmed with Doppler ultrasound. The patient was extubated and transferred to the recovery room in stable condition.

Suggested Reading

1. Follmar KE, Baccarani A, Baumeister SP, et al. The distally based sural flap. Plast Reconstr Surg. 2007; 119(6):138e–48e.

Cross Leg Flap

133

Aditya Sood, Stephen L. Viviano,
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Indications

1. Soft tissue defects of the lower third of the leg or foot with exposed hardware, bone, or tendon.

Contraindications

1. Elderly patients
2. presence of arthritis in hips/knees
3. peripheral edema or venous disease of donor leg
4. morbid obesity

Possible Complications

1. Flap necrosis secondary to ischemia or venous insufficiency
2. Hematoma
3. deep venous thrombosis

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Essential Steps

Preoperative Planning and Marking

1. Measure the total area of the soft tissue defect.
2. Template the defect to the contralateral (donor) proximal posterior lower leg.
3. Plan the axial patterned flap with a superior base centered just lateral to midline and extending to the origin of the Achilles tendon.
4. Mark the flap accordingly, and size it at least 10 % larger than the wound area.

Intra-operative Details

Stage 1: Flap Elevation and Inset

1. General or spinal anesthesia should be used.
2. Position the patient in supine position for anterior defects or prone for posterior defects.
3. Perform wide operative site preparation and draping of the lower extremities to the gluteal fold.
4. Prepare the recipient site with aggressive debridement.
5. Place Steinmann pins through both tibias.
6. Incise the skin, subcutaneous tissue, and fascia along the pre-designed flap borders.
7. Raise the flap in a sub-fascial plane. Care must be taken to not injure the vascular pedicle.

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8. Position the legs to allow for tension-free placement of the flap.
9. Attach the external fixation device to maintain the position.
10. Move and inset the flap to the recipient wound bed.
11. Dress the donor site and exposed underside of the flap with a temporary biologic or non-adherent dressing.

Stage 2: Flap Division

1. General or spinal anesthesia should be used.
2. Position patient in supine or prone position to allow direct access to the flap.
3. Remove external fixation device and Steinmann pins.
4. Divide flap by incising at the point of attachment to the donor leg.
5. Complete flap inset with two-layer closure of the flap to the recipient leg.
6. Remove any temporary biologic dressings and return any redundant flap to the donor site. Split-thickness skin grafts can be used to cover any residual defects on the donor leg, which will be followed with a bolster dressing and compression wrap.

Post-Operative Care

Following Stage 1

1. Monitor the flap.
2. The patient should have physical therapy provide passive range of motion of the hips, knees, and ankles until flap division in Stage 2.

Following Stage 2

1. Remove bolster dressing over skin graft site in 5–7 days.
2. Patient may return to weight bearing as tolerated.

Timing

1. Skin grafts can be unveiled on post-operative day 5–7.
2. Flap division should be performed between post-operative day 14 and 21.

Operative Dictation

Diagnosis: Open wound of (left/right) (leg/ankle/foot)
Procedure: Fasciocutaneous flap for lower extremity reconstruction

Indications

This is a __ with a complicated open wound of the __ leg/ankle/foot with exposed hardware/bone/tendon requiring soft tissue reconstruction with vascularized tissue. All relevant benefits, risks, and alternatives are explained to the patient, including the possibility of joint stiffness and flap loss. The patient understands and accepts these benefits, risks, and alternatives and wishes to proceed with the operation. Informed consent is obtained.

Description of the Procedure

Stage 1

The patient's identity was verified. He/she was brought into the operating room and placed in the supine/prone position. Time out was performed by all operating room staff. Anesthesia was induced by the anesthesia team. Preoperative antibiotics were given. The lower extremities were prepped and draped in the usual sterile fashion. The recipient wound bed was debrided and irrigated of all necrotic and contaminated tissues. Steinmann pins were placed through both tibias. The total size of the wound was measured. Total wound dimensions are __×__ cm. A template was used to transpose the wound dimensions to the contralateral leg donor site area. The flap was designed and marked with a superior base centered just lateral to the midline. Total flap dimensions were __×__ cm. Next, the skin was incised using a #15 scalpel along the markings. The incision was continued through the subcutaneous tissue and fascia. The flap was then elevated and dissected from the apex toward the base in a subfascial plane, taking care to preserve the vascular

pedicle on the underside of the flap. The legs were positioned to allow tension-free placement of the flap to the donor site. External fixation was secured into place to maintain the position. The flap was then mobilized to the recipient site and inset. The flap was evaluated for capillary refill, distal punctate bleeding, and venous outflow. Next, the donor site and undersurface of the flap was measured and a temporary biologic dressing placed. The incision lines were dressed with antibiotic ointment and a sterile non-adherent dressing. The patient was extubated and transferred to the post-anesthesia care unit in stable condition.

Stage 2

The patient's identity was verified. He/she was brought into the operating room and placed in the supine/prone position. Time out was performed by all operating room staff. Anesthesia was induced by the anesthesia team. Preoperative antibiotics were given. The lower extremities were prepped and draped in the usual sterile fashion. The external fixation device and Steinmann pins were removed entirely. Temporary biologic dressings were removed. The pedicle was compressed prior to division to confirm flap viability. Then, the flap was divided by incising at the point of attachment to the donor leg, leaving a comfortable amount of tissue for direct closure. Viability of this divided flap was confirmed. The recipient leg wound was then closed primarily with sutures. Any redundant tissue on the pedicle from the donor leg was returned and sutured in place. Next, the size of the resulting donor site defect was measured. The total size is __×__ cm. A split-thickness skin graft with a thickness of 0.0__ inch was harvested from the __. The graft was then meshed using a 1:1.5 mesher. The skin graft was transferred to the flap donor site and secured into place using __. A bolster composed of __ was applied over the skin graft. The incision lines were dressed with antibiotic ointment and a sterile non-adherent dressing. The patient was extubated and transferred to the post-anesthesia care unit in stable condition.

Suggested Reading

1. Long CD, Granick MS, Solomon MP. The cross-leg flap revisited. Ann Plast Surg. 1993;30(6):560–3.

Medial Plantar Artery Flap

134

Alexandra Condé-Green and Edward S. Lee

Indications

1. Coverage of medial ankle, plantar, or heel soft tissue defects
2. Reconstruction of the great toe
3. Microvascular transfer for defect of the contralateral foot

Possible Complications

1. Partial or total flap necrosis
2. Hematoma
3. Infection
4. Wound dehiscence—delayed wound healing

Essential Steps

Preoperative Markings

1. Measure the wound with patient in prone or decubitus position.
2. Doppler ultrasound of the medial plantar artery and venae comitantes.
3. Outline the dimension of the flap to match the recipient defect.
4. The territory of the flap is located between the first metatarsal and the calcaneus in its long axis. The midline of the plantar surface of the foot and the prominence of the navicular bone determine the medial and lateral limits of the skin.
5. The flap should not include weight-bearing skin.

Intraoperative Details

1. Incise the skin and subcutaneous tissue down to the fascia as it is a fasciocutaneous flap.
2. Transpose the pedicle and inset it into the defect.
3. Confirm perfusion with Doppler ultrasound and clinical exam.
4. Include the median plantar nerve for a sensory flap especially for heel coverage.
5. Fixate the flap under no tension and skin graft the donor site.

Postoperative Care

1. Control pain and blood pressure.
2. Leg elevation.
3. Posterior splint for immobilization for 2 weeks.

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4. Patient is seen in 24 h to check the wound and change the dressing.
5. No weight bearing to the foot for 2 weeks.
6. Remove permanent sutures on POD #14 to 21 in the office.

Note These Variations

1. The flap may include the abductor hallucis muscle.
2. Reverse flap based on communication between the dorsalis pedis and plantar artery.
3. Segmental flap with V-Y advancement for coverage of defects of the first and second metatarsal heads.
4. Microvascular transplantation for distant coverage after division of the medial plantar artery and venae comitantes distal to the lateral plantar vessels.

Operative Dictation

Diagnosis: R/L medial ankle, plantar, or heel soft tissue defect
Procedure: R/L medial plantar flap

Indication

This is a ____ year old male/female with a defect of the R/L medial ankle, plantar region or heel that he has had for _____ days/months/years, following _____. Preoperative examination confirms distal flow to the toes with the posterior tibial artery occluded with manual pressure. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After informed consent was verified, the patient was taken to the operating room and placed in supine position. Time-out among operating room staff was taken. Preoperative antibiotics and DVT prophylaxis were given. General anesthesia was instituted. The patient was placed in a prone position. A well-padded tourniquet was placed over the patient's thigh. The leg and foot were prepped and draped in standard sterile surgical fashion. The wound/defect was debrided, and hemostasis was obtained with an electrocautery. A handheld Doppler was used to confirm presence and course of the medial plantar artery. The location of the perforator between the distal metatarsals was confirmed with a pencil Doppler. The flap was designed with a template to cover the defect and the artery located centrally. The tourniquet was inflated to ____ mmHg. The skin was incised along the markings and extends through the plantar fascia, exposing the flexor digitorum brevis muscle laterally and the abductor hallucis muscle medially. The flap was raised subfascially from distal to proximal, and at its distal end, posterior to the metatarsophalangeal joint, the muscles were separated to expose the medial plantar artery, associated venae comitantes, and medial plantar nerve. The flap was elevated with the axial artery. The nerve was spared (or included for a sensate flap).

Dissection proceeded toward the calcaneus beneath the vascular pedicle in the central flap and deep to the plantar fascia medially and laterally. The sensory nerve fibers of the medial plantar nerve were split as dissection proceeds proximally. Dissection was continued until the tuberosity of the calcaneus was reached. The pedicle fasciocutaneous flap was elevated and transposed into the defect without any kinking or tension on the pedicle. The tourniquet was released. Perfusion of the flap was confirmed with Doppler ultrasound and capillary refill. Capillary refill in the toes was confirmed to be within normal limits. Hemostasis was achieved with electrocautery. The flap was inset into the defect and the skin sutured in one layer with discontinuous nonabsorbable sutures.

Coverage of the donor site was done with a split-thickness skin graft harvested from the _____ (R/L thigh), measuring ____ sq. cm, and placed on the exposed abductor hallucis and flexor digitorum brevis muscles. A bolster dressing was applied on the skin graft and secured

with nonabsorbable sutures. Dressing made of _____ was applied on the flap. A well-padded posterior splint avoiding compression on the flap was placed on the foot. The patient was extubated and transferred to the recovery room in stable condition.

Suggested Reading

1. Mathes SJ, Nahai F. Medial plantar artery flap. In: Reconstructive surgery: principles, anatomy & technique, vol. 2. 1st ed. New York: Churchill Livingstone; 1997. p. 1579–91.

Free Rectus Abdominis Myocutaneous Flap for Lower Extremity Reconstruction

135

Rebecca C. Novo, Nicole Miller, Kenneth A. Guler, and Christopher J. Salgado

Indications

1. Large lower extremity wounds with exposed bone, tendon, or neurovascular structures, due to trauma, malignancy, radiation, burns, or infection

Essential Steps

Preoperative Planning

1. Patients may have diagnostic imaging performed to evaluate the lower extremity arterial and venous patency.

Preoperative Markings

1. The abdomen is marked at the midline, xiphoid process, pubis, and costal margin.
2. Be aware of any preexisting diastasis that may lateralize the rectus muscles. Position of the muscle is palpated. While having patient in supine position, perform a straight leg-raising maneuver.
3. A skin island is designed directly over the surface of the muscle in a vertical orientation, to match the lower extremity defect. Alternatively a skin island may be designed transversely across the abdomen based on the perforating vessels, if a Pfannenstiel incision is implemented, in which case this would be a transverse rectus abdominal myocutaneous flap.
4. The skin island is designed with lower extremity defect in mind, but as importantly, the ability to close the donor site defect primarily, which is usually limited to a width of 6–8 cm. The use of soft tissue reinforcement implants may be used to reconstruct the anterior rectus sheath in efforts to avoid bulging or herniation.

Intraoperative Details

1. Positioning: supine.
2. Anesthesia: General.
3. Clip any excess hair from the abdomen and lower extremity.

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4. Indwelling Foley catheter required.
5. Prep the chest, abdomen, pubis, and circumferential lower extremity.
6. Ensure the lower extremity wound has been thoroughly debrided of all necrotic or devitalized tissue. (Equipment used for debridement should be different from that used for the reconstruction and all gowns and gloves changed prior to actual reconstruction.) Expose the lower extremity recipient vessels prior to flap harvest to ensure vascular inflow and outflow.
7. Incise the abdominal skin paddle parallel and superficial to the lateral and medial border of the rectus abdominis muscle. Incise the anterior rectus sheath along the lateral border of the rectus and medial border of the rectus paying careful attention not to injure perforating vessels from the deep inferior epigastric artery and vein.
8. Dissect the rectus abdominis muscle free from its deep attachments to the posterior rectus sheath. Identify the inferior epigastric artery and vein, entering the inferior lateral aspect of the muscle 4 cm superior to the fibers of origin at the pubis.
9. Dissect the inferior epigastric artery and vein pedicle free of surrounding tissue to its origin at the external iliac artery and vein with use of loupe magnification. Deaver retractors are useful to displace the posterior rectus sheath posteriorly.
10. Once inflow and outflow is confirmed from the recipient vessels, the flap is divided and brought down to the extremity defect.
11. The rectus fascia is approximated with interrupted 0-PDS and if necessary reinforced with (biologic or synthetic) mesh.
12. The microvascular anastomosis is performed after insetting of the flap to the extremity, and the flap is then inset. Passive or active drainage may be used for effluent at the site of the defect.
13. The abdominal skin may be closed in two layers over a drain.

Postoperative Care

1. Control blood pressure and pain in the immediate postoperative setting to avoid spasm of the recipient artery. Patients are admitted to the SICU for standard flap protocol including hourly flap checks by Doppler and clinical inspection.
2. Postoperative instructions for patients include:
   (a) Bed rest with leg elevation
   (b) Aspirin and DVT prophylaxis
3. Lower extremity dangle protocol is initiated under supervision on average at 1 week postoperatively three times a day during meals and increased until discharge. Patient should be strictly non-weight bearing to the affected limb.

Possible Complications

1. Arterial or venous thrombosis
2. Wound dehiscence
3. Scarring, asymmetry
4. Abdominal wall laxity or hernia
5. Hematoma
6. Infection

Operative Dictation

Diagnosis: (laterality) lower extremity wound with exposed (bone/tendon)

Procedure: reconstruction of (laterality) lower extremity wound with free tissue transfer of (laterality) rectus abdominis with skin paddle orientation

Indication

This is a ____ y.o. _____ with (laterality) lower extremity wound secondary to _____. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed with reconstruction using free tissue transfer from the abdomen.

Description of the Procedure

Following informed consent verification, the patient was taken to the operation room and transferred to the operating table in a supine position. General anesthesia was induced and preoperative antibiotics given. A sterile Foley catheter was placed. Sequential compression device was placed on the unaffected extremity. Time-out among operating room staff was performed.

The (laterality) lower extremity and abdomen were clipped, prepped, and draped in the standard sterile fashion.

The lower extremity wound was sharply debrided of all nonviable tissue and pulsed lavage irrigation performed. A template of the defect was made and traced to the anterior abdominal wall, centered to overly the rectus muscle.

This outlined skin paddle was incised and dissection carried down to the anterior rectus sheath. Careful attention was paid to not shear any perforating vessels from the inferior epigastric vessels to the overlying skin paddle. Using loupe magnification, the anterior rectus sheath was incised in an elliptical manner preserving minimum of 1 cm of both medial and lateral edge of rectus sheath. The rectus muscle was then dissected free of the remaining medial and lateral sheath, taking care to avoid muscle injury or disruption of the sheath at the inscriptions. Temporary sutures were placed in an interrupted fashion from the muscle including the fascia overlying the muscle flap to the deep dermis of the skin paddle to prevent shearing and separation of the muscle from the overlying skin paddle.

The rectus muscle was then separated from the posterior sheath. After identification and isolation of the inferior epigastric vessels, and dissection to their origin at the external iliac artery and vein, the rectus muscle was divided proximally at the costal margin, clipping the superior epigastric artery and vein, and all minor vascular pedicles ligated as the muscle was completely dissected free from the posterior rectus sheath.

From a medial lower leg incision, we extended our incision to expose normal tissue planes and in the deep posterior compartment exposed the posterior tibial artery and vein, preparing the vessels for an end-to-end anastomosis. (If the anterior tibial vessels were used, then they were found in the anterior compartment of the leg.)

Once adequate inflow and outflow was confirmed, the inferior epigastric artery and vein were ligated close to their origin from the external iliac artery and vein, and subsequently, the donor artery and vein were flushed with heparinized saline until there was venous return.

After securing the flap to the donor site, under the microscope, a hand-sewn arterial anastomosis with 9-0 nylon suture between the inferior epigastric artery to the _____ artery was performed in an end-to-end fashion. We then sized the donor and recipient veins with a coupler sizer and with the size-matched coupler performed the venous anastomosis.

The inset of the flap was performed over a Penrose drain and sparingly used deep dermal 2-0 absorbable interrupted sutures for inset. The skin was approximated with interrupted 3-0 and 4-0 nonabsorbable sutures. Flap appeared healthy and viable at the end of the inset.

The abdominal donor site was closed by reapproximating the fascial edges primarily with 0-Prolene in an interrupted fashion. (If the remaining fascia appears weak, or tears on closure, a reinforcing underlay or overlay mesh is placed.)

Skin closure was performed over a 19 Fr. round Jackson-Pratt drain and deep dermal sutures placed with 3-0 Monocryl and skin closed with 4-0 running Monocryl (or staples).

The patient was extubated and taken directly to the SICU in stable condition.

Suggested Reading

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2. Salgado CJ, et al. Pfannenstiel incision as an alternative approach for harvesting the rectus abdominis muscle for free-tissue transfer. Plast Reconstr Surg. 2000;105(4):1330–3.
3. Wei F, Mardini S. Flaps and reconstructive surgery. Philadelphia: Saunders; 2009.

Chimeric Latissimus Dorsi-Serratus Free Flap

136

Amir Ibrahim and Matthew Hanasono

Indications

1. Extensive soft tissue defect: pelvis, lower extremity, upper extremity, head and neck, and calvarium coverage.

Essential Steps

Preoperative Markings: Standing Position

1. The borders of the latissimus dorsi muscle (LDM) are marked by palpating the muscle as follows: the anterior border is marked from the posterior axillary fold to the iliac crest; the superior border is marked from the tendinous insertion along the tip of the scapula to the posterior border; and the posterior border is marked approximately 4 cm lateral to the spine.
2. If needed, a skin paddle is marked along the maximum laxity of the back skin (oblique or horizontal).
3. A flap of adequate size is planned of the latissimus muscle, and additional tissue is outlined in the lower third of the serratus anterior muscle (SAM). The proximal five slips of the serratus are not included in the flap design.

Intraoperative Details

1. Patient is positioned in the lateral or prone position as needed according to the defect area to reconstruct.
2. Adequate preparation of the recipient soft tissue defect site is performed and donor vessels are dissected and prepared for microvascular anastomoses.
3. Skin incision is preformed according to preoperative markings (with or without skin paddle).
4. Incisions are deepened down to latissimus muscle fascia. If a skin paddle is needed, mild beveling between the skin and the fascia is performed to improve blood supply to the skin paddle.
5. The usual latissimus muscle elevation is terminated at the point where the serratus anterior collateral branches originate.
6. The serratus anterior is elevated off the scapula and ribs and kept connected to the latissimus

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through the serratus branch of the thoracodorsal artery.
7. The small portion of the serratus that remains is fixed to the rib periosteum to minimize outward rotation of the scapula.
8. Once both flaps are elevated, the cephalad portions of both muscles are transected.
9. The thoracodorsal vessels are dissected (off the accompanying nerve) all the way up to their origin at the subscapular system.
10. The chimeric flap is rendered ischemic for microvascular anastomoses.
11. Partial flap inset at the soft tissue defect and microvascular anastomoses are performed.
12. Inset is completed and closure over suction drains are performed.

Postoperative Care

1. Monitor patient vital signs every 2 h.
2. Pain control.
3. Flap monitoring every 1 h for the first 48 h followed by flap check every 2 h for another 48 h and the flap check every 4 h until discharge; check for color, hematoma, flap skin temperature, capillary refill, and Doppler signal.
4. DVT prophylaxis 12 h after surgery if no bleeding exists.
5. Limb elevation if the flap is used for extremity reconstruction.
6. Keep drains under suction and empty every 4 h.
7. Wound care.

