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Career Skills for Surgeons

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I dedicate this book to my parents and to all my special teachers and trainers

Foreword

This book contains a wealth of knowledge to better guide the aspiring surgeon through the many hoops of fire that they will encounter in their chosen career of surgery. It offers a guide to junior doctors in how to deal with the personal demands, difficulties and pressures of an evolving chosen surgical career path.

Written is an easy to understand, relaxed style, the reader is guided through a series of chapters dealing with all the major obstacles a junior trainee is likely to encounter in their career progression. Choosing surgery as a career ultimately commits and/or condemns a trainee to many years of hard study. Just concentrating on the basics of training preparing for progress assessments and ensuring log book numbers meet indicative targets is all very well, but the average trainee needs to be much more informed and savvy than this. This book will give trainees that extra edge by providing invaluable advice and insight into dealing with the complex challenges and uncertainties that trainees will encounter outside of their core surgical training practice. It will allow trainee surgeons to successfully steer through the many different traps and hurdles they may encounter.

Although primarily written for surgical trainees, one of the strengths of the book is its appeal to newly appointed or established consultants. Established consultants will find a wealth of material contained within its pages of great relevance to their own surgical practice. I particularly enjoyed reading the evidence-based chapter, and the all too easy to forget importance of departmental morbidity and mortality meetings and the correct spirit in which to conduct them.

This book contains information not easily found elsewhere. It has been written in an honest, straightforward manner, packed with pearls and gems of wisdom. It is not scared to deal with issues that are either controversial or not usually discussed for fear of political correctness. These are not easy subjects to write about.

I found this book fascinating to read. The book's content is precise, succinct and important. It is very cleverly written and draws on a wealth of personal experience and knowledge, gained through years of navigating through a career path that for many surgeons has never been particularly easy or straightforward.

The often quoted sentence “if only we knew then what we know now” could be more aptly rewritten as “if only this book had been available many years ago”.

A word of congratulations to Professor Charalambous for writing this book. Hope you enjoy reading the book as much as I have done.

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Preface

The primary objective of this book is to present skills that a surgeon may find helpful in day-to-day workplace practice and in career progression. The inspiration for this book came from personal experiences at various stages of my surgical career and through the observations of similar challenges that other surgeons faced.

The aim of this book is to present information in an easily read, succinct way and break down a vast subject into small, manageable sections. An attempt is made to provide the reader with knowledge and information, but also stimulate lateral thinking though repeated, often rhetoric, questioning.

I would like to thank Liz Pope, Associate Editor at Springer, and Vignesh Iyyadurai Suresh, Project Coordinator at Springer Nature, for their invaluable help and advice in the preparation and presentation of this book.

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Chapter 1
Introduction

The transition from medical school to being a junior doctor, and then a practicing surgeon is challenging. It requires knowledge, clinical skills and technical dexterity but also the ability to efficiently function in the surgical workplace and be a reliable team member. Being a surgeon is not just a profession but a way of life.

Medical school and postgraduate training often provide clinical and technical knowledge that are essential in formulating a clinical diagnosis, initiating medical treatment, and planning or carrying out invasive surgical procedures. However, surgery may be viewed not just as another medical specialty, but as an apprenticeship, that requires the acquisition, application, and constant refinement of lifelong skills. Surgery doesn't get taught simply through books, but has to be seen and experienced, over and over again.

This book presents some well-known career skills to help improve your day to day surgical performance, development and progression. The generic guidance presented in this book may be of use to aspiring surgeons, no matter their surgical subspecialty choice and no matter where they practice.

Professionalism is central in our day to day performance, guiding our interactions with patients, other doctors, or non-medical staff. The chapter on professionalism explores some of the behaviours that may help improve one's conduct.

Effective communication is necessary in transmitting and receiving information as well as developing and maintaining functional relationships. The first part of the communication chapter discusses basic concepts of communication and ways in which one may improve their communication skills. The second part focuses on how to communicate to patients surgical treatment options and the processes of shared decision making and informed consent.

The ability to organise a surgical theatre list and achieve efficient theatre utilisation is an inherent part of surgical practise. It involves planning the content and order of a surgical list, taking into account, amongst others, clinical priorities, safety factors, and available resources. Hence, a chapter is devoted discussing how to construct a theatre list, followed by ways in which theatre time utilisation may be enhanced.

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Acquiring, improving and maintaining technical surgical skills in the era of working hours restriction is a highly demanding task, hence training opportunities must be maximised and thoroughly utilised. The chapter on surgical technical skills discusses how to plan for a surgical procedure, along with ways of developing surgical motor skills.