Possible Complications

1. Venous congestion, arterial ischemia, flap partial, or total necrosis
2. Bleeding
3. Infection
4. Donor site complications: seroma, hematoma

Operative Dictation

Diagnosis: Extensive soft tissue defect in any location (calvarium, head and neck, upper or lower extremities, pelvis, etc.)
Procedure: Soft tissue reconstruction with chimeric latissimus dorsi-serratus anterior myocutaneous free flap

Indications

This is an X-year-old male/female presenting with extensive soft tissue defect secondary to trauma and post-oncologic resection with or without radiation history. Healthy vascularized tissues are needed for coverage, but no local or regional options are available for such a soft tissue reconstruction. Free soft tissue transfer is necessitated. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. General anesthesia was induced. The patient was positioned in the lateral decubitus position with the ipsilateral arm prepped and placed on a sterile Mayo stand; additionally, an axillary roll was placed to avoid any contralateral brachial plexopathy. A proper timeout was completed verifying correct patient, procedure, site, positioning, and special equipment prior to beginning the procedure.

The patient had already an existing defect after the oncologic surgeon has completed the tumor resection; the plastic surgery team took over. Attention was directed to the recipient soft tissue defect site. The donor vessels were dissected and adequately prepared for microvascular anastomoses.

Attention was directed to the back. Markings were designed. Incisions were performed. (If there was a question about the integrity of the thoracodorsal vessels, then they were exposed and dissected first in the posterior axillary region. They were traced to their origin from the subscapular artery, and the serratus anterior branch was identified, dissected, and protected.)

Incisions were deepened down to latissimus muscle fascia. Mild beveling between the skin and the fascia was performed to improve blood supply to the skin paddle. Superior and inferior fasciocutaneous flaps were developed on top of the latissimus dorsi muscle. Dissection in all directions, above the latissimus dorsi muscle (LDM) fascia, was performed. The anterior (lateral) border of the LDM was identified. The latissimus dorsi muscle was separated from the serratus anterior starting at the inferolateral edge and continuing superiorly along the lateral edge. The distal part of the muscle was then reflected proximally. Dissection was continued medially (posteriorly) until reaching the paraspinous muscle fascia. The intercostal and lumbar perforators were carefully clipped and divided. Superomedially, the covering fibers of the trapezius muscle were identified and elevated away from the underlying latissimus muscle. After the superior border of the latissimus was identified, dissection was carried out laterally until reaching the previous plane of dissection, separating the fibers of the teres major muscle that coalesce with those of the latissimus. The latissimus muscle elevation was terminated at the point where the serratus anterior collateral branches originate. The serratus anterior was elevated off the scapula and ribs and kept connected to the latissimus through the serratus branch of the thoracodorsal artery. The lower part of the serratus anterior muscle (SAM) was used completely or partially. A small remnant portion of the SAM was fixed to the rib periosteum. Once both LDM and SAM flaps were elevated, the cephalad portions of both muscles were transected, and therefore two true island flaps were created. The thoracodorsal vessels were dissected (off the accompanying nerve) all the way up to their origin at the subscapular artery, and therefore dissection was completed.

The chimeric flap was rendered ischemic for microvascular anastomoses. Partial flap inset at the soft tissue defect and microvascular anastomoses were performed. After securing patent vessel anastomoses, inset was completed, and closure over suction drains (applied away from the pedicle) was performed.

Attention was directed to the back donor area. Hemostasis and irrigation were performed. Closure is performed with 2-0 Vicryl suture. Quilting sutures were applied to minimize donor site seroma formation. The deep dermal layer was closed with a 3-0 Monocryl buried suture. A 4-0 Monocryl subcuticular stitch was used on the skin. The incision was dressed with antibiotic-based dressing.

Flap Doppler signals were checked prior to patient transfer to PACU or ICU.

Suggested Reading

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Part VIII

Lymphedema Surgery

Charles Procedure for Lymphedema

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Amir Ibrahim and Alexander T. Nguyen

Indications

Advanced and end-stage lymphedema:

1. Campisi lymphedema clinical stage 4 or 5
2. ISL (International Society of Lymphology) lymphedema stage III
3. MD Anderson ICG (indocyanine green) lymphography stage 4

Possible Complications

1. Inadvertent nerve injury
2. Massive fluid loss and kidney hypovolemic injury
3. Extensive blood loss
4. Infection
5. Skin graft loss
6. Skin graft scar contracture

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Essential Steps

Preoperative Markings

1. Performed preoperatively in the standing position to mark the proximal and distal edges of lymphedema swelling
2. Proximal wedge incision markings for a smooth transition and contour between the grafted area and normal skin

Intraoperative Details

1. The patient is placed in the supine position under general anesthesia.
2. The limb is hanged on a stirrup or with a hanger from the ceiling (if available).
3. Prepping and draping in a sterile fashion.
4. Limb exsanguination with Esmarch bandage and apply sterile pneumatic tourniquet as high as possible on the limb proximal to the affected area and to the marked incisions and inflate to 150 mmHg above the patient's systolic blood pressure.
5. Using any kind of dermatome, split-thickness skin grafts are harvested from planned excision area.
6. Make the incisions according to the preoperative markings using a scalpel or cutting diathermy.

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7. Deepen incisions down to the deep investing muscle fascia and paratenon (whenever over the tendons) that are carefully preserved. All the soft tissue superficial to those planes is excised.
8. At the proximal aspect at the wedge areas, flaps are raised, thinned tangentially, and then sutured together over suction drains.
9. At the web spaces, the skin flaps are preserved to avoid skin grafts contractures.
10. Tourniquet is deflated and hemostasis and irrigation are performed. Monitor blood pressure during this step.
11. Previously harvested skin grafts are applied to the whole excised area, secured, and dressed with nonadherent dressings, gauzes, ACE wrap, and posterior splint.
12. Monitor vital signs and urine output throughout the whole case.

Postoperative Care

1. Elevation of operated limb
2. General regular patient post-op monitoring
3. Keep patient inpatient. Dressing change on post-op day 5 from surgery. Discharge home after if no issues.

Operative Dictation

Diagnosis:

- Campisi clinical stage 4 or 5
- ISL (International Society of Lymphology) lymphedema stage III
- MD Anderson ICG (indocyanine green) lymphography stage 4

Procedure: Charles procedure

Indications

This is an X-year-old male/female presenting with advanced upper/lower limb lymphedema resistant to conservative and physiologic surgical measure. As the last option, the patient is a good candidate for ablative surgery.

Description of the Procedure

After obtaining an informed consent the patient was taken to the operating room. He was placed in supine position. A proper time-out was performed. General anesthesia was instituted. The limb was hanged on a stirrup. The patient was prepped and draped in a standard sterile surgical fashion. Markings of the incisions were reenforced according to preoperative ones. Proximal wedge incision markings for a smooth transition and contour between the grafted area and normal skin were planned.

The affected limb was exsanguinated with Esmarch bandage, and a sterile pneumatic tourniquet was applied proximal to the affected area and inflated to 150 mmHg above the patient's systolic blood pressure. Using a dermatome, split-thickness skin grafts were harvested from planned excision area.

Incisions began according to the preoperative markings using a #10 scalpel. Electrocautery was used to deepen incisions down to the deep investing muscle fascia and paratenon. Care was taken to preserve paratenon. All of the soft tissues superficial to those planes were excised. At the web spaces of the foot, the skin flaps were preserved to avoid skin graft contractures. At the proximal aspect at the wedge areas, flaps were raised, thinned tangentially, and then sutured together over suction drains.

Tourniquet was deflated and hemostasis and irrigation were performed. Previously harvested skin grafts were meshed. They were applied to the whole excised area, secured with skin staples, and dressed with nonadherent dressings, gauzes, elastic bandage wrap, and posterior splint. Distal limb capillary refill was checked to be adequate.

Patient tolerated the procedure well and was transferred to PACU in stable conditions.

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Lymphovenous Bypass

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Amir Ibrahim and Roman Skoracki

Indications

1. Primary or secondary lymphedema of the following stages:
   (a) Campisi early stages (IB, II, early III)
   (b) MD Anderson Cancer Center lymphedema stages 1, 2, and 3

Possible Complications

1. No improvement
2. 1–2 % worsening of lymphedema
3. Wound infection
4. Allergy to indocyanine green dye

Essential Steps

Preoperative Markings

1. With the aid of indocyanine green lymphangiography using the photodynamic eye (PDE) machine, any possible open lymphatic channel is marked preoperatively on the skin of the involved limb.

Intraoperative Details

1. Patient is placed in the supine position under general anesthesia.
2. Preoperative antibiotic is given.
3. Intraoperative indocyanine green lymphangiography and marking the open lymphatic channels.
4. Prepping and draping of the lymphedematous limb site in a sterile fashion.
5. 1% Lidocaine with epinephrine 1:100,000 is injected at the incision sites.
6. 0.1 ml of isosulfan blue dye is injected 1–2 cm distal to each incision.
7. 2- to 3-cm incisions are made according to marked areas.
8. Subdermal microdissection (using surgical microscope at 25–50 magnification).

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9. Lymphatic vessel and an adjacent venule are dissected and prepared for microanastomosis within the same incision.
10. Lymphovenous bypass or anastomosis is performed.
11. After completion of all the planned bypasses, wounds are closed.
12. The affected limb is wrapped loosely with compression bandages.

Postoperative Care

1. Limb wrapping loosely with compression bandages.
2. Limb elevation over one pillow.
3. Pain control.
4. Antibiotic given for 24 h.
5. Patient is discharged within 24 h.
6. Compression therapy is encouraged after 1 week from surgery.

Operative Dictation

Diagnosis:

1. Primary or secondary lymphedema of:
   (a) Campisi early stages (IB, II, early III)
   (b) MD Anderson Cancer Center lymphedema stages 1, 2, and 3

Procedure: Lymphovenous bypass

Indications

This is an X-year-old Male/female presenting with extremity lymphedema (primary or secondary) with failed conservative treatment (physical therapy) for 6 months. Benefits and risks of lymphovenous bypass (LVB) versus vascularized lymph node transfer are discussed with the patient in details. Patient is a good candidate for LVB. The patient understands his/her options and wishes to proceed.

Description of the Procedure

After obtaining an informed consent, the patient was taken to the operating room. He/she was placed in supine position. A proper time-out was performed. General anesthesia was instituted. Perioperative antibiotics were administered.

Indocyanine green lymphangiography was first performed by intradermal injection of 0.01–0.02 ml of indocyanine green dye into each web space between the toes of the lymphedematous limb. Immediately after injection, photodynamic eye (PDE) machine was used to visualize fluorescent images of lymphatic channels' pathways. They were marked immediately on the skin using a marking pen. Those skin markings dictated our planned sites for the incisions where the lymphovenous bypass (LVB) was performed.

The entire procedure was performed under the surgical microscope at 25–50× magnification. A 2- to 3-cm incision was made at the preoperative marking. Subdermal dissection was performed to identify a patent lymphatic vessel that appeared blue with the isosulfan blue dye (or sometimes it can be colorless if no dye is taken up.) Once identified, if viable, patent, nonfibrotic, and of adequate size, the lymphatic vessel was dissected and prepared for supermicroanastomoses. Attention was directed to an area surrounding the dissected lymphatic channel. A search for a venule of a size that was close to that of the lymphatic vessel (even a larger venule would be adequate as well) took place. The venule was dissected as well in a similar fashion to the lymphatic channel and prepared for anastomoses.

Superfine microsurgical instruments were used for dissection and for performing the bypasses. Super-microanastomoses were performed in an end-to-end fashion (even an end-to-side or a parachuting technique where the lymphatic channel telescoped into the venule was used whenever a significant size mismatch was encountered.) Bypasses were performed using 11-0 or 12-0 nylon sutures on a 50-μm needle.

Careful hemostasis was achieved. The wound was irrigated. Patency of the bypass was tested by observing the blue dye going from lymphatic across the lumen into the vein. The skin was closed in layers with 5-0 Monocryl followed by subcuticular nylon suture.

Attention was directed to other planned bypasses and a similar procedure was performed. Bypasses were performed as many as open healthy lymphatic channels were available.

Steri-Strips were placed. The leg was loosely wrapped with compression elastic bandage.

Patient tolerated the procedure well and was transferred to PACU in stable conditions.

Postoperative Home Instructions

1. The operated leg was elevated over one pillow for 2 weeks after surgery.
2. Pain control.
3. Discharged home within 24 h.
4. Patient was encouraged to resume previous compression therapy.

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Free Vascularized Lymph Node Transfer

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Amir Ibrahim and Edward I. Chang

Indications

1. Primary lymphedema, any stage
2. Secondary lymphedema, any stage

Possible Complications

1. Donor area lymphedema
2. Microvascular thrombosis
3. Infection

Essential Steps

Preoperative Markings

1. Donor lymph node skin paddle (any location) is outlined.
2. Recipient inset location is defined (proximal or distal) and outlined.

Intraoperative Details

1. Patient is placed in the supine position under general anesthesia.
2. Prepping and draping of donor lymph node area and recipient site in a sterile fashion.
3. Recipient site preparation:
   (a) Incision and release of scar tissue is done.
   (b) Dissection and preparation of recipient vessels is performed; artery and vein are rendered ready for microvascular anastomoses.
4. Lymph node flap harvest with a skin paddle for monitoring and preparation of donor vessels for microvascular anastomoses.
5. Free lymph node flap transfer to the recipient area and microvascular anastomoses.
6. Closure of surgical wounds.

Postoperative Care

1. Lymph node flap monitoring (color, capillary refill, and Doppler signal) every 1 h for the first 48 h followed by a check every 2 h for the consecutive 48 h and then a check every 4 h until discharge
2. General regular patient postoperative monitoring
3. Limb elevation
4. Pain control

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Operative Dictation

Diagnosis:

1. Primary lymphedema, any stage.
2. Secondary lymphedema, any stage.

Procedure: Free vascularized lymph node transfer

Indications

This is an X-year-old male/female presenting with extremity lymphedema (any stage) with failed conservative treatment. Options for lympho-venous bypass are discussed and they are not indicated or not doable. Patient is a good candidate for a vascularized lymph node (VLN) tissue autotransplantation. The risks and benefits of this procedure are discussed in great detail with the patient who understands and wishes to proceed.

Description of the Procedure

After obtaining an informed consent, the patient was taken to the operating room. He was placed in supine position. A proper time-out was performed. General anesthesia was instituted. Perioperative antibiotics were administered. Sequential compression devices were placed. Pressure points were padded. The patient was prepped and draped in the sterile surgical usual fashion.

Attention was directed to the planned recipient area for the VLN flap. A new incision or previous incision was reopened. Scar tissue was released throughout the deep planes. After adequate release of scar tissue, attention was directed to expose any adequate recipient vessels that could be used for microvascular anastomoses. Careful hemostasis was achieved and donor vessels are prepared and rendered ready for microvascular anastomoses.

Harvesting of Free Vascularized Groin Lymph Node Flap

Attention was directed to the groin. The anterior superior iliac spine and the pubic tubercle were palpated and a line was drawn between the two landmarks. A point located one third medially and 2–3 cm below this line was marked to target the lymph nodes to harvest. A Doppler was used to mark the superficial circumflex iliac artery (SCIA) and its perforator(s). A reverse lymphatic mapping was done by injecting radiolabeled technetium isotope as well as Lymphazurin in the web spaces of the foot of the ipsilateral chosen donor groin. Small amount of indocyanine green (ICG) was injected into the lower abdomen. Lymph nodes identified by ICG lymphangiography were consistent with those draining the lower abdomen correlating with the SCIA-based nodes. Gamma probe was used to mark the lower extremity sentinel lymph node and therefore to avoid during harvest.

A flap similar to a SCIP-type (superficial circumflex iliac perforator) flap was elevated with the flap axis being parallel to and just below (2 cm) the inguinal crease and the medial-most tip of the flap overlying the femoral vessels. The flap length was usually 10–12 cm with a width of approximately 5–6 cm. The superior incision was made first; skin flaps were elevated in the supra-Scarpa plane. The superficial circumflex iliac vein and the superficial inferior epigastric vein were both divided when identified. The most targeted lymph nodes usually lay between these vessels. Flap elevation continued lateral to medial above the sartorius fascia with the aim to identify SCIA emanating from the femoral artery and supplying the adipolymphatic flap with its skin paddle. The SCIA and SCIV were mobilized to their origin and rendered ready for free tissue transfer. During dissection, particular attention was paid to identifying any blue dye in the wounds to ensure not to harvest any lymph nodes that are primarily involved with drainage of the leg. Sometimes several channels were identified deep to the plane of dissection but are not

involved with the dissection. Similarly, ICG injection and the infrared camera were used to identify any channels or any spillage of ICG in the wound, indicating that no major lymphatic channels that were draining the leg are cut. Also, with the beta gamma counter, we ensure that several "hot" nodes deep to the plane of dissection were not involved with our flap and they are carefully preserved throughout. Next, the flap was harvested and brought into the previously prepared recipient defect, and microvascular anastomoses were completed between the lymph node flap vessels and the donor vessels.

Harvesting of Free Vascularized Supraclavicular Lymph Node Flap

A right-side harvesting was preferred to avoid injury to the main thoracic duct.

Flap design: it was located in the posterior triangle of the neck defined by anatomical landmarks that consist of the sternocleidomastoid muscle anteriorly, the trapezius muscle posteriorly, the clavicle inferiorly, and the external jugular vein that was included with the flap and used as a second outflow of the flap. A horizontal ellipse centered over the posterior border sternocleidomastoid muscle (SCM), 1.5 cm above the clavicle, was designed.

Skin incision was made first at the inferior border of the ellipse. Dissection was deepened to raise subplatysmal flaps confined within the previously marked landmarks. Careful attention was taken to identify, dissect, and preserve, with a vessel loop, the external jugular vein (EJV). Starting at the lateral border of the SCM, a deep dissection proceeded lateral to medial where the omohyoid muscle was identified, isolated, and reflected cephalad. Dissection continued deep to the muscle until the transverse cervical artery (TCA) and vein (TCV) were identified. The artery had some anatomical variability since it could arise from the thyrocervical trunk directly from the subclavian artery. A handheld Doppler was used to identify a skin perforator that was marked to facilitate postoperative monitoring.

The TCA and its accompanying TCV were dissected posterolateral where they ran toward the trapezius muscle in a plane beneath the omohyoid muscle and above the anterior scalene muscle and the brachial plexus within the fibrofatty tissue of the supraclavicular fossa. Larger lymph nodes were visible and palpable in the fibrofatty tissue overlying the TCA; therefore, separation of these two structures was avoided to minimize the risk of lymph node devascularization. Indocyanine green fluorescent dye was used to confirm the vascularity of the lymph nodes. The SCV, superficial and posterolateral to the TCA, was dissected and included with the flap. To avoid venous congestion, of major importance was the EJV that was included in the flap dissecting and ligating it proximally and distally. If identified within the fibrofatty tissue including the lymph nodes, sensory nerves were sacrificed to avoid their dissection and optimize viability of the harvested lymph nodes. [If divided, nerves can be reanastomosed after harvesting the flap.]

After completing the flap dissection, the posterior incision was performed to include an elliptical skin paddle of about 4–8-cm dimensions. Sometimes a direct skin perforator was not identified due to its small size; however, the skin paddle could still be harvested with safety without separating the skin from the underlying soft tissues. After skeletonizing the TCA, TCV and EJV were prepared for microvascular anastomoses. The flap was harvested and brought into the previously prepared recipient defect. Microvascular anastomoses were completed between the lymph node flap vessels and the donor vessels.

A 15-French suction drain was placed in the donor area, and final skin closure was performed.

Harvesting of Free Vascularized Lateral Thoracic Lymph Node Flap

The lateral thoracic lymph nodes flap was located in the lower axillary area, between the anterior and the posterior axillary lines. In between these two lines that corresponded to the pectoralis major anteriorly and the lateral edge of latissimus dorsi

muscle posteriorly, a longitudinal 5–7-cm incision was planned 2 cm lateral to the nipple areola complex. Subcutaneous tissues and fat in between these two landmarks contain functional lymph nodes. These lymph nodes were raised as a flap based on the lateral thoracic vessels or the thoracodorsal vessels. Due to the high anatomic variations of the lateral thoracic vessels, it was preferred to raise the flap based on the thoracodorsal system.

Dissection was deepened through the subcutaneous tissues toward the lateral edge of the latissimus dorsi muscle until it was identified. The thoracodorsal vessels were identified and dissected on the anterior aspect of the muscle:

- If adequate cutaneous perforator of the thoracodorsal pedicle was identified, skeletonizing the perforator was avoided and it was protected. Dissection was continued anteriorly toward the pectoralis muscle edge in a deep plane between the chest wall and the fibrofatty tissues containing the lymph nodes until reaching 2 cm from the lateral edge of the pectoralis. A skin paddle was designed and centered over the cutaneous perforator. Anterior incision was made, and the flap was then dissected off the subcutaneous layer in a superficial plane until the previous plane of dissection was encountered and the flap harvest is completed. Anteriorly, the lateral thoracic vessels and its branches might be encountered, and therefore they were protected when possible; otherwise they were ligated and divided if necessary.
- If the cutaneous perforators of the thoracodorsal pedicle were absent or aberrant, decision was then made to raise the flap based on the lateral thoracic vessels. An ellipse of the skin was centered over the area between the anterior and posterior axillary lines. Anterior incision was made, and dissection was deepened into the subcutaneous plane, superficial to the tissues containing the lymph nodes. Dissection continued anteriorly toward the lateral edge of the pectoralis muscle where the lateral thoracic pedicle lied, crossing the lymphatic chain and sending branches to irrigate the lymph nodes before reaching the subcutaneous layer. The lateral thoracic vessels were identified, dissected, and protected. If a cutaneous perforator was identified, skeletonization was avoided and the perforator was protected. Adequate skin Doppler signal was ensured. Flap raising was completed by dissecting it in a deep plane between the chest wall and the overlying fibrofatty tissues containing the lymph nodes until all planes were connected. Any small branches of the thoracodorsal system were ligated and divided. The thoracodorsal vessels were preserved.

Whether it was the thoracodorsal or the lateral thoracic pedicle, the vessels were prepared and rendered ready for free tissue transfer. After rendering the lymph node flap, ischemic, free tissue transfer and microvascular anastomoses were performed with the donor vessels at the recipient site. Adequate flow of blood across both anastomotic sites with no arterial or venous insufficiency was ensured. Adequate hemostasis at the donor and recipient sites was irrigated with copious amounts normal saline. A 10- or 15-French Blake drain was inserted each at the recipient and the donor area. The flap was inset using 4-0 Monocryl and 4-0 Vicryl Rapide.

Attention was to the donor area. The incision was closed in layers using 2-0 Vicryl, 3-0 Monocryl, and 4-0 Vicryl Rapide. Dressing was applied. Patient tolerated the procedure well and was transferred to PACU in stable conditions.

Postoperative Monitoring

1. Flap monitoring every 1 h for the first 48 h followed by flap check every 2 h for another 48 h and the flap check every 4 h until discharge
2. DVT prophylaxis 12 h after surgery if no bleeding exists

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Part IX

Migraine Surgery

Migraine Surgery, Zone 1 (Frontal), Zone 2 (Zygomaticotemporal), and Zone 5 (Auriculotemporal)

140

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Introduction

Migraine surgery targeting peripheral nerves in the head and neck is a relatively recent treatment option. It originated when Dr. Bahman Guyuron discovered marked symptomatic improvements in migraine patients undergoing endoscopic forehead and brow lift surgery. Numerous studies have demonstrated that extracranial decompression of specific trigeminal and cervical branches leads to a marked reduction in migraine headache frequency, intensity, and duration [1, 2].

Nomenclature of migraine trigger zones and their associated nerves are as follows: zone 1 (frontal, supraorbital and supratrochlear nerves), zone 2 (temporal, zygomaticotemporal nerve), zone 3 (sinonasal, involves nasoseptal deviation with turbinate contacts and concha bullosa, resulting in irritation of the sinonasal nerves and triggering of migraine symptoms), zone 4 (occipital, greater and lesser occipital nerves [often referred to as zone 6]), and zone 5 (auriculotemporal nerve) [3]. Recent identification of a fifth trigger zone, the auriculotemporal nerve, where impingement occurs by means of the superficial temporal artery and other proximal fascial compression points, leads to further technical refinements and overall greater success rates in migraine surgery.

Before migraine surgery is considered, it is crucial that migraine is accurately diagnosed. Patient must undergo a detailed history and physical examination with an established neurologist. Identifying the trigger areas based on constellation of symptoms may be sufficed in certain patients. Injection of botulinum toxin, nerve blocks, or both into specific trigger sites is confirmatory and carries a positive predictive value for success of surgical treatment [4]. Collaboration with a board-certified neurologist specializing in migraines and chronic headaches is important in identifying patients who may be candidates for surgery, as it is usually reserved for patients whose symptoms are not adequately controlled with medication or those who have significant adverse effects with the medications.

Open and endoscopic approaches to trigger release of zones 1, 2, and 5 will be discussed in this chapter.

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Indications

1. Migraines (with or without aura) refractory to medication or resulting in severe functional debility
2. Migraines (with or without aura) in a patient who desires to eliminate dependency on repeat site-specific injections with botulinum toxin or adverse effects of medications

Contraindications

1. Rebound headaches occurring as a result of narcotic treatments or overuse of abortive medications
2. Unrealistic expectations of patients regarding response rate to surgery
3. Severe depression or anxiety that is not recognized or appropriately managed by a mental health specialist

Essential Steps

Preoperative Markings (Zones 1, 2, and 5)

1. The ipsilateral supratarsal crease of the upper eyelid (zone 1 open transpalpebral approach) to access the corrugator and depressor supercilii muscles.
2. Identify and mark the supraorbital nerve (SON) and supratrochlear nerve (STN). The SON usually exits through a notch in the superior orbital rim at the level of the medial pupillary line. The STN is located approximately 9 mm medial to the SON.
3. Surface coordinates of the zygomaticotemporal nerve (ZTBTN) are 1.7 mm lateral and 6 mm cranial to the lateral canthus [5].
4. Zones 1 and 2 may be simultaneously addressed using an endoscopic approach. Five access ports in the scalp are used. Location of the hairline and forehead curvature dictates incision placement beyond the hairline. A second central scalp incision may be used for patients with a wide forehead to facilitate better visualization with the insertion of a camera or endoscopic instrumentation. The same two lateral scalp incisions at the level of the temporal fusion lines are used to access the temporal zone.
5. Zone 5 can be addressed by means of the most lateral incision during endoscopic port placement, a more proximal periauricular incision, or both 5A and 5B respectively.

Intraoperative Details

Open Technique: (Zones 1 and 5):

1. The patient is placed in the supine position.
2. General anesthesia or sedation is administered.
3. A neurosurgical Mayfield horseshoe headrest or a regular support pillow is used to support the head.
4. An incision is made along the upper eyelid crease through the orbicularis oculi muscle (OOM).
5. The plane between the OOM and the orbital septum is dissected in the cephalad direction until corrugator and depressor complex is reached.
6. The muscles are resected thoroughly to release the SON and the STN.
7. If the SON exits through a foramen as opposed to a notch, a foraminotomy is performed.
8. Excess eyelid fat is interposed between transected ends of corrugator muscles to provide cushioning for the SON and the STN and to avoid external divots.
9. A periauricular incision is made to access the auriculotemporal nerve and temporal artery. This open technique can be used simultaneously with an endoscopic approach for zones 1 and 2 endoscopic approach [6].
10. An open approach to zygomaticotemporal branch of the trigeminal nerve (ZTBTN) through the eyelid has also been described [7], but it is not commonly used and thus is not described here.

Endoscopic Technique (Zones 1, and 2, and 5)

1. The patient is positioned just as in the open technique.
2. Five total incisions are made: one midline and two laterally on either side.
3. Lateral incisions are approximately 7 and 10 cm from midline and slightly behind the anterior hairline.
4. Lateral incisions are made first and taken to the deep temporal fascia, connecting with more medial port sites.
5. Site 5A can be addressed during the placement of lateral incisions with the aid of an intraoperative Doppler to identify the temporal artery and then the auriculotemporal nerve (ATN).
6. A midline incision is taken down to the bone.
7. Subperiosteal dissection is extended to the supra and lateral orbital rims and the malar arch.
8. The deep layer and the superficial layer of deep temporal fascia are separated, and the layers superficial to the superficial temporal fascia where the temporal branch of the facial nerve resides are protected.
9. The ZTBTN is identified at a point approximately 1.7 cm lateral and 0.6 cm superior to the lateral canthus.
10. Care is taken not to injure the sentinel vein, which often lies in close proximity.
11. The ZTBTN is avulsed under direct endoscopic visualization.
12. Dissection is carried down to the zygomatic arch, and the extension of the lateral buccal fat is harvested.
13. The SON and STNs are targeted along the supraorbital rim.
14. Subperiosteal dissection transitions superficially at the level of orbital rim to expose the corrugator supercilii muscle and the intimately involved SON and STN.
15. The muscle is grasped and removed piecemeal to decompress the nerves.
16. The accompanying vessels around the SON and STN are all ligated.
17. If the SON exits via a bony foramen or notch that is narrowed by a constricting fibrous band, a transcutaneous foraminotomy may need to be performed.
18. Harvested fat is placed in the gap left by the resected muscles to avoid any external divots and cushioning.

Postoperative Care

1. It is not necessary to admit the patient unless They have issues with nausea and pain control.
2. The patient should avoid placing his or her head in a dependent position for 2–3 days after the operation.
3. Showing is allowed in 48 h.
4. A Swiss eye mask is used for cooling.
5. The drain is removed when less than 10 mL/12 h is observed (usually within 24–48 h of the operation).
6. No permanent sutures are placed, but it may be necessary to trim the edges of the absorbable sutures to decrease scalp irritation at postoperative week 2.
7. Frequent scalp massage and the use of a heavy-tipped hairbrush (e.g., Mason Pearson) are recommended for daily use to decrease the potential for hyperesthesia. (Starting 2–3 weeks post op).
8. Compounding creams containing analgesics, anesthetics, and anti-inflammatories are useful to decrease hyperesthesia and discomfort.
9. For severe scalp itching, Lyrica may be helpful. However, this and any other postoperative medications other than the acute postoperative narcotics should be used under the direction of the patient's neurologist.

Possible Complications

1. Scalp paresthesia or anesthesia (usually transient)
2. Port-site alopecia around the incision sites
3. Injury to the temporal branch of the facial nerve
4. Scalp and forehead itching and hyperesthesia
5. Injury to the eye
6. Brow asymmetry

Operative Dictation

Diagnosis: Migraine headache with frontal and temporal triggers, irritation, neuralgia, and neuritis of the SON, STN, ZTBTN, and ATN.

Procedure: Endoscopic and open frontal and temporal trigger zone release with decompression of the SON and STN and avulsion of the ZTBTN, ATN, and lysis of the accompanying vessels

Indication

This is a _____ with frontal and temporally triggered migraine headaches. Symptoms have been severe and refractory to traditional medication therapy. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position, with his or her head in a Mayfield or foam pillow headrest. Time-out among operating room staff was taken. The forehead and anterior scalp were injected with lidocaine (1%) with epinephrine (1:100,000) in non-hair-bearing areas and lidocaine (1%) with ropivacaine (0.25%, 1:200,000) in hair-bearing areas for adequate hemostasis. The solution with the lower epinephrine concentration was injected in the hair-bearing scalp. The patient was prepped and draped in standard sterile surgical fashion and the eyes were closed shut for protection using Steri-strips.

A 1-1.5 cm midline scalp incision was made behind the anterior hairline and taken down to the subperiosteal plane. Another similar incision was made 10 cm laterally on both sides and was taken down to the deep temporal fascia. Through these incisions, a freer elevator extended medially 3 cm was used to create another incision down to the deep temporal fascia or close to the junction of the deep temporal fascia to the fusion line (7 cm from midline). Endoscopic access ports were placed through these incisions. An endoscopic periosteal elevator was used to create a subperiosteal plane through the central incision. This incision was carried down to the supraorbital area and then extended laterally through the temporal fusion line to meet the plane created by means of the lateral two incisions, just superficial to and directly over the deep temporal fascia. Two ports, one for the camera and another for an endoscopic instrument, were used at all times. The dissection was kept directly over the deep layer of deep temporal fascia to avoid injury to the temporal branch of the facial nerve. The ZTBTN was encountered approximately 1.7 cm lateral to and 0.6 cm superior to the lateral canthus as it exited the deep temporal fascia through the temporalis muscle. The nerve was separated from the soft tissue before it was avulsed (traction neurectomy) with an endoscopic grasper or hemostat. The same was done on the contralateral side. The accompanying vessel was lysed using endoscopic suction electrocautery. Caudal dissection was complete when the periosteum of the zygomatic arch was identified. With the sharp end of a long elevator, an incision was made in the deep temporal fascia at its attachment to the superior border of the zygomatic arch orbital rim junctions. With the assistant pushing on the cheek, the lateral buccal fat was teased out with a grasper and harvested for later use.

Next, the glabellar region was addressed. The previously dissected subperiosteal plane was followed to the supraorbital rim. Scoring through the periosteum was not needed, as the dissection was carried out over the rim. The fascia was opened and revealed the corrugator supercilii muscle superficially. Endoscopic scissors were used to extend this fascial opening to increase the visibility of the SON nerve and the muscle. The depressor supercilii was found medial to the corrugator and the STN was identified. The muscle was grasped and then serially debulked in a piecemeal fashion. Care was taken to protect the nerve branches, and any accompanying vessels were lysed using endoscopic suction electrocautery. The SON was then followed caudal to its exit from the foramen/notch, which was being

compressed by a fibrous band. A transcutaneous incision was made over the eyebrow, and a 2-mm to 3-mm osteotome was inserted at the level of the brow. With this and under endoscopic guidance, the presence of a fibrous band was confirmed and a D-knife was used to lyse this in the case of a bony compression, a foraminotomy was performed until the nerve was no longer circumferentially bound. Even in this case of a long forehead and frontal bossing, this technique was used and open approach was not necessary. STN was decompressed similarly but partial avulsion of the deeper branches of the STN was necessary). The buccal fat was placed in the space between the nerve and periosteum. A 10-French round drain was introduced from the most lateral port and grabbed serially with an endoscopic grasper to direct it toward the opposite temple. The lateral incisions were suspended from the deep temporal fascia using 3-0 PDS sutures to prevent canthal malposition or to elevate the lateral canthus. Incisions were closed in layers with deep dermal stitches, 4-0 Monocryl sutures, and 5-0, 6-0 running locking fast gut skin sutures.

Site 5B was addressed with injection of epinephrine solution with out lidocaine. Ligation of the main trunk of the ATN in the preauricular area was chosen. A 1.5-cm incision was made 0.5 cm in front of the tragus and extended above the temporomandibular joint area with the aid of Doppler. The main trunk of the ATN was identified first, and the temporal artery was then located in the deeper plane, associated with another small nerve branch. Caution was taken to avoid injury to the facial nerve, which was deep to the dissection. The patient was not paralyzed during this dissection. All incisions were closed using 5-0 and 4-0 Monocryl sutures with running locking 6-0 fast sutures.

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Migraine Surgery, Zone 3 (Nasoseptal), Zone 4 (Greater Occipital), and Zone 6 (Lesser Occipital)

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Introduction

Migraine surgery targeting peripheral nerves in the head and neck is a relatively recent treatment option that originated when Dr. Guyuron discovered marked symptomatic improvements in migraine patients undergoing endoscopic forehead and brow lift surgery. Numerous studies have demonstrated that extracranial decompression of specific trigeminal and cervical root branches leads to a marked reduction in migraine headache frequency, intensity, and duration [1, 2].

The nomenclature of migraine trigger zones and their associated nerves is as follows: zone 1 (frontal—supraorbital and supratrochlear nerves), zone 2 (temporal—zygomaticotemporal nerve), zone 3 (sinonasal—involves nasoseptal deviation with turbinate contacts or concha bullosa, resulting in irritation of the sinonasal nerves and triggering of migraine symptoms), zone 4 (occipital—greater and lesser occipital nerves; often referred as to zone 6), and zone 5 (auriculotemporal nerve) [3]. The recent identification of a fifth trigger zone, the auriculotemporal nerve, where impingement occurs by means of the superficial temporal artery and other proximal fascial compression points, is leading to further technical refinements and overall greater success rates in migraine surgery.

Before migraine surgery is considered, it is crucial that an accurate diagnosis was confirmed and that the patient must undergo a detailed history and physical examination with an established neurologist. Identifying the trigger areas based on the constellation of symptoms may suffice in certain patients, but the injection of botulinum toxin, nerve blocks [4], or both into specific trigger sites is confirmatory and carries a positive-predictive value for the success of surgical treatment. Collaboration with a board-certified neurologist specializing in migraines and chronic headaches is important in identifying patients who may be candidates for surgery, as it is usually reserved for patients who are not adequately controlled with medication or who have significant adverse effects with the medications.

The approach to trigger release of zones 3, 4, and 6 will be discussed in this chapter.

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Indications

1. Migraines (with or without aura) refractory to medication or resulting in severe functional debility
2. Migraines (with or without aura) in a patient who desires to eliminate dependency on repeat site-specific injections with botulinum toxin or adverse effects of medications
3. Headaches with occipital or sinonasal trigger zones (such as sinus migraines, occipital neuralgia, and new daily persistent headaches) with the needs for surgical treatment described in indication #2

Contraindications

1. Rebound headaches occurring as a result of narcotic treatments or overuse of abortive medications
2. Unrealistic expectations of patients regarding response rate to surgery
3. Severe depression or anxiety that is not recognized or appropriately being treated by a mental health specialist

Essential Steps

Preoperative Markings

Zone 4 and 6

1. All markings should be made with the patient in a sitting position, with shoulders relaxed and symmetrical.
2. A 4-cm vertical incision is marked in the midline of the hair-bearing scalp in the occipital region. The caudal part of the incision should be at the level of the hair line.
3. The point of maximal tenderness of the greater occipital nerve is marked on each side of the first marking.
4. The point of maximal tenderness of the lesser occipital nerve is marked. This point is generally behind the posterior border of sternocleidomastoid muscle.
5. The topographic location of the greater occipital nerve, GON (1.5 cm lateral to the midline and 3 cm below the occipital protuberance) and lesser occipital nerve, LON (7 cm lateral and 6 cm inferior to the line connecting the external auditory canal) has been described previously in cadaver studies. However, marking the point of maximal tenderness on both the GON and LON may vary slightly from the described anatomical landmarks and it helps to identify these nerves during surgery by directing the dissection toward the markings.

Zone 3

1. Mark an L-shaped Killian incision on the left side of the mucosa of the cartilaginous septum, just posterior to the membranous portion, leaving at least 1 cm of cartilaginous strut behind.

Intra-operative Details [5, 6]

Zone 4 and 6

1. After induction with general anesthesia, the patient is placed in the prone position.
2. Soft padding is used to raise the shoulders, and the patient's neck is flexed.
3. A midline incision is made in the occipital skin, just inferior to the occipital protuberance.
4. The trapezius muscle (oblique fibers) is identified, just lateral to the midline raphe.
5. The semispinalis muscle (vertical fibers) is identified, just deep to the trapezius muscle and fascia.
6. Dissection is carried out in the plane between the trapezius and semispinalis muscles.
7. The trunk of the GON is identified approximately 1.5 cm lateral to the midline and 3 cm caudal to the occipital protuberance as it emerges from the semispinalis muscle.
8. The fibers of the semispinalis capitis muscle medial and inferior to the emergence point of the GON are transected.
9. The GON is dissected, free of any muscle and fascial bands laterally.

10. The muscle that intimately contacts the nerve laterally undergoes a limited wedge-shaped excision for release.
11. Caudally based subcutaneous flaps are raised and placed under the GON and sutured to the midline raphe and deeper fascia lateral to the nerve (providing padding and restricting regeneration of transected muscle fibers).
12. A suction drain is placed.

Zone 3

1. The patient is placed in a supine position. An L-shaped Killian incision is made in the cartilaginous septum, just proximal to the membranous septum.
2. The mucoperichondrial flap is raised to expose septal cartilage.
3. Any deviated portions of the septum, vomer, and perpendicular plates of the ethmoid are resected.

In cases of combined surgery, migraine 4 should always be performed first. If the patient is in the prone position following nasal surgery with a flexed neck for migraine 4 surgery, it can compromise the venous return from the face and nose, which can lead to excessive bleeding. Thus, migraine 4 should be performed first with the patient in the prone position before turning the patient to the supine position for migraine 3 surgery.

Postoperative Care

1. It is not necessary to admit the patient unless he or she has issues with nausea or pain control.
2. The patient should avoid dependent positioning of the head for 2–3 days after the operation.
3. No permanent sutures are placed, but it may be necessary to trim the edges of the absorbable sutures to decrease scalp and neck irritation at week 2.
4. Nasal stents are removed 1 week after the procedure, and irrigation protocol with saline is started.
5. Suction drains in the occipital region are removed when the drainage drops below 10 mL/12 h.
6. Light activity is recommended, but any heavy activity, lifting, and sports should be avoided for 3 weeks.
7. The patient is encouraged to see his or her neurologist no longer than 3 weeks after the operation for proper follow-up, medication adjustment, and maintenance of mental health hygiene.
8. Frequent scalp massage and the use of a heavy-tipped hair brush (e.g., Mason Pearson) for daily use on the scalp is recommended to decrease the potential for hyperesthesia.
9. Compounding creams containing analgesics are recommended. Anesthetics and anti-inflammatory medications are useful in the occipital area to decrease hyperesthesia and discomfort.
10. For severe scalp itching, Lyrica may be helpful. However, any postoperative medications other than acute postoperative narcotics should be used under the direction of the patient's neurologist.
11. Postoperative antibiotics are recommended for nasal surgery patients for 1 week after the operation.
12. For migraine 4 surgery patients, gentle physical therapy of the neck is started 4 weeks after the operation.
13. For migraine 3 surgery a nasal drip pad is maintained for 2–3 days after the operation. If excessive nasal bleeding is noted, 0.3 mcg/kg of desmopressin is administered before invasive maneuvers.

Possible Complications

Migraine 4 and Migraine 6

1. Scalp paresthesia or anesthesia (usually transient)
2. Alopecia around the incisions
3. Scalp itching and hyperesthesia

4. Complications related to prone positioning, such as blindness and pressure soars
5. Seroma in the neck region
6. Shifting of the trigger areas, with worsening of the overall migraines
7. Injury to the spinal accessory nerve during lesser occipital dissection

Migraine 3

1. Postsurgical nasal bleeding
2. Intranasal infections
3. Cerebrospinal fluid leak
4. Dry nose and empty nose syndrome

Operative Dictation

Diagnosis: Migraine headache with occipital and nasoseptal trigger sites
Procedure: Release of occipital and nasoseptal trigger zones with decompression of greater occipital artery and lesser occipital nerve, avulsion of the 3rd occipital nerve, lysis of the occipital vessels, transposition of the greater occipital nerve and/or adjacent tissues transfer, septoplasty, inferior turbinectomy, and middle turbinate concha bullosa reduction.

Indication

This is a _____ with occipital and nasoseptal-triggered migraine headaches. Symptoms have been severe and refractory to traditional medication therapy. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

The patient was intubated with a flexible reinforced tube and placed in a prone position. The positioning of the patient was very meticulous and took 30 minutes. The head of the bed was 180° from the anesthesia workstation, and the cushion of the headboard was removed. Three pillows were used for the legs, and two gel donuts were used for the knees. The positioning of the shoulders was significantly improved by using a Wilson frame, and his or her shoulders were raised with soft cross-taping to the back and side of the bed using 3-inch cloth tape. The neck was gently flexed until the back of the neck had minimal soft-tissue bunching. The arms were tucked with padding, and a blanket was used to "mummy-like" wrap the patient, with three towel clips to secure the top part. The breasts were placed in the middle of the Wilson frame. A special prone pillow with a mirror (ProneView® Helmet and Mirror system) was used, which provided the anesthesiologist the ability to check the eyes and airway before, during, and after the procedure. (Alternatively, for patients with a high body mass index, a transverse shoulder role was used with a foam prone pillow (GentleTouch® Prone Positioning Pillows. The latter required caution to ensure that the jugular vessels were not compressed during neck flexion.)

Limited clipping of the hair was done up to the cephalic part of the occipital protuberance, and gel was used to tuck the rest of the hair back.

Lidocaine was infiltrated into the incision area and the occipital region of the GON, but not the LON. The patient was kept paralyzed until the time of the LON was dissected, at which time paralysis was reversed. During the LON dissection, a nerve stimulator was employed to avoid inadvertent injury to the spinal accessory nerve.

The incision was made in the midline occipital area and continued down to the midline raphe. Dissection was carried out to the right of midline, and an incision was made on the trapezius fascia. The transverse fibers of the trapezius were divided and deeper fascia was opened using electrocautery. The vertical fibers of the semispinalis capitis muscle were identified. Dissection continued along the surface of the semispinalis capitis and immediately under the trapezius fascia, from medial to lateral. The dissection was directed to the area of the preoperative marking for the GON. Muscle fibers of the semispinalis capitis were dissected, and a block of the muscle was transected medial to the GON using electrocautery until the nerve was completely uncovered

medially. Dissection of any fascial bands caudal to the nerve was performed until the fascia most proximal to the spine was released. Finger dissection was done to ensure maximum proximal compression. After proximal and medial decompression, a block of the 1 × 1 cm of trapezius fascia was freed over the nerve and excised. Obwegeser retractors were used at this point, with the aid of the assistant on the opposite side of the table to free up the GON nerve distally using electrocautery to cut the trapezius fascia. Tension-counter tension with sharp Schnidt Tonsil Hemostat Forceps and gradual upgrading of the Obwegeser as the dissection got deeper was important to avoid inadvertent injury to the nerve or underlying vessels. As soon as the distal part the trapezium fascia was opened, the sharp end of the tonsil was used as a guide to make a counter incision above the ear for the modified extended method. A 3-cm incision was made above the ear, following the path of the GON nerve, with careful dissection using sharp mosquito. The complex intertwining of the vessel and the branching of the nerve was identified in this area. (Occasionally, the dissection was carried out closer to the ear to identify the LON as well.) The nerve was freed at the most distal edge of the counter incision using electrocautery. A 30° endoscope was then inserted from the proximal incision to identify the areas of dynamic compression of the vessel on the nerve, and a radical excision of the nerve was done from the proximal and distal counter incision using scissors and cautery. It was important to completely ligate or remove all the vessels, as the back flow of the blood in these vessels was very strong. Once the nerve was completely free, the same steps were performed on the opposite side.

Caudally based subcutaneous flaps (adjacent tissue transfer) and approximately 3 × 5 cm in dimension were raised on each side, passed under the GON, and sutured to the midline raphe to prevent any muscle or fibrous reconstitution around the nerve. It was important to avoid injury to the hair follicles during this dissection.

The third occipital nerve was also avulsed during this dissection.

A 10 French Blake drain was placed and passed under an opening created using cautery under the midline raphe to adequately drain both sides. The area was irrigated, and the exposed areas of the nerve prone to future scarring and compression were padded with an AxoGuard nerve wrap. The soft tissue around the nerve in the distal counter incision was injected with Kenalog. The midline incision was closed with several 3-0 Monocryl sutures, catching the midline raphe to close the dead spaces. The skin was closed using a running locking 5-0 chromic suture. The distal counter incisions were closed using 3-0 interrupted subdermal sutures and running locking 4-0 chromic sutures.

At this point, we ensured that the patient was not paralyzed, and only the incision on each side of the neck was injected with a solution containing epinephrine (1:100,000) with no lidocaine to provide good hemostasis and ensure no unwanted anesthesia of the motor nerves.

The posterior border to the sternocleidomastoid muscle was identified, and the LON was located behind the muscle. The smaller branch over the muscle was avulsed, but the main trunk of the nerve was decompressed using scissors and cautery proximally and distally for 2–3 cm. Any associated vessels were cauterized or ligated with clips. It was important to avoid iatrogenic injury to the spinal accessory nerve in this area, and if unsure about the anatomy, a nerve stimulator was used. The incision was closed with 3-0 subdermal interrupted monocryl and 4-0 subcuticular running sutures. The midline incision and the lower LON incisions were covered with longitudinal Steri-Strips and Telfa Tegaderm dressings, and the counter incision was covered with Bacitracin.

After the completion of the occipital surgical procedure, the patient was turned to supine position. Time out among operating room staff was taken. The nasal septum and ipsilateral (side toward which the nasal septum was bowing/deviated) inferior turbinates were injected with a solution of 1% lidocaine with 1:200,000 epinephrine mixed with ropivacaine 0.25%. The artery was injected under nasoendoscopic view. Intranasal Afrin-soaked pledgets were placed. The nasal vibrissae were trimmed, and the patient was prepped and draped in standard sterile surgical fashion.

After 10 min of initial hemostasis, a second injection with 1% lidocaine with 1:100,000

epinephrine was administered to the septum. The middle turbinate was also injected under the endoscopic view.

Intranasal inspection revealed a leftward deviated nasal septum impinging on the left inferior and middle nasal turbinate. An L-shaped left Killian incision was made, and the mucoperichondrium was lifted off the cartilaginous septum. An incision was then made in the cartilage, and the opposite mucoperichondrium was elevated. The deviated portion of the cartilaginous septum was resected, taking care to maintain a sufficient L-strut for nasal support. (The vomer plate and perpendicular plate of the ethmoid were removed as needed.) The mucoperichondrial flaps were repaired with a 5-0 chromic suture and running quilting sutures. Alternatively, a limited incision was made in the mucoperichondrium and only the deviated part of the septum was removed, with an intentional perforation in the opposite but not mirror side of the left mucoperichondrium incision to facilitate the drainage of the intraseptal blood.

The left inferior and middle and right superior turbinates were infiltrated again with a solution of 1 % lidocaine and 1:100,000 epinephrine, with the use of endoscope if needed. First, an inferior turbinectomy was performed using turbinate scissors or turbinate reduction using an Endoshaver. Partial infracture was performed, followed by cauterization of the raw edge for hemostasis. The middle turbinate was approached by elevating the mucoperichondrium off the protruding portion of the turbinate and excising it. The remaining raw surface was cauterized for hemostasis. Superior turbinate was addressed by using Endoshaver and microdebrider and out fracture technique using narrow endonasal instruments. Caution was taken not to injure the perpendicular plate of the ethmoid. Seprafilm® was placed between the middle turbinate and septum. Doyle stents were placed in both nostrils for septal stability and fixed to the septum with 3-0 Prolene sutures. (In the case of limited endoscopic septoplasty, no sutures or stents were used to allow adequate drainage from the septum.)

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Part X

Transgender Surgery

Metoidioplasty

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Miroslav L. Djordjevic and Borko Stojanovic

Indications

1. Female-to-male transgender with appropriate psychological/psychiatric evaluation and hormonal treatment
2. Fulfilled standards of care criteria of the World Professional Association for Transsexual Health

Possible Complications

1. Minor (nonoperative management): postoperative hematomas, wound infections, partial skin necrosis, urinary retention, urinary tract infections, and complications related to urethroplasty (dribbling, spraying, fistulas, and strictures)
2. Major (operative management): urethral fistulas, urethral strictures, testicular implant dislocation, or rejection

Essential Steps

Intraoperative Details

1. General anesthesia
2. Gynecological position
3. Clipping off the hair
4. Suprapubic urinary drainage
5. Removal of the vagina (colpocleisis)
6. De-attachment of both fundiform and suspensory clitoral ligaments
7. Urethral plate division for complete lengthening and straightening of the clitoris
8. Buccal mucosa graft harvesting
9. Labia minora and/or clitoral skin flap dissection
10. Urethral lengthening by combined buccal mucosa graft and genital flaps
11. Scrotoplasty with silicone testicular implants
12. Neophallus skin reconstruction
13. Compressive dressing

Postoperative Care

1. Intravenous broad-spectrum antibiotics and painkillers
2. Frequent moisturizing of the buccal mucosa graft with saline during the first 48 h
3. Dressing control every 2–3 days
4. Discharge with proper oral antibiotic therapy

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5. Dressing removal 10–14 days postoperatively
6. Urethral stent and suprapubic tube removal 10 days and 3 weeks after surgery, respectively
7. Vacuum device usage for a 6-month period, starting 4 weeks after surgery

Operative Dictation

Diagnosis: Gender incongruence (female-to-male transgenderism)
Procedure: Metoidioplasty, urethral reconstruction, scrotoplasty, and vaginectomy

Indication

This genital reconstruction is a final step in female-to-male transition. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and general anesthesia was instituted. Patient was placed in lithotomy position, prepped, and draped in standard sterile surgical fashion.

Foley urinary catheter was introduced and suprapubic tube was placed into the bladder for urine drainage. Traction suture was placed through the glans clitoris. Vaginectomy was performed by colpocleisis using thermocautery, and a small part of anterior wall near urethral meatus is preserved to be used as a flap for the upcoming urethral reconstruction. Vaginal space was closed by anterior-to-posterior approximation using 1 Vicryl interrupted sutures.

Circular incision was made at the border between the inner and outer layer of the clitoral prepuce and carried out around the urethral plate and native urethral meatus. Clitoral degloving was performed to expose clitoral body and dorsal fundiform and suspensory ligaments. Clitoral ligaments were then de-attached from the pubic bone by thermocautery to advance and lengthen the clitoris. Ventrally, the short urethral plate was dissected from the clitoral body, including the bulbar part around the native meatus to enable its good mobility for urethral reconstruction. Care was taken to prevent possible injury of the spongiosal tissue around the urethral plate and extreme bleeding. Since the urethral plate was short, causing ventral curvature of the clitoris, it was divided at the level of glanular corona to achieve complete straightening and lengthening of the clitoris.

Reconstruction of the urethra was started with reconstruction of its bulbar part. A well-vascularized periurethral flap was harvested from the anterior vaginal wall, with the base close to the urethral meatus, and joined with the proximal part of the divided urethral plate with interrupted sutures, forming the bulbar part of the neourethra. Further urethral lengthening was done by combined buccal mucosa graft and vascularized genital flaps (labia minora skin flap or clitoral skin flap).

Buccal mucosa graft was harvested from the left inner cheek. The endotracheal tube was taped to the contralateral side from the graft harvest. The inner mouth was washed with hydrogen peroxide-soaked gauze. The tongue was moved medially with packed gauze. Ellipse-shaped graft of appropriate size was marked, keeping the margin away from Stenson's duct and at least 1 cm away from the vermillion border. Size of the graft depends on the distance between the tip of the glans and native urethral meatus. Graft area was infiltrated with epinephrine 1:100,000 solution to prevent excessive bleeding. Graft was harvested superficially to the buccinator muscle and defated with scissors while it was stretched over the index finger. After proper hemostasis was carried out, harvest site was closed with 3-0 Vicryl running suture. The outer cheek was covered with ice pack.

The graft was fixed to the ends of divided urethral plate to cover the gap and additionally quilted to the corporeal bodies for better survival of the graft, with 5-0 Monocryl interrupted sutures. This way, the dorsal urethral plate was created. The blood supply of the labia minora was very rich, enabling creation of a good vascularized skin flap.

This was fashioned to create the ventral part of the neourethra. Its dissection started from the vaginal vestibule and moved upward to the clitoral glans. The lateral margin of the flap was designed along the border between the inner and outer labial surface. The flap was harvested by de-epithelialization of the outer labial skin to preserve excellent vascularization of the flap. The pedicle of the flap was additionally mobilized and lengthened from the subcutaneous tissue of the labia majora to enable suturing with buccal mucosa graft without tension. The margins of labia minora flap were finally joined to the margins of buccal mucosa graft by two lateral 5-0 Monocryl running sutures. Neourethra was additionally covered with one layer of well-vascularized genital tissue to prevent superposition of the suture lines and formation of urethral fistula.

The glans was then opened in the midline by two vertical parallel incisions, and both glans wings were dissected extensively to enable glans approximation without tension and advancement of the neourethra to the tip of the glans with creation of new meatus. A perforated 14 French silicone tube was placed into the new urethra, as a small-caliber stent fixed to the glans with simple suture, to be used for buccal mucosa moisturizing and to maintain lumen of the neourethra. Available clitoral and labia minora skin were used to cover the shaft of the neophallus.

Both labia majora were joined in the midline to create the scrotum. Incision was made at the top of each labia majora and subcutaneous pockets were created for testicular prosthesis. Appropriate size silicone testicular implants were inserted and irrigated with antibiotic solution, and the pockets were closed in two layers, finalizing the scrotoplasty. The skin was closed with 4-0 Monocryl. Drain was inserted in perineal region.

Self-adhering wrap was placed around the neophallus, and compressive dressing was applied on the scrotal and perineal region.

The patient was returned into the supine position, extubated, and taken to the postoperative recovery room in good condition.

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Total Phalloplasty with Latissimus Dorsi Musculocutaneous Flap in Female-to-Male Transgender

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Indications

1. Female-to-male transgenders with appropriate psychological/psychiatric evaluation and hormonal treatment
2. Penile agenesis and micropenis
3. Disorders of sexual development
4. Severe genital trauma
5. Failed epispadias or hypospadias repair
6. Oncologic resection reconstruction

Possible Complications

1. Minor (nonoperative management): postoperative hematomas and seromas, wound infections, partial skin necrosis, urinary retention, urinary tract infections, complications related to urethroplasty (dribbling, spraying, fistulas, and strictures)
2. Major (operative management): complete or partial flap necrosis, wound dehiscence, urethral fistulas, urethral strictures, testicular implants dislocation or rejection, penile prosthesis protrusion or rejection

Essential Steps

Preoperative Management

1. Mark the pedicle for the harvest of latissimus dorsi flap
2. Map out an appropriate size myocutaneous flap with 3D construct in mind intraoperative details

Intraoperative Details

First Stage

Part One:

1. General anesthesia
2. Gynecological position
3. Foley catheter
4. Suprapubic urinary drainage
5. Removal of the vagina (colpocleisis)
6. Lengthening of the clitoris—detachment of dorsal clitoral ligaments
7. Urethral lengthening using urethral plate and various genital flaps: anterior vaginal flap,

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both labia minora skin flaps and clitoral skin flap on a well-vascularized pedicle
8. Scrotoplasty with silicone testicular implants
9. Mons pubis recipient area creation and recipient vessel dissection (femoral artery, saphenous vein, and ilioinguinal nerve)
10. Creation of a tunnel between the recipient site and recipient vessels to receive the pedicle

Part Two:
11. Lateral decubitus position
12. Nondominant side musculocutaneous latissimus dorsi (MLD) flap design—11–15 cm wide and 13–18 cm long
13. MLD flap harvesting on neurovascular pedicle (thoracodorsal artery, vein, and nerve)
14. MLD flap tubularization and detachment of the pedicle from the axillary region
15. Donor site closure

Part Three:
16. Supine position
17. Microsurgical vascular anastomosis between flap blood vessels and recipient vessels
18. Neophallus fixation in a midline position
19. Clitoral glans positioning under the base of the neophallus
20. Neourethra fixation, neomeatus positioned in the first half of neophallus

Second Stage
1. General anesthesia
2. Supine position
3. Infrapubic or penoscrotal approach for insertion of penile prostheses
4. Hegar dilators used to create the space for penile prosthesis implantation
5. Semirigid or inflatable penile prosthesis insertion into the neophallus
6. Prosthesis fixation to the periosteum of the inferior pubic rami
7. Glans reconstruction
8. Buccal mucosa graft harvesting
9. Fixation of the buccal mucosa graft at the ventral side of the neophallus, as the new urethral plate

Third Stage
1. General anesthesia
2. Supine position
3. Foley catheter
4. Suprapubic tube
5. Urethral plate mobilization and tubularization
6. Compressive dressing

Postoperative Care

First Stage
1. Anticoagulant therapy, intravenous broad-spectrum antibiotics, and painkillers.
2. Elevate neophallus and recipient leg in a tension-free position with special dressing.
3. Neophallic skin color, temperature, and capillary refill, as well as leg pulses, are continuously checked.
4. Patient is allowed to stand up on the third postoperative day.
5. Dressing change every day.
6. Discharge with proper oral antibiotic therapy.
7. Urethral catheter and suprapubic tube removal 2 and 3 weeks after surgery, respectively.
8. Dilation of the neourethra every day, for 1 month.

Second Stage
1. IV broad-spectrum antibiotics and painkillers.
2. Frequent moisturizing of the buccal mucosa graft with saline during the first 48 h.
3. Elevate neophallus in a tension-free position
4. Dressing change every 2–3 days.
5. Discharge with proper oral antibiotic therapy.
6. Dressing removal 10–14 days postoperatively.
7. Keeping buccal mucosa soaked and soft with moisturizer until tubularization.

Third Stage
1. IV broad-spectrum antibiotics and painkillers
2. Dressing change every 2–3 days
3. Dressing removal 7–10 days postoperatively
4. Urethral catheter and suprapubic tube removal 3 weeks after surgery

Operative Dictation

Diagnosis:

Gender incongruence (female-to-male transgenderism)

Penile absence (total or partial, congenital or acquired)

Procedure: total phalloplasty, urethral reconstruction, scrotoplasty, colpocleisis

Indication

This staged genital reconstruction is a final step in female-to-male transition. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and general anesthesia was induced.

First Stage

Patient was placed in lithotomy position, prepped, and draped in standard sterile surgical fashion. Foley urinary catheter was introduced and suprapubic tube was placed into the bladder for urine drainage. Traction suture was placed through the glans clitoris. Vaginectomy was performed by colpocleisis, and a small part of the anterior wall near the urethral meatus was preserved to be used as a flap for the upcoming urethral reconstruction. Vaginal space was closed by anterior-to-posterior approximation using 1 Vicryl interrupted sutures.

Circular incision was made at the border between the inner and outer layer of the clitoral prepuce. Clitoral degloving was performed, and the dorsal fundiform and suspensory ligaments were then separated from the pubic bone by thermocautery to advance and lengthen the clitoris and enable its fixation in a new position at the base of the neophallus.

Reconstruction of the urethra started with reconstruction of its bulbar part. A well-vascularized periurethral flap was harvested from the anterior vaginal wall, with the base close to the urethral meatus, and joined with the proximal part of the urethral plate with interrupted sutures, forming the bulbar part of the neourethra. Both labia minora and available clitoral skin were dissected with long pedicle and used for further urethral tubularization, creating neourethra approximately 15 cm long. In this way, new urethral opening was placed as far as possible into the neophallus.

Both labia majora were joined in the midline to create the one-sac scrotum. Skin incision ("Y" shape) was made in the midline at the mons pubis region for further fixation of the neophallus. Using this approach, appropriate size silicone testicular implants were inserted. After copious irrigation of the pocket with antibiotic solution, the neoscrotal space was closed in two layers. Drain was inserted in the perineal region.

The patient was placed in the lateral decubitus position using a "beanbag," with the upper torso placed in a full lateral position at 90° and the pelvis tilted at 30°, to provide access to the groin, allowing simultaneous flap harvesting and recipient-site preparation. The groin and mons pubis regions, as recipient sites, as well as the thoracic donor area, were exposed and prepared in standard sterile surgical fashion. Flap design started with marking the anterior and superior muscle margin. The projection of the thoracodorsal artery was defined, and the flap was marked with the base positioned over its hilum and extending 5–7.5 cm on either side of the artery. The flap dimensions were created according to the adult penile size: 11–15 cm wide and 13–18 cm long. The flap consisted of two parts: a rectangular part for the neophallic shaft and a circular component for glans reconstruction. Flap harvesting started with an incision of the anterior skin margin down to the deep fascia, along the plane between the latissimus dorsi and serratus anterior muscles, using sharp and blunt dissection. The flap was divided

inferiorly and medially, cauterizing the large posterior perforators of the intercostals vessels, and then lifted to expose the neurovascular pedicle (thoracodorsal artery, vein, and nerve). The pedicle, surrounded by fatty tissue, was identified and dissected proximally up to the axillary vessels. The neurovascular hilum was 8–9 cm from the axillary artery and entered the deep surface of the muscle 1.5–3.0 cm from its anterior border. The vessels and nerve were identified as they bifurcated and ran together on the deep surface of the muscle. One main branch ran parallel to the anterior, while the other ran parallel to the superior border of the muscle. The thoracodorsal nerve was identified and isolated proximally for 3–4 cm, preserving its vascularization. The flap was elevated completely, except for the neurovascular bundle, which was not transected until the recipient vessels and nerve have been prepared for microanastomosis. The latissimus dorsi muscle was fixed to the margins of the skin at several points with interrupted absorbable sutures to prevent layer separation during further dissection. The flap was tubularized to create the neophallus while it was still perfused on its vascular pedicle. The circular terminal part was rotated back over the distal body and sutured to create a neo-glans penis.

A second surgical team simultaneously prepared the recipient sites. Inguinal incision was made, and the superficial femoral artery, saphenous vein, and the ilioinguinal nerve were identified, dissected, and mobilized. Finally, wide tunnel was created between the incisions of mons pubis and inguinal region by sharp and blunt dissection.

The previously constructed neophallus was detached from the axilla region after the thoracodorsal artery, vein, and nerve were clamped and divided at their origins, to achieve maximal pedicle length. The neophallus was transferred to the recipient area and its pedicle was transferred through previously created tunnel to recipient vessels. Microsurgical anastomoses were created between the thoracodorsal and femoral artery (end to side) and the thoracodorsal and saphenous vein (end to end) using operative loupes, with 7-0 Prolene interrupted suture. The epineurial neurorrhaphy was done between the ilioinguinal and thoracodorsal nerve. The inguinal incision was closed with skin stapler device. The neophallic base was fixed to the skin at the recipient site, using 3-0 Vicryl mattress stitches. The clitoral glans was fixed under the base of the neophallus.

Wound margins of the donor site were undermined, approximated, and closed directly, using 2-0 Vicryl mattress stitches. A drain was placed into the axilla region. A split-thickness skin graft was used for covering the donor site. An appropriate size split-thickness skin graft was harvested from the ipsilateral thigh region, using the dermatome. Donor thigh area was compressed and draped in standard fashion. Skin graft was placed to cover donor site defect, fixed with stapler device, and perforated. Donor and recipient areas were covered with sterile dressing in standard fashion, with compression applied only to the donor thigh area.

The patient was returned into the supine position, extubated, and taken to the postoperative recovery room in good condition. Special dressing was used to keep neophallus in an elevated position and to prevent pedicle kinking. A small pillow was placed under the knee to keep it in a partially flexed, tension-free position.

Second and Third Stages

Patient was placed in supine position, prepped, and draped in standard sterile surgical fashion. The infrapubic and/or the penoscrotal approaches were used for penile prosthesis implantation into the neophallus. In case of infrapubic approach, a longitudinal or transverse incision was made below the pubis, just above the base of the neophallus. Otherwise, a vertical or a transverse incision was made ventrally at the penoscrotal junction, and all layers were opened longitudinally allowing good visualization of all structures, especially the urethra. Hegar dilators were then used to create the space for insertion of the semirigid or inflatable prosthesis. After implantation, the prosthesis was covered with vascular grafts imitating tunica albuginea to prevent protrusion through the glans. The prosthesis was additionally fixed to the periosteum of the inferior pubic rami. The

pump of the inflatable prosthesis was inserted into the scrotum using a small incision above the scrotum. The incisions were closed with absorbable sutures.

Buccal mucosa graft was used for neophallic urethral reconstruction. It was harvested from the inner cheek using standardized procedure. Buccal mucosa grafts (either pairs or single, depending on the required size of the neourethra) were placed on the ventral side of the neophallus to create distal urethral plate and fixed to the surface with 4-0 Vicryl interrupted U-sutures. Before tubularization, buccal mucosa grafts were treated with hydratant cream for moisturizing and softening.

The final stage of urethral reconstruction was performed when the formed urethral plate has matured enough to be supple and more easily mobilized for tubularization. Then, it was important to incise the underlying tissue that will support the neourethra and avoid ischemia at the neourethral suture line. New-formed distal urethral plate was mobilized and tubularized with absorbable running suture, over the Foley catheter. Proximally, it was anastomosed with proximal neourethra with interrupted stitches, and distally the new meatus was formed, closer to the glans as possible. Surrounding vascularized tissue was mobilized to cover and support the neourethra.

Compressive dressing was wrapped around the neophallus. The patient was extubated and taken to the postoperative recovery room in good condition.

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Rectosigmoid Vaginoplasty in Male-to-Female Transsexuals

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Indications

1. Male-to-female transgenders with appropriate psychological/psychiatric evaluation and hormonal treatment
2. Vaginal agenesis (Mayer–Rokitansky–Kuster–Hauser syndrome)
3. Disorders of sexual development
4. Failed vaginoplasty

Possible Complications

1. Postoperative ileus
2. Bowel dehiscence
3. Prolapse of neovaginal mucosa
4. Introital and neovaginal stenosis

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Essential Steps

Preoperative Management

1. Sigmoidoscopy
2. Mechanical bowel preparation with 2-L polyethylene glycol solution

Intraoperative Details

1. General anesthesia
2. Extended lithotomy position
3. Foley urinary catheter placement
4. Combined abdominoperineal approach
5. Rectosigmoid pedicled flap mobilization and division
6. Length of segment from 8 to 11 cm
7. Colorectal end-to-end anastomosis using intraluminal circular stapler device
8. Formation of perineal cavity for neovagina fixation
9. Vaginoplasty—coloperineal anastomosis without tension
10. Introitoplasty using vascularized perineal flaps
11. Clitoroplasty and labioplasty
12. Packing of the neovagina

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Postoperative Care

1. IV broad-spectrum antibiotics and painkillers
2. Intravaginal packing for 5–7 days
3. Dressing control every 2–3 days
4. Discharge from the hospital with proper oral antibiotic therapy
5. Removal of urinary catheter 7 days after surgery
6. Irrigation of the neovagina once a day for 2 weeks
7. Dilation of the neovaginal introitus every day for 1 month

Operative Dictation

Diagnosis: Gender incongruence (male-to-female transgenderism)
Procedure: Vaginoplasty, clitoroplasty, labioplasty, urethroplasty

Indication

This genital reconstruction is a final step in male-to-female transition. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and general anesthesia was induced. The patient was placed in an extended lithotomy position for a simultaneous combined abdominoperineal approach.

Through a Pfannenstiel incision, the peritoneum was opened and the sigmoid colon was identified and maximally mobilized from its lateral retroperitoneal attachment. Before making the final selection of the sigmoid colon segment, the length of the sigmoid and its mesentery was assessed to determine whether it can reach the perineum easily. (*If the lowest point of the sigmoid can be pulled down to reach the pubic symphysis*, *a tension-free rectosigmoid neovagina can be created*.) Isolated segment of the rectosigmoid of 10 cm long was selected to avoid excessive postoperative mucus production.

Rectosigmoid segment was harvested with its blood supply originating from sigmoidal arteries and/or superior hemorrhoidal vessels. It was divided distally first in order to check its mobility and determine the correct site for its proximal division. The proximal portion of the sigmoid segment was closed in two layers with absorbable sutures. The anal canal was then irrigated with saline and colorectal end-to-end anastomosis was performed with intraluminal circular stapler 29–33 mm, using the purse-string technique, followed by overstitching with polydioxanone (PDS) interrupted sutures. The mesenteric defect was closed with the neovagina and its mesentery at the left side, using absorbable suture.

Perineal cavity for vaginal replacement was created using a simultaneous approach through the abdomen and perineum. Precise dissection was performed to avoid injury to the rectum, bladder, and urethra. In female transsexuals, scarred and nonfunctional vagina was completely excised to provide adequate space to position the sigmoid loop. Isolated sigmoid pedicled flap was brought down to the perineal canal to create a tension-free coloperineal anastomosis. To prevent purse-string scarring, introital or perineal skin flaps were harvested and approximated to sigmoid vagina.

"U"-shaped incision posterior to the urethra was made and completed with two lateral vascularized introital flaps. Vascularized lateral flaps were created and completely mobilized to form the neo-introital opening as high as possible, to prevent mucosal prolapse, and to achieve good cosmetic result.

In primary male-to-female surgery, the clitoris was created from the reduced glans penis with completely preserved neurovascular bundle and positioned at the proper site. The male urethra was removed at the level of the bulbar part. Bulbar muscles were reduced and a new urethral meatus was created in a standard female anatomical position. Labia minora and labia majora were created using remaining penile and scrotal skin. Previously, both testicles were removed.

(In re-do surgery, all aspects of clitoral-vulvar complex were corrected. Remnants of neovagina after failed reconstruction were removed, except elastic and vascularized parts. New channel, between the bladder and rectum was created carefully with care to prevent injury of these organs. Flaps, created from good vascularized parts of old vagina, were used for anastomosis with bowel segment that was done deeply to prevent the prolapse of bowel mucosa and poor appearance of external genitalia.)

The patient was returned into the supine position, extubated, and taken to the postoperative recovery room in good condition.

The neovagina was packed with gauze for 5–7 days. Foley catheter was left in place for 7 days.

Suggested Reading

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Part XI

Trunk Reconstruction

Laparoscopic Omental Flap Harvest

145

Amir Ibrahim, Ramzi Alami,
and Alexander T. Nguyen

Indications

1. Large soft tissue defect in any location requiring vascularized tissue
2. Mediastinal defect with or without infection
3. Advanced and end-stage lymphedema
4. Large soft tissue free flap needed in a morbidly obese patient

Possible Complications

1. Inadvertent bleeding or pedicle injury and the need to convert to open technique
2. Inadvertent intra-abdominal visceral injury
3. Flap partial or total necrosis after inset
4. Abdominal hernia at the flap delivery site

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Essential Steps

Preoperative Markings

1. One umbilical camera port and three other operative trocar ports

Intraoperative Details

1. Patient is placed in the supine position under general anesthesia.
2. Prepping and draping of the abdomen and recipient defect in a sterile fashion.
3. Pneumoperitoneum and access using Veress needle and Optiview trocar.
4. Three additional 5 mm trocars are inserted under vision.
5. Dissection is done either by using ultrasonic energy source or monopolar cautery. Gentle traction and minimal touch technique are required throughout the harvest.
6. Colo-epiploic detachment is performed along avascular plane.
7. Transpose the entire omentum cranially to expose the entire colon.
8. All attachments between the splenic flexure on the left and hepatic flexure on the right is divided for extra mobility.
9. The lesser sac is entered and short gastric and left gastroepiploic vessels are ligated.

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Surgical hemoclips may be required to divide any large vessels for better hemostasis.
10. Section of anastomotic branches between the Barkow's arcade and gastroepiploic arcade.
11. Avoid traction injury to the spleen or thermal injury to the stomach edge.
12. The omentum is then mobilized from its gastric attachments pedicled on the right gastroepiploic artery.
13. Infraumbilical or epigastric incision is extended, approximately 3 cm for atraumatic extraction.

For Pedicled Use

14. Transposition of omentum to the recipient defect followed by inset

For Free Tissue Transfer

15. Dissect the right gastroepiploic artery.
16. Prepare the recipient soft tissue defect, divide the flap pedicle, and render the flap ischemic, ready for free tissue transfer.
17. Microsurgical anastomosis is performed.

Postoperative Care

1. Free flap: Monitoring (Doppler signal) every 1 h for the first 48 h followed by checking every 2 h for the consecutive 48 h then checking every 4 h until discharge
2. General regular patient postoperative monitoring
3. Pain control

Operative Dictation

Diagnosis:

1. Large soft tissue defect (any location) requiring vascularized tissue
2. Mediastinal defect
3. Advanced and end-stage lymphedema

Procedure: laparoscopic omental flap harvest

Indications

This is an X-year-old male/female presenting with extensive soft tissue defect requiring vascularized tissue for coverage.

Or

This is a Y-year-old male/female advanced upper/lower limb lymphedema resistant to conservative and physiologic surgical measure. As a last option, patient is a good candidate for ablative surgery and coverage with vascularized lymphoid tissue.

Description of the Procedure

After obtaining an informed consent, the patient was taken to the operating room. He was placed in supine position. A proper time out was performed. Perioperative antibiotics were given. Sequential compression devices were placed. General anesthesia was instituted. Pressure points were padded. A nasogastric tube and Foley catheter were inserted. The patient was prepped and draped in the sterile surgical usual fashion.

Attention was then turned to the abdomen that was insufflated with a Veress needle up to 14 mmHg. A 10-mm midline fascial opening was obtained and direct entry in sharp fashion was performed and without injury to deep structures. A 10mm trocar is inserted through the preiously created fascial opening. A laparoscopic camera is inserted thourhg the 100mm torcar. Insertion of additional two working 5-mm trocars lateral to the left rectus muscle and another 5-mm trocar lateral to the right rectus muscle is all placed under direct vision.

After exploration of the abdomen, the omentum was reflected cranially for better exposure. Dissection was done by using ultrasonic harmonic energy source. Gentle traction and minimal touch technique were maintained throughout the harvest. Colo-epiploic detachment was performed along the avascular plane. All attachments between the splenic flexure on the left and hepatic flex-

ure on the right were divided for extra mobility. The lesser sac was entered and short gastric and left gastroepiploic vessels were ligated. Surgical hemoclips are often needed to clip any large vessels before dividing them for better hemostasis. Section of anastomotic branches between Barkow's arcade and gastroepiploic arcade was completed. Any traction injury to the spleen or thermal injury to the stomach edge was avoided.

(Depending on the amount of mobilization needed, the omentum may be left attached to the greater curvature of the stomach. Most often, full mobilization is needed, and the omentum is released off its gastric attachments, pedicled based on the right gastroepiploic artery that is meticulously dissected.)

For Pedicled Use (Mediastinal Coverage)

An upper epigastric incision was made near the xiphoid through the mediastinal defect. The omentum was delivered from the abdominal cavity into the sternal wound without tension or torsion on the pedicle. (For deep mediastinal wound, delivery of the flap can be performed through an opening in the diaphragm or pericardium.) Flap inset was completed.

For Free Tissue Transfer

After preparing the donor vessels at the recipient defect, the right gastroepiploic pedicle was skeletonized carefully. The flap was rendered ischemic, ready for transfer. An infraumbilical incision was extended, approximately 3 cm for atraumatic extraction. The flap was extracted and transferred to the soft tissue defect and inset. Microvascular anastomosis was performed. Split-thickness skin graft was applied on a part or the whole flap for adequate monitoring.

Intra-abdominal hemostasis and irrigation were secured, and the trocar sites were closed with interrupted deep dermal suture using 4-0 Monocryl. Patient tolerated the procedure well and was transferred to PACU in stable conditions.

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Trapezius Myocutaneous Flap

146

Ian C. Hoppe and Ramazi O. Datiashvili

Indications

1. Soft tissue defects of the back, neck, and spine (based on the dorsal scapular artery)
2. Soft tissue defects of the upper aerodigestive tract (based on the superficial branch of transverse cervical artery)
3. Bony defects of the mandible and lower face (osteocutaneous flap based on the superficial branch of transverse cervical artery)

Possible Complications

1. Possible damage to spinal accessory nerve
2. Decreased strength in shoulder/arm elevation
3. Suboptimal donor site cosmesis

Essential Steps

Preoperative Markings

1. Patient should be in sitting or standing position with arms adducted.
2. Line drawn between the spinous processes of C7 and T12 and another line drawn between the acromion and spinous process of T12 to delineate extent of muscular borders of the trapezius.
3. Skin island may be designed to extend approximately 1 cm beyond border of the muscle.
4. Handheld pencil Doppler may be utilized to determine course of the artery or confirm the presence of perforators within the desired skin island. Dominant pedicle can be found superior to the rhomboid minor muscle.

Intraoperative Details

1. General anesthesia.
2. Patient placed in prone position, ensuring adequate padding of all bony prominences.
3. Skin island determined based on defect to be closed, ensuring an adequate arc of rotation.
4. Skin island incised with identification of the trapezius muscle and underlying latissimus dorsi muscle.
5. Care taken to leave the latissimus dorsi in place.
6. Recipient site connected to the skin island with vertical incision.
7. Care taken to preserve the spinal accessory nerve if upper trapezius flap is utilized.
8. Pedicle may be visualized if true island flap required.

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9. Insert flap into recipient site under minimal tension.
10. Depending on the size of the flap, donor site may be closed primarily following undermining or a skin graft may be needed.
11. Prudent to place drains at recipient and donor sites.

Postoperative Care

1. Flap monitoring should be performed clinically for approximately 5 days.
2. Pressure over recipient site and pedicle should be minimized postoperatively.
3. Monitor drain outputs and remove when indicated.

Operative Dictation (For Flap Based on Dorsal Scapular Artery)

Diagnosis: Open wound of back, complicated
Procedure: Closure of open wound of back with trapezius myocutaneous flap

Indication

This is a patient with an open wound of the back following resection of tumor. The nature of the wound necessitates coverage with vascularized tissue. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

The patient was brought to the operating room and placed in the supine position on the operating room table. Sequential compression devices were placed on bilateral lower extremities. Preoperative antibiotics were administered. Following induction of general anesthesia, the patient was placed into the prone position. All bony prominences were padded and verified by anesthesia, nursing staff, and myself. Patient was prepped and draped in the standard fashion with care to include the entire back from occiput to T12 in the surgical field. The patient then underwent extirpative surgery by the primary team. Following this, I was called back into the room to assess the defect. Due to the size, location, and exposure of vital structures, it was determined that the best method available for closure of the wound was a trapezius myocutaneous flap. The flap was patterned out over the left/right trapezius muscle.

The lateral portion of the skin island was incised first with identification of the latissimus dorsi muscle fascia. Dissection proceeded superficial to this fascia in a medial direction until the lateral border of the trapezius was encountered. The trapezius muscle was subsequently elevated with care to preserve the overlying skin paddle. The medial portion of the skin paddle and the skin bridge connecting donor and recipient sites were then incised. At this point the skin paddle and trapezius muscle were elevated distal to proximal with eventual identification and preservation of the dorsal scapular artery and vein. Lateral fibers of the trapezius muscle were divided as needed to achieve rotation into the recipient site with preservation of the vascular structures. Care was taken to preserve the superior attachments of the trapezius muscle to avoid a postoperative shoulder droop. Once adequate length was achieved with minimal tension evident upon rotation into recipient site, the dissection was stopped. The donor and recipient sites were copiously irrigated with normal saline and meticulous hemostasis was achieved. The distal portion of the trapezius skin paddle was noted to be bleeding without evidence of venous congestion. A 15-round Blake drain was placed to drain the recipient site. The flap was rotated into the recipient site and inset with 2-0 braided absorbable deep dermal sutures in an interrupted fashion. The skin was closed with 4-0 monofilament sutures in an interrupted fashion. The donor site was widely undermined medially and laterally to facilitate primary closure. A 15-round Blake drain was placed to drain the donor site. Following this the deep dermal layer was closed utilizing 2-0 braided absorbable sutures in an interrupted fashion.

The skin was closed with 4-0 monofilament sutures in an interrupted fashion. A dressing of antibiotic ointment and nonadherent gauze was placed over incisions with overlying gauze and abdominal pads. The patient was placed back into the supine position and turned over to anesthesia for extubation.

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Paraspinal Advancement Flap for Back Reconstruction

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Rebecca C. Novo and Morad Askari

Indications

1. To provide muscle coverage for midline posterior wound defects, either acute or chronic
2. Soft tissue coverage over dural repairs, or spinal hardware
3. Congenital defects of spine
4. Revision spine operation with instrumentation

Contraindications

1. Extensive damage and scarring to paraspinal muscles

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Essential Steps

Pre-operative Markings

1. Mark the posterior midline and posterior iliac crests

Intra-operative Details

1. General anesthesia
2. Patient placed in prone position
3. Skin is clipped as necessary, prepped, and draped
4. Ensure adequate debridement of any devitalized or necrotic tissue
5. Locate the paraspinal muscles by incising the thoracolumbar fascia medially.
6. If a chronic wound, the incision may need to be extended proximally and/or distally to identify normal tissue planes
7. Release the muscle from its origin on the spine. Bluntly elevate the muscle by releasing it from the transverse processes from medial to lateral to mobilize it enough on each side.
8. Mobilize the muscle medially, while preserving the lateral perforators
9. Skin and subcutaneous tissue is undermined bilaterally in a supra-fascial plane, to allow primary closure without tension

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10. Muscles are approximated medially with figure-of-eight using braided absorbable sutures
11. Skin is approximated over two round drains, with a deep dermal layer and a subcuticular layer using monofilament suture

Post-Operative Care

1. Control blood pressure, and pain
2. Drains maintained to bulb suction until output is less than 30 mL/24 h for two consecutive days
3. Patient is maintained on an air-fluidized mattress for 3 weeks
4. Incentive spirometry and breathing exercises are critical to prevent pulmonary complications

Note These Variations

A turnover flap can be performed by making the fascial incision on the lateral aspect of the erector spinae fascia, elevating the muscle groups from lateral to medial, preserving the medial perforator row, transposing the lateral edges of bilateral muscle flaps toward the midline and repairing them under minimal tension.

Possible Complications

1. Infection, bleeding, wound dehiscence or recurrence
2. Hematoma, seroma
3. Flap necrosis
4. Meningitis

Operative Dictation

Diagnosis: Lumbar open wound with exposure of spinal elements
Procedure: Paraspinal muscle advancement flap

Indication

This is a patient with a lumbar spinal wound with exposure of bone. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room. Preoperative antibiotics were administered, and sequential compression devices placed on bilateral lower extremities. General endotracheal anesthesia was induced without difficulty, and the patient was then placed in prone position. The skin was clipped of all hair, prepped and draped in the usual standard sterile fashion. Time out among operating room staff was then performed. The existing wound was completely debrided of all devitalized tissue and copious irrigation with warmed normal saline performed. The midline skin was then incised proximally and distally through the subcutaneous tissue down to the paraspinal muscle fascia, and elevated in the supra-fascial plane bilaterally to allow mobilization of this layer to the midline without tension. The paraspinal muscles were identified by incising the thoracolumbar fascia medially and elevating the underlying muscle bodies from the spine and transverse processes. Once this plane was created, the muscle group was elevated bluntly, releasing it from the transverse processes from medial to lateral 4–5 cm to obtain needed size and mobility. The lateral row perforators were preserved. This was performed bilaterally to allow muscles to be approximated medially with figure-of-eight 0-Vicryl [or 0-PDS] sutures without tension. Skin was approximated over two round drains, with an interrupted deep dermal layer and a subcuticular layer with monofilament suture. Drains were secured at the skin with 2-0

Nylon. Surgical glue was placed along incision, Biopatch and Tegaderm dressings were applied to the drain sites. All instrument, sponge, and needle counts were correct. The patient was taken to the post anesthesia recovery unit in stable condition.

Suggested Reading

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Component Separation

148

Rebecca C. Novo and Morad Askari

Indications

1. Repair of large, midline abdominal wall incisional hernias that cannot be closed primarily
2. Repair of large, midline abdominal wall hernias that have failed primary or mesh repair
3. Repair of open abdomen or defect from trauma, malignancy, or infection
4. Repair of congenital midline abdominal wall defects

Essential Steps

Pre-operative Markings

1. Mark the midline and the lateral border of bilateral rectus muscles
2. Mark bilaterally: anterior superior iliac spine, costal margin, xiphoid process, inguinal ligaments

Intra-operative Details

1. Placed in supine position
2. General anesthesia
3. Pre-operative antibiotics administered
4. Sequential compression devices placed on bilateral lower extremities
5. Indwelling Foley catheter is placed to monitor intra-abdominal pressures and effect on urine output
6. At the margin of abdominal defect, begin by dissecting in the plane between the subcutaneous fat and underlying fascia on each side. Raise skin and subcutaneous tissues off the rectus and external oblique fascia, extending to the costal margins cephalad, to the pubis caudally, and laterally to the anterior superior iliac spine. Attempt to preserve as many perforating vessels as possible particularly at the level of umbilicus.

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7. Incise the external oblique fascia 2 cm lateral to border between rectus abdominis muscle and external oblique muscle (the semilunar line). Extend this incision from the costal margin to the inguinal ligament.
8. Bluntly dissect the underlying external oblique muscle from the internal oblique fascia
9. Re-approximate the fascial edges on each side of the defect with figure of eight 0 PDS or Ethibond sutures
10. Place two round Jackson Pratt drains in the subcutaneous plane
11. Quilting sutures can be placed from the external oblique and anterior rectus fascia to Scarpa's fascial layer to potentially reduce the presence of seroma
12. Approximate the skin with deep dermal interrupted monofilament suture, and a running subcuticular suture

Post-Operative Care

1. Control blood pressure, and pain
2. Jackson Pratt drains should remain to bulb suction, and be removed after output is less than 30 mL/24 h for two consecutive days
3. Abdominal binder can be worn at surgeon's preference
4. Patient should refrain from lifting >5 lbs. for 6 weeks

Note These Variations

1. In severe cases, the rectus abdominus can be mobilized off the costal margin.
2. It is expected that by release of external oblique fascia alone, approximately 10 cm in the mid-abdomen per side, 5–6 cm in the upper third per side, and 3–5 cm per side in the lower third of the abdomen total advancement of fascial edges can be achieved to close defects. For larger defects, the posterior rectus can be incised on the lateral aspect of the rectus muscle to allow for greater medial movement.
3. Biologic or synthetic mesh can be placed as an underlay, for reinforcement, or inlay bridge for larger defects. The mesh should span from external oblique muscle on one side to the external oblique on the contralateral side. The sutures maintaining the mesh in place should pass through the full thickness of abdominal muscles and be tied above the muscle fascia.

Possible Complications

1. Recurrence
2. Seroma, hematoma, or infection
3. Skin edge ischemia or necrosis
4. Bowel injury, herniation, strangulation, adhesions

Operative Dictation

Diagnosis: Ventral hernia with associated abdominal wall defect
Procedure: Ventral hernia repair with component separation

Indication

The patient presents with a significant abdominal wall defect and associated hernia. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. After pre-operative antibiotics were administered, sequential compression devices were placed on bilateral lower extremities, and general endotracheal anesthesia was induced without difficulty. Abdominal hair was clipped. An indwelling Foley catheter was placed under sterile conditions. The abdomen and chest were prepped and draped in the stan-

dard sterile fashion. The surgical markings were reinforced including the midline, xiphoid process, costal margin, pubis, and anterior superior iliac spines bilaterally. A time-out was performed among the operating room staff.

Skin and subcutaneous tissues were incised with a scalpel in the midline. The subcutaneous tissue was then dissected from the anterior rectus sheath and laterally above the external oblique fascia. This plane was extended superiorly to the costal margin, laterally to the anterior axillary line, and inferiorly to the anterior superior iliac crest. Care was taken to preserve all perforating vessels to the skin and subcutaneous flaps. The area of defect in the abdominal wall was identified. The position of rectus muscles as well as the external oblique muscle was noted and the linea semilunaris marked with a marking pen. The edges of the anterior rectus sheath on each side of the ventral hernia were identified, and the hernia sac was carefully entered. Bowel was carefully separated from the sac, lysis of adhesion performed, and the sac was resected. External oblique fascia was incised along a line 2 cm lateral to linea semilunaris. This incision was extended to the costal margin cephalad and to the inguinal ligament caudally. This again was performed bilaterally. The external oblique muscle was then bluntly dissected free from the internal oblique muscle bilaterally. This allowed for the midline fascial edges to approximate without tension. Irrigation was performed in the wound bed. Meticulous hemostasis was performed with electrocautery. The fascia was approximated in the midline with interrupted figure of eight 0-PDS suture. The peak airway pressures were observed and deemed within normal limits, and urine output maintained throughout closure of the abdomen. Single 19 French round Jackson Pratt drains were placed bilaterally in the subcutaneous plane. Interrupted quilting sutures were placed between the external oblique fascia, and the Scarpa's fascial layer as well as the anterior rectus sheath and Scarpa's fascial layer. The drains were secured externally at the skin level with 2-0 Nylon sutures. The deep dermal layer was approximated with interrupted 3-0 Monocryl and the skin was closed with 4-0 Monocryl in a running subcuticular fashion (for clean cases only). The wound was dressed a with non-occlusive dressing. All instrument, sponge, and needle count was correct. The patient was taken to the post anesthesia care unit in stable condition.

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Tensor Fascia Lata Musculocutaneous Flap for Trochanteric Pressure Ulcer Coverage

149

Gustavo A. Rubio, Christie S. McGee, and Seth R. Thaller

Indications

1. Coverage of pressure ulcer or defects in trochanteric, ischial, gluteal, groin, perineum, and lower abdominal regions.
2. Free flap can be mobilized to cover soft tissue defects in the head and neck, abdominal wall, breast, or extremities.

Essential Steps

Pre-operative Markings

Tensor fascia lata flap can be designed in a variety of fashions depending on the location of the defect. Markings for the V-Y advancement flap with posterior rotation for trochanteric coverage are described.

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1. Draw a line from the anterior superior iliac spine (ASIS) inferiorly along the anterolateral border of the thigh for the desired length (approximately down to 10 cm above lateral condyle of the tibia). Distal extent of this line will be the apex of the V.
2. From apex of the V draw the posterior line superiorly to the level of the posterior rim of the trochanteric defect.

Intra-operative Details

1. General anesthesia.
2. Urinary catheter, DVT prophylaxis, and pre-operative intravenous antibiotics.
3. Lateral decubitus position (opposite side of defect) with appropriate pressure point padding.
4. Prepare and drape wound and flap, including gluteal region and entire ipsilateral lower extremity for possible skin harvest.
5. Excision and debridement of trochanteric wound and associated bursa. Debride bone. Obtain wound cultures and deep bone cultures. Irrigate wound with antibiotic solution. Change gown, gloves, and surgical instruments.
6. Incise skin starting at the distal apex of the flap along previous markings. Dissect through subcutaneous tissue and fascia. Suture distal skin to the fascia to prevent shearing. Elevate the flap distal to proximal along subfascial

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plane up to the vascular pedicle (branch of the lateral femoral circumflex artery).
7. Rotate flap posteriorly and superiorly to cover trochanteric defect. Place 19 Fr. Jackson-Pratt drain deep to flap. Close flap in three layers.
8. Close donor site primarily. If under tension, cover with split thickness skin graft from ipsilateral gluteal donor site.

Post-Operative Care

1. Bed rest for 2–3 weeks in air-fluidized bed.
2. Optimize nutrition and pain management.
3. Culture-directed antibiotics, if indicated.
4. Drain removal at 1–2 weeks post-operative, if <30 cc/day. Be mindful of possible biphasic drainage pattern.
5. Suture removal 3 weeks post-operative.

Possible Complications

1. Wound dehiscence
2. Wound infection
3. Seroma
4. Hematoma
5. Pressure ulcer recurrence
6. Distal margin necrosis or complete flap loss

Operative Dictation

Diagnosis: Trochanteric pressure ulcer
Procedure: Tensor fascia lata V-Y flap

Indication

This is a _____ with a history of right/left trochanteric pressure ulcer requiring soft tissue coverage. Risks, benefits, alternatives, and possible complications have been explained to the patient. He/she expresses understanding and wishes to proceed with surgery.

Description of the Procedure

Patient was examined in the pre-operative area. Operative site was marked. Informed consent was verified. Patient was then taken to the operating room in satisfactory condition. Sequential compression devices were placed. General endotracheal anesthesia was induced. Urinary catheter was placed. Patient was transferred onto the operating table and placed in the right/left lateral decubitus position with adequate pressure point padding. Pre-operative intravenous antibiotics were administered. Surgical sites were aseptically prepped and draped in standard fashion. A final time-out was performed identifying the patient, procedure, site, and position.

Skin was outlined with sterile marker over the proposed flap site. Methylene blue was applied to the ulcer to stain the entire wound and associated bursa to facilitate excision. Next, the trochanteric wound was completely excised using a combination of sharp dissection and electrocautery. Wound cultures were sent. A deep bone biopsy was obtained. They were sent for histopathology. Bone edges of the greater trochanteric prominence were removed with a rasp and edges smoothed with a file. After hemostasis was ensured, the wound bed was copiously irrigated with sterile saline and antibiotic solution. At this point, the surgical team changed gowns, gloves, and instruments.

Next, skin incision was made along the previous flap markings. It was commenced at the distal apex. Dissection was carried down through the subcutaneous tissue and fascia with electrocautery. Distal skin and fascia were secured with 4-0 Vicryl to prevent damage from shearing forces. Flap was then elevated proximally along the subfascial plane, separating it from the vastus lateralis muscle underneath. Anterior portion of the flap was dissected proximally until reaching the vascular pedicle of the branch of lateral femoral circumflex artery. Flap was subsequently advanced, rotated posteriorly and superiorly in a V-Y fashion into the trochanteric defect. Proximal end of the flap was inset to cover the

wound. Flap was anchored to the wound with 0 Vicryl over a 19-French round Jackson-Pratt drain. This was then placed deep to the flap and exited through a separate stab wound incision on the lateral thigh. After ensuring hemostasis, we completed closure of the fascial layer with 2-0 Vicryl followed by 3-0 Monocryl for the subcutaneous layer. Skin was closed primarily with 3-0 Prolene horizontal mattress sutures. (Note: If tension encountered at the V-Y advancement junction, a split thickness skin graft from the gluteal region is used to cover the donor site defect). Skin was cleaned, dried, and dressed with petrolatum gauze followed by adhesive wound dressing.

At the completion of the procedure, all instrument and needle counts were correct. Patient was transferred onto an air-fluidized mattress bed in supine position. Patient was extubated and transferred to the Post-Anesthesia Care Unit in stable condition.

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Bilateral Gluteus Maximus Myocutaneous Flap

150

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Indications

1. Coverage of large sacral pressure ulcers or defects
2. Perineal reconstruction

Essential Steps

Pre-operative Markings

1. Place patient in the prone jack-knife position
2. Draw bilateral horizontal V-shaped flaps with each flap extending from midline toward and inferior to posterior superior iliac spine. The entire vertical length of the sacral ulcer/defect should correspond with the width of the base of the V. The angle of the V should be 45–60° to decrease tension and dog-ear creation during closure.

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Intra-operative Details

1. General anesthesia.
2. Urinary catheter, DVT prophylaxis, and pre-operative intravenous antibiotics.
3. Prone jack-knife position with appropriate pressure point padding.
4. Excision and debridement of sacral wound and associated bursa. Debride bone as needed. Obtain wound cultures and deep bone cultures. Irrigate wound.
5. Incise skin and dissect down to superficial gluteus maximus muscle bilaterally along previous markings.
6. Undermine medial portion of flaps. Advance V-Y flaps to midline without tension to cover sacral defect and close midline in three layers.
7. Place 19 Fr. Jackson-Pratt drains deep to flaps.
8. Close donor sites primarily.
9. Skin closure.

Post-Operative Care

1. Pressure off-loading with air-fluidized bed.
2. Bed rest for 2–3 weeks, then progressive sitting regimen.
3. Optimize nutrition.
4. Culture-directed antibiotics, if indicated.

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5. Drain removal at 1–2 weeks post-operative, if <30 cc/day.
6. Suture removal at 3 weeks post-operative.

Possible Complications

1. Wound dehiscence
2. Wound infection
3. Seroma
4. Hematoma
5. Pressure ulcer recurrence
6. Flap loss

Operative Dictation

Diagnosis: Large sacral pressure ulcer
Procedure: Bilateral Gluteus Maximus Advancement Flap

Indication

This is a _____ with a history of a large sacral pressure ulcer requiring soft tissue coverage. The risks, benefits, alternatives, and possible complications have been explained to the patient. He/she expressed understanding and wishes to proceed with surgery.

Description of the Procedure

The patient was examined in the pre-operative area and the operative site was marked. Informed consent was verified and the patient was then taken to the operating room. Sequential compression devices were placed. General endotracheal anesthesia was induced. Urinary catheter was placed. The patient was transferred onto the operating table and placed in the prone jack-knife position with careful attention to applying adequate pressure point padding. Pre-operative intravenous antibiotics were initiated. The surgical sites were prepared and draped in standard surgical fashion. A final time-out was performed to correctly identify the patient, procedure, site, and position, with everyone involved in agreement. The skin was outlined with sterile marker over the proposed flap sites in the bilateral gluteal region. Next, attention was turned to excision of the sacral ulcer. Methylene blue was applied to the ulcer to stain the entire wound and associated bursa to facilitate a complete excision. The wound was then completely excised using a combination of sharp excision with a blade scalpel and electrocautery. The wound was sent for culture and pathologic evaluation. A deep bone biopsy was obtained and sent for culture and the bone edges were removed with a rasp. After hemostasis was achieved, the wound bed was copiously irrigated with pulse lavage. At this point, the surgical team changed gowns and gloves as well as changed instruments.

Next, skin incision was made along the previous flap markings and dissection was carried down through the subcutaneous tissue and fascia with electrocautery. The medial aspect of each flap was carefully undermined in a limited fashion with care not to disrupt the perforating vessels. The flaps were then advanced medially and secured in the midline with 0 Vicryl suture followed by 2-0 Vicryl to the superficial fascial layer. Next, two 19 French round Jackson-Pratt drains were placed under each flap and exited inferolaterally through separate stab incisions. After ensuring hemostasis, we completed the closure of the fascial layer with 2-0 Vicryl, followed by 3-0 Monocryl for the subcutaneous layer. Skin was closed with 3-0 Prolene horizontal mattress sutures. The area was cleaned, dried, and dressed with petrolatum gauze followed by adhesive wound dressing. At the completion of the procedure, all instrument and needle counts were correct. The patient was transferred onto an air-fluidized mattress bed and placed in the supine position. Anesthesia was reduced and the patient was extubated without incident and transferred to the Post-Anesthesia Care Unit in stable condition.

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Posterior Thigh Advancement Flap 151

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Indications

1. Treatment of ischial and trochanteric pressure sores
2. Perineal reconstruction

Essential Steps

Preoperative Markings

The posterior thigh flap can be designed in any of a number of patterns, depending on the defect needing reconstruction. Medially or laterally based advancement, V-Y advancement, and superiorly based rotation (in addition to pedicled island and perforator) flaps are used. Markings for medially based advancement flap are described.

1. Place patient in the prone position
2. Mark the ischial tuberosity and the greater trochanter. Mark a point vertically inferior to the ischial tuberosity and three finger breadths cephalad to the popliteal fossa. Draw a vertical line from the lateral extent of the wound (2–3 cm inferior to the greater trochanter) along the lateral posterior thigh to a point approximately three fingerbreadths cephalad to the popliteal fossa. Continue the line medially and transversely, curving it slightly to end just above the medial most point. A back-cut in the flap may be necessary which is made in the cephalad and vertical direction at the medial most aspect of the incision.

Intraoperative Details

1. Sequential compression devices are placed and IV antibiotics are initiated prior to general anesthesia. A Foley catheter is also placed.
2. Place patient in the prone position with adequate pelvic and chest pressure point padding. The operative table should be checked prior to the patient going on the table to make sure that it is functional, and a

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jackknife position may be obtained if necessary.
3. Prepare and drape wound and flap in standard fashion. Prepare the contralateral thigh for skin graft harvest and cover with a sterile towel. (The ipsilateral thigh may be used for skin graft harvest as well.)
4. Excise margin/debride/irrigate wound as indicated, followed by changing of gown, gloves, and surgical equipment. Pre-debridement and post-debridement cultures may be obtained.
5. An incision can be made from the lateral most aspect of the ischial pressure sore and extended laterally toward the greater trochanter. The incision is then extended along the lateral thigh distally. The dissection is carried through the subcutaneous tissue and underlying fascia. The flap is elevated in the subfascial plane from lateral to medial while preserving perforators from the descending branch of the inferior gluteal artery. A Doppler probe may be used to identify perforating blood vessels preoperatively and intraoperatively.
6. If there is insufficient flap tissue to fill the defect, then the dissection can be carried medially; however, there will be a compromise in vascularity and the flap will have a random pattern flap classification.
7. Rotate/advance the flap into the defect. The flap should overlap the wound and lower buttock without tension, leaving a donor-site defect inferior to the flap just cephalad to the popliteal region.
8. Mark the area of the flap that overlies the cephalad portion of the skin defect and de-epithelialize that portion of the flap.
9. If more flap tissue is needed for the surgical defect, a back-cut can be done cephalad at the inferior-medial aspect of the flap.
10. Imbricate the de-epithelialized flap into the wound with a long-lasting absorbable suture. A 19 French drain is placed deep to the flap in the surgical defect and the flap inset with deep fascial sutures using long-lasting absorbable sutures. A second dermal layer is reapproximated followed by cutis approximation with 3-0 nonabsorbable suture with everted edges.
11. A 12/1000 in. split-thickness skin graft is harvested and the graft placed at the inferior donor-site defect and secured in place with chromic suture. A bolster is placed over the graft. This inferior defect should always be skin grafted as primary closure will pull on the advancement needed from the flap for the reconstruction of the defect.

Postoperative Care

1. Air-fluidized mattress and bed rest × 3 weeks, followed by initiation of progressive sitting regimen (1/2 h BID first week and increased by 1/2 h BID every subsequent week).
2. Maintain adequate nutrition.
3. Drain may be removed at 1–2 weeks post-op.
4. Sutures may be removed at 3 weeks post-op.

Possible Complications

1. Wound dehiscence and infection
2. Recurrence of pressure sore
3. Seroma/hematoma
4. Flap loss

Operative Dictation

Diagnosis: Ischial pressure sore
Procedure: Posterior thigh flap

Indication

This is a _____ with a history of a stage ___, right/left ischial pressure sore of ____ months/years duration. The wound has been debrided and the patient presents today for coverage of the wound. The risks, benefits, alternatives, and possible complications have been explained to the patient. He/she expresses understanding of all things discussed and desires to proceed.

Description of the Procedure

The patient was examined in the preoperative area, sequential compression devices were applied, and IV antibiotics were initiated. After the informed consent was verified, the patient was taken to the operating room, and endotracheal intubation was successfully obtained. A Foley catheter was placed and the patient was then placed prone on the operating table, taking great care to ensure pressure points were appropriately padded.

The surgical sites were then prepared and draped in standard fashion following placement of a perianal suture to temporarily close off the anus. A final time out was performed. The preoperative markings were then reinforced with a sterile marker. The ischial wound was examined and cultures were obtained. The wound was then copiously irrigated following excisional surgical debridement with saline and examined for hemostasis. Bone was sent for histopathology. All parties then changed gown and gloves in addition to changing of surgical equipment.

The lateral aspect of the defect was extended laterally inferior and parallel to the gluteal fold toward the greater trochanter however 2–3 cm prior to reaching it. The incision was then carried inferiorly and then transversely just cephalad to the popliteal fossa. The incision was then carried medially and curved slightly cephalad in preparation for a possible back-cut. Dissection was carried through the subcutaneous tissue and underlying fascia. The fascia was then elevated from lateral to medial, taking great care to preserve perforating vessels which were previously identified with a Doppler probe. We then rotated the flap into the defect, noting overlap of the inferior buttock and the thigh flap. This area of overlap was then marked and de-epithelialized. The flap was examined for viability and hemostasis. Viability was assessed with abrasion of the flap edge with gauze following by brisk bleeding of the flap edge.

The de-epithelialized portion of the flap was then anchored in the wound with 0 PDS suture and imbricated under the inferior buttock. A 19-French round Jackson-Pratt drain was then placed into the surgical defect and exited through a separate incision on the lateral thigh. A second drain was placed deep to the advanced flap tissue. The flap was inset with 3-0 PDS subcutaneous sutures followed by 4-0 Prolene horizontal mattress stitches.

Following advancement of the flap, an inferior donor-site defect remained. A dermatome was then used to obtain a 12/1000 in. split-thickness skin graft from the ipsilateral thigh. The graft was placed in the donor-site defect and anchored in place with 3-0 chromic suture following meshing of the graft 1:1.5. The graft was then dressed with Xeroform gauze and bolstered with a sterile sponge. The surgical incision was dressed with gauze and tape, and the skin graft donor site was dressed with a large clear adhesive bandage.

At the completion of the procedure, all instrument and towel counts were correct. The patient was placed on an air-fluidized mattress and was extubated without difficulty. He was then transferred to the postanesthesia care unit in stable condition.

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Singapore Flap (Pudendal Thigh Fasciocutaneous Flap) for Vaginal Reconstruction

152

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Indications

1. Vaginal agenesis
2. Post-pelvic exenteration for gynecologic malignancy
3. Perineal wound closure
4. Rectovaginal fistula
5. Disorders of sexual differentiation

Essential Steps

Preoperative markings

1. Medial and lateral: Equidistant from crease of the groin and no more than 6 cm apart, maximum 15 cm.
   (a) Medial: Vertical, just lateral to the hair-bearing area of labia majora
   (b) Lateral: Vertical, on medial thigh, lateral to crease of the groin
2. Base: Transverse at level of the posterior introitus, at most 6 cm wide.
3. Superior: Tip of the flap should be in the femoral triangle

Intraoperative Details

1. Place patient in lithotomy position.
2. Catheterize the bladder.
3. Give general anesthesia.
4. The flap is marked prior to administration of local anesthetic (if used).
5. An incision is made circumferentially at the flap margins and then raised with the use of loupe magnification without injury to vascular pedicle.
6. In the case of a vaginal defect, the labia majora may be elevated off the pubic rami and perineal membrane and the flaps transposed by tunneling under the labia majora to reach the defect keeping the labia as a bipedicled flap.
7. Approximate the posterior aspect of each flap together followed by anterior aspects to create a cul-de-sac.
8. Invaginate the tip of the cul-de-sac and anchor using nonabsorbable sutures.
9. Suture the opening of the vagina to the mucocutaneous edge of the labia minora.

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10. Insert drains into the cavity containing the vagina as well as both flap donor sites.
11. Pack vaginal canal.
12. Close the donor site skin primarily and in two layers.

Postoperative Care

1. Keep patient in bed with thighs slightly abducted for 48 h postoperatively.
2. Irrigate vaginal canal daily with normal saline for 1 week.
3. Maintain patency with vaginal packing or conformer for 1 week and vaginal dilation is continued until sexual activity is resumed.
4. Keep Foley catheter in place for 1 week postoperatively.
5. Clean, dry, and dress skin incisions daily.
6. Remove drains when output is less than 30 cc daily.

Possible Complications

1. Flap loss or necrosis
2. Wound dehiscence
3. Vaginal stenosis
4. Neovaginal prolapse
5. Infection
6. Hair growth
7. Vulvar pain or dyspareunia

Operative Dictation

Diagnosis: history of radical pelvic exenteration
Procedure: vaginal reconstruction with pudendal thigh fasciocutaneous flap

Indication

This is a ___-year-old woman with a history of radical pelvic exenteration secondary to stage IIIB cervical cancer requiring reconstruction of genitalia. Vaginal reconstruction with pudendal fasciocutaneous flap has been thoroughly discussed with the patient. She understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

Following informed consent verification, the patient was taken to the operation room and transferred to the operating table. General endotracheal anesthesia was instituted and preoperative antibiotics given. Time out among operating staff was taken. The patient was placed in lithotomy position. The patient was then prepped and draped in normal sterile fashion. A Foley catheter was inserted and bladder drained. Attention was first paid to the right side. Beginning at the superior tip of the flap, the skin was incised through the subcutaneous tissue to the deep fascia using a 10-blade scalpel, including the epimysium of the adductor muscle along both sides. The tissue was dissected away from the muscle in order to identify, isolate, and preserve the vascular pedicle at the base of the flap. Hemostasis was achieved with electrocautery. Next, the flap was elevated to the posterior skin margin. The posterior skin was incised using a #10 scalpel through dermis to subcutaneous tissue approximately 1.5 cm and then undermined posteriorly in a parallel plane approximately 4 cm using electrocautery. The left flap was then elevated in the same fashion. The labia majora were then elevated off the periosteum of the pubic rami and perineal membrane. The flaps were tunneled medially under the labia majora and everted through the introitus to meet centrally. The posterior aspects of the flaps were brought together with 3-0 monocryl suture in a vertical mattress fashion. Next the anterior aspect was approximated in the same way. The tip of the cul-de-sac was invaginated and anchored to the periosteum of the sacrum with nonabsorbable suture (may also be anchored within the vaginal canal). The opening of the vagina was sutured to the mucocutaneous edge of the labia minora with

3-0 monocryl suture. Drains were inserted in the vaginal cavity as well as both donor sites. The subcutaneous tissue of the donor sites was reapproximated with a 2-0 vicryl suture in an interrupted fashion and the skin closed in a running subcuticular fashion with 4-0 monocryl suture. A vaginal conformer (or packing) was inserted into the vaginal canal. Topical estrogen cream was placed on the suture lines, and the wounds were dressed. The patient tolerated the procedure well. All counts were correct times two. The patient was taken to recovery in stable condition.

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Gracilis Wrap for Anal Incontinence 153

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Indications

1. Anal incontinence due to anal sphincter defect and pudendal neuropathy.
2. Persistent incontinence after other standard surgical treatments have failed.
3. Voluntary motor function of the gracilis muscle must be present.

Essential Steps

Preoperative Markings

1. Standard bowel prep should be used prior to surgery.
2. Mark in the supine position with thighs abducted.
3. Draw a line from the pubic tubercle to the medial femoral condyle. Draw a second line 2–3 cm posterior to the initial line. This line overlies the gracilis muscle.

Intraoperative Details

1. General anesthesia.
2. Place in lithotomy position with pressure points padded (particularly the common peroneal nerve).
3. Make a 3–4-cm incision over the musculotendinous insertion of the gracilis muscle distally.
4. A more proximal incision of 3–4 cm is made over the proximal aspect of the muscle however 10 cm distal to the pubic tubercle.
5. Circumferential dissection of the proximal and distal aspect of the muscle is performed and circumferential traction on each muscle end with the aid of a Penrose drain is performed to ensure that the same muscle is visualized in each proximal and distal incision.
6. Identify minor pedicles from the superficial femoral artery to the muscle and ligate them.
7. Retract the adductor longus medially and identify the major pedicle to the gracilis muscle.
8. The distal aspect of the muscle is transected at its insertion, and the distal aspect of the muscle is passed through the proximal incision.

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9. Make two, 2-cm anteroposterior perianal incisions and dissect to the distal rectum.
10. Create two subcutaneous tunnels connecting the two incisions.
11. Create a subcutaneous tunnel from the proximal gracilis incision to the ipsilateral perianal incision paying careful attention not to injure the vascular pedicle to the gracilis muscle.
12. Pass gracilis muscle tendon through the posterior tunnel first and wrap around the anus circumferentially so that the tendon may be anchored to the contralateral ischial tuberosity with a nonabsorbable suture or a Mitek anchor.
13. Close the donor site in two layers over a suction drain and the perianal incisions are closed in two layers.
14. A small digit should be inserted into the anus to ensure patency and tightness.

Postoperative Care

1. Drains to bulb suction
2. Bed rest × 48–72 h
3. Urinary catheter, antibiotics, and deep vein thrombosis prophylaxis

Possible Complications

1. Deep vein thrombosis
2. Hematoma/seroma
3. Partial/total flap failure
4. Wound dehiscence
5. Anal incontinence

Operative Dictation

Diagnosis: Anal incontinence
Procedure: Gracilis wrap for anal incontinence.

Indication

This is a _____ with anal incontinence who requires surgical intervention. The risks, benefits, alternatives, and possible complications have been explained to the patient. He/she expresses understanding of all things discussed and desires to proceed.

Description of the Procedure

Standard bowel prep was given prior to the procedure. The patient was examined and marked in the preoperative area, sequential compression devices were applied, and IV antibiotics were initiated. After verification of the informed consent, the patient was taken to the operating room and placed on the operating table. Endotracheal intubation was successfully obtained, the patient was repositioned into a high lithotomy position, and a Foley catheter was placed.

The pelvis, perineum, and bilateral lower extremities circumferentially to the knees were prepared and draped in standard fashion. A time out was then performed. The surgical markings were reinforced, and a 3–4-cm longitudinal incision was made over the distal third of the skin mark. Dissection was continued through the subcutaneous tissue and fascia overlying the musculotendinous portion of the gracilis. A more proximal incision of 3–4 cm was then made over the proximal aspect of the muscle approximately 10 cm distal to the pubic tubercle. Circumferential dissection of the proximal and distal aspect of the muscle was performed and circumferential traction on each muscle end with the aid of a Penrose drain was performed to confirm the identification of the gracilis muscle. The tendon was transected at its most distal aspect at the insertion.

The dissection proceeded from distal to proximal, separating the muscle from surrounding tissue. Minor pedicles from the superficial femoral artery were identified. The adductor longus muscle was identified and retracted medially. The major pedicle to the gracilis was then identified, and the distal aspect of the muscle was then passed through the proximal incision.

We then turned our attention to the anus. Two incisions of approximately 2 cm in length were made in the anterior and posterior aspects of the anus through the skin and into the subcutaneous tissues. Both incisions were connected in the subcutaneous planes so that the gracilis muscle could be wrapped around the anus in this plane.

Care was taken not to injure the rectal wall during tunnel creation.

A separate tunnel was created between the proximal gracilis incision and the ipsilateral perianal incision. A tunnel was also created from the perianal incisions toward the contralateral ischium for later anchoring of the gracilis muscle. The muscle was passed through the tunnel and wrapped around the anus from the posterior aspect toward the anterior aspect and back posteriorly followed by anchoring of the tendon to the ischial periosteum. Anchoring was performed with nonabsorbable suture on Mitek anchor device into the contralateral ischial tuberosity.

The surgical sites were copiously irrigated with normal saline and checked for hemostasis. A 19-French round drain was placed in the gracilis donor site and exited through a separate stab incision. All incisions were closed in three layers with absorbable sutures using 2-0 vicryl for fascia, 3-0 monocryl for deep dermal, and 4-0 monocryl sutures for the skin. A topical skin adhesive was applied, and 4×4 gauze and abdominal pads were placed over the incisions. The legs were then wrapped with Kerlix gauze and Ace bandages, and mesh undergarments were placed on the patient.

At the completion of the procedure, all instrument and sponge counts were correct. The patient was then awakened from anesthesia without difficulty and was transferred to the postanesthesia care unit in stable condition.

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Anteromedial Thigh Flap

154

Arij El Khatib, Peirong Yu, and Amir Ibrahim

Indications

1. Soft tissue coverage of areas up to 6×15 cm to 9.5×20 cm
2. As a complement to the anterolateral thigh flap when the anterolateral thigh flap vascular anatomy is unfavorable or when multiple skin islands are required for soft tissue reconstruction

Possible Complications

1. Absence of AMT perforator
2. Thigh contour deformity
3. Iatrogenic perforator damage
4. Flap partial or total ischemia
5. Bleeding and/or infection
6. Donor-site seroma

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Essential Steps

Preoperative Markings

1. Mark for an anterolateral thigh flap: draw a line (AP) between the anterior superior iliac spine (A) and the superolateral corner of the patella (P); the midline of the AP line is designated as point B.
2. AMT perforators are marked 3 cm medial to the AP around point B.
3. The AMT skin paddle will be designed and raised after exploration and identifying the perforators.

Intraoperative Details

1. Patient placed in supine position.
2. Under general anesthesia.
3. Lower extremity prepped and draped circumferentially.
4. Preoperative markings freshened.
5. Incision made 1.5–2 cm medial to the AP line, length of incision must span the locations of the perforators heard on Doppler signal.
6. Incision deepened into the subfascial plane.
7. Subfascial dissection performed medially over the rectus femoris muscle until the intermuscular space between the rectus femoris

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laterally and the vastus medialis/sartorius muscles medially.
8. The intermuscular space is easily entered; perforators are identified at their respective location, dissected, and preserved.
9. Fasciocutaneous flap is designed, centered, and raised over the perforators.
10. The main vascular pedicle, the rectus femoris branch of the descending branch of the lateral circumflex femoris artery, is dissected all the way to its origin.
11. For anteromedial thigh free flap, the main pedicle is divided and the flap is rendered ischemic and ready for free tissue transfer.
12. For pedicled anteromedial thigh flap, after dissecting the pedicle and rendering the flap as an island flap, it is then transposed to cover the regional defect planned to reconstruct.
13. Donor-site closure over drain.

Postoperative Care

1. Keep patient normothermic, well hydrated with normal vital signs.
2. Flap check (bleeding, congestion, color, temperature, capillary refill, and Doppler signal) every 1 h for the first 48 h, then every 2 h for another 48 h, and finally every 4 h until the day of discharge.
3. DVT prophylaxis on postoperative day one.

Operative Dictation

Diagnosis: soft tissue defect measuring Y × Z cm
Procedure: anteromedial thigh flap

Indication

This is an X-year-old patient with a Y cm soft tissue defect necessitating coverage with well-vascularized tissue. The patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in the supine position. Time-out among operating room staff was performed. The patient was placed under general anesthesia and preoperative antibiotics were given. The designated lower extremity was prepped and draped circumferentially. #15 scalpel was used to make a straight incision parallel and 1.5–2 cm medially to the preoperatively marked AP line. Skin incision was made long enough for dissection and full exposure of AMT perforators (which were marked according to preoperative measurements and Doppler signal localization).

Electrocautery was used to deepen the skin incision into the subfascial plane. The rectus femoris muscle was identified, and dissection is carried out to reach its medial border where the intermuscular space between the rectus femoris laterally and the vastus medialis/sartorius was reached. The vastus medialis and sartorius muscles were likewise identified. The intermuscular space was easily entered and the perforators were identified at their respective location, dissected down to the main pedicle from which they originate and preserved.

Once the perforating vessels have been identified through the initial skin incision, the skin paddle design was modified and centered and raised over the perforators. Flap incisions were made, deepened through the muscle fascia, and the fasciocutaneous component of the flap was raised on the previously identified perforating vessels

The main vascular pedicle, the rectus femoris branch of the descending branch of the lateral circumflex femoris artery, was dissected all the way to its origin.

(a) For anteromedial thigh free flap, the main pedicle was divided and the flap was rendered ischemic and ready for free tissue transfer to be anastomosed to recipient vessels.
(b) For pedicled anteromedial thigh flap, after dissecting the pedicle and rendering the flap as an island flap, it was then transposed

to cover the regional defect planned to reconstruct.

The donor site of the flap was irrigated and hemostasis was performed. Primary closure of the skin after wound edge undermining was performed when patient has enough skin laxity to afford wound closure without significant tension. Wound closure performed in layers over 19 French Blake drain. In case of insufficient laxity for primary closure, a split thickness skin graft was used to provide donor-site closure.

Donor site was dressed in ointment-impregnated gauze and elastic bandages.

Suggested Reading

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Double-Barrel Free Fibula Flap for Pelvic Ring Stabilization

155

Amir Ibrahim, Said Saghieh,
and Alexander T. Nguyen

Indications

Post pelvic tumor resection, the patient has an acquired internal hemipelvectomy wound with large disruption of pelvic ring continuity. If the skeletal support to achieve full weight-bearing is not restored, this will significantly affect the patient's gait with ilium collapse and residual limb discrepancy and eventually formation of an iliosacral pseudoarthrosis. In order to achieve a better functional results and improved quality of life with a near-normal gait, pelvic ring reconstruction with a free vascularized fibular bone graft is recommended.

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Possible Complications

1. Fibular flap thrombosis and ischemia
2. Bleeding
3. Infection
4. Seroma formation
5. Wound dehiscence
6. Abnormal gait, limp

Essential Steps

Preoperative Markings

1. Fibular flap marking is done with knee in the semi-flexed position.
2. Straight line is drawn between the fibular head and the later malleolus.
3. 5 cm proximal and distal are marked on the skin.

Intraoperative Details

1. Patient is placed in the "sloppy" position under general anesthesia.
2. Pelvic ring bony defect measurement after completion of the hemipelvectomy procedure.
3. Fibula flap harvest forms the ipsilateral limb in the usual fashion.

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4. Fibula is osteotomized for a double strut reconstruction.
5. The bone segment proximal to the vascular pedicle (usually longer segment) is planned in the more superficial position in the pelvis to facilitate microvascular anastomoses.
6. Bony fixation (by orthopedic team).
7. Microvascular anastomosis.
8. Internal Doppler insertion
9. Closure over suction drains.
10. Monitor vital signs and urine output throughout the whole case.

Postoperative Care

1. Elevation of operated limb
2. General regular patient post-op monitoring
3. Keep patient inpatient. Dressing changed on post-op day 5. Discharge home after if no issues.

Operative Dictation

Diagnosis:

- Pelvic tumor (most commonly sarcoma)
- Acquired pelvic ring bone defect

Procedure: Double-Barrel Free Fibula Flap for Pelvic Ring Stabilization

Indications

This is an X-year-old male/female presenting with pelvic tumor who has undergone limb saving internal type 1 hemipelvectomy by the orthopedic team. The patient has a residual large pelvic ring discontinuity that needs reconstruction for skeletal support to achieve full weight-bearing gait. Pelvic ring reconstruction with a free vascularized fibular bone graft is necessitated. Benefits and risks of the procedure are discussed with the patient or legal guardian in detail.

Description of the Procedure

After obtaining an informed consent, the patient was taken to the operating room and placed in the "sloppy" lateral position. A proper time out was performed. General anesthesia was instituted. The lower extremity, pelvis and lower flank, and abdominal area were prepped and draped in a standard sterile surgical fashion.

After starting and completing the type 1 internal hemipelvectomy by the orthopedic team, the plastic surgery team took over. The defect was measured in collaboration with the orthopedic surgeon.

Attention was directed to the ipsilateral leg. Leg marking was performed. Tourniquet was applied (based on surgeon's preference). A longitudinal incision on the lower lateral aspect of his leg according to preoperative marking was performed. Dissection was deepened to the lateral compartment and continued though the peroneal muscles (longus and brevis) that were detached from the fibular periosteum where a small cuff was left around the fibular bone. Dissection continued toward the anterior intermuscular crural septum. The septum was opened and the anterior compartment was entered. The extensor digitorum longus and the extensor hallucis longus were detached from the fibula until the interosseous membrane was identified. Distal and proximal osteotomies were performed where 5 cm were preserved proximally and distally to maintain knee and ankle stability. The interosseous membrane was incised, and the tibialis posterior muscle was divided. The peroneal vessels at the distal osteotomy site were dissected and divided. Dissection continued proximally until the tibioperoneal trunk was reached. Two bone clamps were applied at the proximal and distal edge of the fibula to aid in traction and manipulation during dissection. The flexor hallucis longus muscle was divided from the vascular pedicle. Dissection was completed posterior to the fibular bone through the posterior intermuscular crural septum where the two surgical planes were connected.

Pelvic bone defect was measured in collaboration with the orthopedic team. While in situ, the fibula was osteotomized according to measurements needed for the pelvic defect to provide two struts for reconstruction. The bony strut (usually longer one) that was proximal to the vascular pedicle was usually placed in the more superficial position in the pelvis for easier microvascular anastomoses.

Exploration of donor vessels in the recipient pelvic defect was performed. Most common vessels identified, dissected, and prepared for and end-to-end or end-to-side microsurgical anastomosis were:

- Deep inferior epigastric vessels
- Branches of the internal iliac vessels
- Branches of the external iliac vessels
- Deep circumflex iliac vessels

Both struts were then fixed by the orthopedic surgeon. An appropriate sized burr hole was created in the supra-acetabular bone where one of the strut's bone ends was inserted intramedullary and fixed with bicortical screw(s). The proximal end of this first deep strut was fixed to the sacrum. The distal end of the second (superficial) strut was usually fixated to the lip of the anterior superior iliac spine with an intramedullary screw and the proximal end fixed to the sacrum also in a similar fashion to the first strut. Depending on the orthopedic surgeon preference, other bone fixation modality can be used such as plate and screws or by using the Cotrel-Dubousset rod (C-D rod) system. C-arm X-ray was taken to ensure adequate bone fixation.

After ensuring that the pedicle was not compressed by bony fixation, microvascular anastomoses were performed by the reconstructive team. An internal Doppler was inserted and fixed around the vein or artery. After securing a patent vessel anastomosis, hemostasis and irrigation were performed. 19-French Blake drains were inserted into the defect and away from the bone flap pedicle and secured in place with a 2-0 nylon suture. Muscles and Scarpa's layer were closed with 0 and 2-0 Vicryl suture, and the deep dermal layer was closed with a 3-0 Monocryl buried suture. A 4-0 Monocryl running subcuticular stitch was used on the skin. The incision was dressed with antibiotic-based dressing. The leg was then wrapped in an elastic bandage. Flap internal Doppler arterial or venous signal was checked prior to patient transfer to PACU or ICU.

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Part XII

Robotic Surgery

Robotic Harvest of the Latissimus Dorsi Muscle for Flap Reconstruction

156

Karim A. Sarhane, Amir Ibrahim, and Jesse C. Selber

Indications

1. Breast reconstruction (used as pedicled flap)
   (a) Reconstruction of lateral defects following partial mastectomy
   (b) Implant-based reconstruction following NAC-sparing mastectomies
   (c) Secondary reconstruction in patients with expanders who received adjuvant radiotherapy (delayed-immediate protocol)
   (d) Poland syndrome
2. Scalp/head/extremity reconstruction (used as a free flap)

Essential Steps

Preoperative Markings

1. Performed with the patient in the standing position. Mark the anterior, middle, and posterior axillary lines.
2. Mark the midline of the back and the tip of the scapula.
3. Identify the borders of the latissimus dorsi muscle by palpating the muscle.
4. Mark the anterior border of the latissimus dorsi from the posterior axillary fold to the iliac crest.
5. Mark the superior border from the tendinous insertion along the tip of the scapula.
6. Mark the posterior border approximately 4 cm lateral to the spine.
7. Mark the planned vertical incision line about 5–6 cm along the midaxillary line starting from the midaxillary crease. *In case of immediate breast reconstructions, the axillary lymph node dissection incision is used.*
8. Two additional ports are marked for the robotic arms. These are placed at a mean distance of 3–5 cm from the anterior border of the muscle at the same level of the inframammary fold and umbilicus.
9. The central camera arm is placed in the inframammary fold-level port, and the ipsilateral and contralateral robotic arms are placed in the axillary incision line and umbilical-level port.

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Intraoperative Details

1. The patient is positioned in the decubitus position with the ipsilateral arm prepped.
2. Axillary incision is opened, and the first port placed at its inferior end.
3. The latissimus dorsi muscle and its thoracodorsal pedicle are identified. The pedicle is isolated and marked with a vessel loop under endoscopic vision.
4. The subcutaneous space anterior to the anterior border of the muscle is dissected.
5. The two additional ports are placed and the axillary incision is temporarily closed.
6. The robotic side cart is brought and positioned posterior to the patient with the two robotic arms and the endoscope extending over the patient in proximity to the ports.
7. The ports are docked, and insufflation is applied at 10 mmHg.
8. Robotic dissection begins along the under surface of the muscle and proceeds over its superficial surface.
9. Once dissection is completed, the muscle is released from its inferoposterior border.
10. The robot is undocked, the axillary incision is reopened, and the muscle delivered.
11. Drains are placed through the two lower port sites.

Postoperative Care

1. Monitor patient vital signs every 4 h.
2. Pain control.
3. Monitor every shift for any bulge in the back suggesting for any possible hematoma.
4. DVT prophylaxis 12 h after surgery if no bleeding exists.
5. Limb elevation if the flap is used for extremity reconstruction.
6. Keep drains under suction and empty every 4 h.
7. Wound care.

Possible Complications

1. Donor-site complications (seroma, hematoma, or overlying skin injury)
2. Temporary radial nerve palsy in the contralateral extremity (likely from positioning)
3. Transection of the thoracodorsal pedicle
4. Violation of the parietal pleura and entry into the pleural space
5. Conversion to an open technique

Operative Dictation

Diagnosis:

1. Missing partial or total breast with previous history of radiation treatment
2. Distant soft tissue defect in need for vascularized soft tissue coverage

Procedure: Robotic harvest of the latissimus dorsi muscle flap

Indications

This is a X year-old patient with a breast/scalp soft tissue defect, who needs flap coverage and desires a minimally invasive donor-site harvest approach. Patient understands the benefits, risks, and alternatives associated with the procedure and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. General anesthesia was induced. The patient was positioned in the lateral decubitus position. The ipsilateral arm was prepped and placed on a sterile Mayo stand (similar to the conventional latissimus dorsi harvest); additionally, an axillary roll was placed to avoid any contralateral brachial plexopathy. A time-out

was completed verifying correct patient, procedure, site, positioning, and special equipment prior to beginning the procedure.

[Choose one:]

a. For breast reconstruction: The sentinel lymph node incision/axillary node dissection incision was used (without the need for an additional incision).
b. For free flap reconstruction: A 5–8-cm axillary incision oriented along a line between the posterior axilla and the nipple-areolar complex was marked.

The first port was marked at the end of the axillary incision. Two additional ports were marked 8 cm from the end of the axillary incision and anterior to the muscle and 8 cm distal to the second port and anterior to the muscle. Open dissection was performed first. The axillary incision was opened and the latissimus dorsi muscle was identified. The first port was placed at the inferior end of the incision. The thoracodorsal pedicle was identified, isolated, and marked with a vessel loop under endoscopic vision. The subcutaneous space anterior to the anterior border of the muscle was then dissected using long-tip electrocautery and a lighted retractor. The deep muscular plane was dissected under direct vision as far as technically feasible. Approximately 4 cm of the superficial plane over the muscle was dissected through the axilla, releasing the anterior border of the muscle so that it was loosely suspended but not released. The two additional ports were then placed. A 1-cm incision was then made for the second port. A digit was introduced through the axillary incision to palpate the port as it entered the subcutaneous space, and a 12-mm camera port was introduced. A 5-mm incision was then made over the other port site. A zero-degree endoscope was placed in the 12-mm port, and an 8-mm port was placed at the third port site under endoscopic vision. The axillary incision was then temporarily closed using a running 4-0 Nylon around an 8- or 12-mm port to maintain insufflation. After port placement, the robotic side cart was positioned posterior to the patient with the two robotic arms and the endoscope extending over the patient in proximity to the ports. The ports were docked to the robotic arms, and insufflation was applied at 10 mmHg. The bed can be retroflexed in the middle to help open the space between the iliac crest and the lower border of the ribcage.

Robotic dissection began along the under surface of the muscle. Monopolar scissors and Cadière grasping forceps were used for the dissection. Blood vessels were clipped using a laparoscopic/robotic clip applier. After the undersurface of the muscle was dissected to the borders, the grasper was used to direct the anterior edge of the muscle toward the chest wall, and dissection proceeded over the superficial surface of the muscle. After the undersurface of the muscle was dissected to its borders, the Cadière grasper was used to pull the anterior edge of the muscle down, and dissection proceeded over the superficial surface of the muscle. Once dissection was complete along both the deep and superficial surfaces, monopolar scissors were used to release the muscle from the inferoposterior border. A 30-degree down scope was used at this juncture to "look over" the curvature of the back. As the muscle was divided, it was continually "gathered" toward the axilla to maintain an optical window at the point of dissection. The muscle was finally liberated beyond the tip of the scapula. During the whole dissection especially when it approached the axilla, the thoracodorsal pedicle was under direct visualization, always ensuring that it was not in danger.

At this stage, the robot was undocked. The axillary incision was then reopened, and the muscle was delivered. Any remaining attachments were divided posterosuperiorly. An endoscope was reintroduced to confirm adequate hemostasis. Drains were placed though the two lower port sites, positioned in the donor site, and sutured into place using 3-0 Nylon.

[If the muscle was being harvested as a free flap, the tendinous insertion and the vascular pedicle were divided after the recipient site is prepared and a microsurgical free tissue transfer is performed in the usual fashion.]

If the muscle is being transferred as a pedicled flap for breast reconstruction, the majority of the posterior insertion was divided, and the muscle was passed into the mastectomy space in preparation for a change to the supine position.

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Robotic Harvest of the Rectus Abdominus Muscle for Flap Reconstruction

157

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Indications

1. Soft tissue reconstruction of extremity and scalp defects (free flap)
2. Soft tissue coverage of anterior midline chest wall and sternal defects following oncologic resection or wound debridement (superiorly based pedicled flap)
3. Soft tissue reconstruction of abdominal wall, pelvic floor, bladder or vaginal defects following abdominopelvic resection, radical cysto-prostatectomy, and pelvic exenteration (inferiorly based pedicled flap)
4. Soft tissue coverage of major vessels or visceral repairs, such as rectal repairs following prostate surgery with rectal involvement (inferiorly based pedicled flap)

Essential Steps

Pre-operative Markings

1. The contralateral costal margin and iliac crest are marked along a line connecting the anterior axillary line and the anterior superior iliac spine.
2. Mark the midpoint between these two landmarks and 2 cm lateral to it is the desired location of the 12-mm camera port.
3. Mark on either side of the camera port, approximately three fingerbreadths away, or 1–2 cm from the costal margin and iliac crest, respectively, for the planned location of the two 8-mm instrument ports.

Intra-operative Details

1. General anesthesia is induced
2. Patient is placed in either a supine or a low lithotomy position, depending on the procedure.
3. Peritoneum is accessed using a Veress needle, and insufflation begins to attain a pneumoperitoneum between 10 and 15 mmHg.
4. The camera port is placed. The scope is inserted "free hand" and the other two ports are placed under direct vision.
5. The surgical robot is placed and docked on the ipsilateral side to the muscle being harvested.

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6. The deep inferior epigastric pedicle is identified, the peritoneum overlying it is opened sharply, and the vessels are dissected from their origin to their entrance.
7. The rectus abdominis is dissected between the anterior surface of the muscle and the anterior rectus sheath across its entirety.
8. Completion of dissection and extraction of the muscle (depending on whether the muscle is used as a pedicled flap or as a free flap).

Post-Operative Care

1. Monitor patient vital signs every 4 h.
2. Pain control.
3. DVT prophylaxis 12 h after surgery if no bleeding exists.
4. Limb elevation if the flap is used for extremity reconstruction as a free flap.
5. Keep drains under suction and empty every 4 h.
6. Wound care.

Possible Complications

1. Stage I decubitus ulcer (resulting from long multiservice cases)
2. Complications related to accessing and working in the peritoneal cavity (bowel injury, adhesions, and hernia formation).
3. Conversion to an open technique

Operative Dictation

Diagnosis: Remote or regional soft tissue defect in need for vascularized soft tissue covergae
Procedure: Robotic harvest of the rectus abdominus muscle flap

Indications

This is a XX year-old Female/Male patient with an extremity/pelvic/chest/scalp soft tissue defect, who needs flap coverage and desires a minimally invasive donor site harvest approach. Patient understands the benefits, risks, and alternatives associated with the procedure, and wishes to proceed.

Description of the Procedure

After the informed consent was verified, the patient was taken to the operating room and placed in supine position. General anesthesia was induced. The patient was placed in either a supine or a low lithotomy position with legs in Allen stirrups (depending on the procedure to be performed, free tissue transfer vs. regional pelvic reconstruction). Bilateral arms were tucked at the patient's flanks after adequate padding. If necessary (depending on the anesthesiologist's need for access), one arm can be left abducted on the contralateral side of the rectus muscle to be harvested. The abdomen was prepped and draped in the usual sterile fashion. A time-out was completed verifying correct patient, procedure, site, positioning, and special equipment prior to beginning the procedure. An Ultra Veress Needle was used to access the peritoneum and attain insufflation using standard technique and pressure parameters. Once pneumoperitoneum was achieved, the port sites were confirmed or adjusted. Once port location was determined, a #15 scalpel was used to cut the skin. The first port (12-mm port) was placed 7 cm lateral to the rectus abdominis in line with the umbilicus using a Hassan cannula technique. Carbon dioxide insufflation was then initiated and pneumoperitoneum maintained at 15 mmHg. The robotic endoscope was then inserted and held by hand to visualize placement of the remaining two 8-mm ports. The second port was placed 4 cm inferior to the costal margin and 5 cm lateral to the lateral edge of the rectus abdominis muscle. Similarly, the third port was placed 4 cm superior to the anterior superior iliac spine and 5 cm lateral to the lateral edge of the rectus abdominis muscle. The surgical robot was brought into position perpendicular to the patient on the ipsilateral side to the muscle being

harvested (opposite side from the ports) until the camera arm was flexed at 90° at the elbow. The central column of the robot was positioned at the level of the umbilicus. The camera port was then docked. Arms 1 and 2 were brought in from the sides with the elbows akimbo to not conflict with the camera arm. The two 8-mm ports were docked and instruments placed. A Cadière Grasper was used in the nondominant arm (arm 2 for right-handed people and arm 1 for left-handed people), and the monopolar cautery or Hot Shears was placed in the dominant arm. The camera was angled to visualize the instruments as they enter the peritoneal cavity, making sure internal organs were not injured.

Robotic dissection began. First, the deep inferior epigastric pedicle was identified. The peritoneum overlying the pedicle was opened sharply and the vessels were dissected from their origin at the external iliac artery and vein to their entrance into the rectus muscle. Next, posterior dissection was started by incising the posterior rectus sheath immediately lateral to the linea alba. The rectus abdominis was dissected, bluntly with minimal cautery, and in an avascular plane between the anterior surface of the muscle and the anterior rectus sheath. This dissection continued across the entire muscle until the other side of the posterior sheath was visible over the muscle. This exposed the medial edge of the muscle, which was then grasped, retracted downward, and carefully dissected off the anterior sheath along its entire length from pubis to costal margin. Neurovascular structures that enter the rectus muscle laterally from the intercostal system and the perforators from the deep inferior epigastric artery/vein were identified and controlled during the muscle dissection using laparoscopic/robotic clips and cauterization (depending on their size). The inscriptions were separated from the anterior sheath by dissecting the sheath both above and below them. Care was taken not to damage either.

After dissecting the entire width of the muscle, the posterior sheath, which becomes visible on the lateral side of the muscle, was either divided (in which case a strip remains with the muscle) or dissected off the muscle and repaired with a running barbed suture. The muscle was now bipedicled and free.

[Choose one:]

(a) Inferiorly based rectus muscle flap: The inferior epigastric vessels were gently dissected down to the external iliac vessels and freed. Using the monopolar scissors, the muscle was then divided cephalad at the costal margin, and caudad between the symphysis pubis and the entrance of the pedicle into the muscle; this completely "islandized" the muscle on the pedicle. In a controlled fashion, the muscle was then directed into the pelvis for insetting.

(b) Superiorly based rectus muscle flap: The Inferior Epigastric vessels were dissected down to their origin of the External Iliac vessels, freed, ligated with a Weck Clip (Intuitive, Surgical, Sunnyvale, CA) and divided sharply. The superior epigastric vessels were gently dissected up to internal thoracic vessels and freed. Using the monopolar scissors, the muscle was then divided cephalad at the costal margin, and caudad between the symphysis pubis and the entrance of the pedicle into the muscle; this completely "islandized" the muscle on the pedicle. In a controlled fashion, the muscle was then turned over superiorly and passed through an epigastric tunnel created between the chest defect and the muscle.

(c) Rectus muscle for free tissue transfer: The inferior epigastric vessels were gently dissected down to the external iliac vessels and freed. Using the monopolar scissors, the muscle was then divided cephalad at the costal margin, and caudad between the symphysis pubis and the entrance of the pedicle into the muscle. This completely "islandized" the muscle on the pedicle. Once islandized, a Weck Clip (Intuitive, Surgical, Sunnyvale, CA) was used to divide the pedicle at its origin. The pedicle was then sharply divided with the scissors. A 12 mm port was then placed in one of the lateral or accessory ports and an Anchor® retrieval sac (Anchor

Products, Addison, IL) was inserted. Once liberated, the muscle is guided into the gall bladder bag and withdrawn from the abdomen. Closure of the 12 mm ports was performed at the fascial level using 0 Prolene, and at the skin level using interrupted 3-0 and running 4-0 Biosyn level. The 8 mm ports were closed at the skin level only.

Suggested Reading

1. Ibrahim A, Sarhane KA, Pederson J, Selber J. Robotic harvest of the rectus abdominis muscle: principles and clinical applications. Semin Plast Surg. 2014;28:26–31.
2. Pedersen J, Song DH, Selber JC. Robotic, intraperitoneal harvest of the rectus abdominis muscle. Plast Reconstr Surg. 2014;134:1057–63.

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