Surgeons often practise under dynamic, constantly changing conditions. A clear understanding of the context in which one practises is essential in facilitating decision making and improving performance. Appreciating the process of situation awareness and recognising the factors that may assist or impair a surgeon from reaching that state are important skills to develop and are discussed in the subsequent chapter.

As surgeons we are often faced with a constant need of making decisions. Being aware of how we reach such decisions and recognising the potential limitations of our decision making are important skills to develop. The chapter on decision making discusses intuitive and analytical decision processes, and explores the various biases in making decisions. It also discusses some of the factors that may influence our decision to offer surgery, especially in the absence of strong scientific evidence.

Surgeons are often called upon to lead or manage, through formal or informal roles, and these are important skills in surgical practise. The chapter on leadership describes various leadership styles, discusses the challenges a surgeon leader may face, and presents both desirable and undesirable leadership behaviours for the surgeon leader. The need to distinguish between leading and holding leadership titles or posts is emphasised.

Surgical research may be considered as the process through which we can discover new information to improve our understanding and management of surgical conditions. The surgeon has a central role in identifying areas in which further research is needed, in carrying out surgical research and implementing its findings. The chapter on surgical research discusses the challenges faced in setting up and running clinical surgical studies as well as incorporating their findings in day to day practise. Advice is given on how to deal with such challenges, and also on how to contribute to the assessment of research as part of a Journal Club.

Audit is the process through which we can compare our surgical practise to a pre-defined ideal to help identify strengths and deficiencies, reflect, and further improve. The chapter on surgical audit describes the audit cycle and discusses the role of the surgical logbook, mortality and morbidity meetings, and national databases in assessing surgical outcomes.

The subsequent two chapters explore safety in surgery and discuss what to do when things go wrong. As surgeons we aim to improve our patients' condition but without causing harm. Understanding the factors that may lead to errors and harmful events, as well as the system processes and individuals' behaviours that may promote safety, are important skills to develop and are discussed. Nevertheless, despite all good intentions, it may be difficult, if not impossible, to achieve absolute safety, and on occasions adverse events will occur. Ways of dealing with an adverse event, exploring and understanding its root causes are presented. Particular refer-

ence is made to the process of evaluating clusters of uncommon, yet recognised, surgical complications.

The next chapter discusses how to prepare for postgraduate surgical interviews, along with potential questions and scenarios. Factors that may be considered in choosing a surgical specialty or sub-specialty are also given. Finally, the last chapter explores some aspects of a surgeon's world of emotions, with advice on how to deal with these.

As a Consultant Surgeon in Trauma and Orthopaedics who has done all my undergraduate and postgraduate training in the United Kingdom, the career skills presented in this book originate from personal experiences, the teaching and "wisdoms" of my senior trainers and from supervising and mentoring multiple junior surgeons.

Much of what is presented is commonly available knowledge, or is based on critical evaluation of the published literature, and every attempt has been made to acknowledge and reference its origins as warranted.

Some may not fully agree with what is presented, some may have opposite views, but that is understandable and acceptable. Nevertheless, I hope the reader will gain and benefit from what is said and incorporate some of the advice given in their surgical career.

Chapter 2
Professionalism in Surgery

Professionalism is the ability to practise and act in line with standards and values conferred by one's profession.

The Royal College of Physicians of London working party on Medical Professionalism defined professionalism as "a set of values, behaviours and relationships that underpins the trust the public has in doctors" [1]. Along similar lines there have been several definitions of professionalism in surgery, which nevertheless share a common theme—working in the best interests of patients and the wider society and public.

The Committee on Professionalism of the Canadian Association of General Surgeons refers to the essence of professionalism as "in return for professional autonomy, self-regulation and a recognition of their unique place in society, the public demands of physicians accountability, ethical standards and an altruistic manner of delivering care" [2].

The American College of Surgeons, in their Code of Professional Conduct refer to "individual and collective participation in ways that promote the good of both our patients and society" [3]. Geoffrey Davies, retired judge of the Supreme Court of Queensland, in delivering the Presidential Lecture at the 2010 Annual Scientific Conference of the Australian Orthopaedic Association, described as the main elements of professionalism a "duty, individually and collectively, to put the interests of patients (clients) ahead of those of your own, of your profession and of other bodies", a "wider duty to existing and future patients", "duties of public service" [4].

Professional behaviours may be rooted in one's own personal upbringing and development, general education, may be shaped by one's life experiences and character maturity. However, professionalism may also be taught or learned in daily practise through observation of our seniors, juniors, peers or colleagues, medical and non-medical professionals, through self-reflection, trial and error.

This chapter describes certain behaviours that may improve professional conduct in surgery, and may help strengthen your professional practise. It is not meant to be exhaustive or to replace any advice given by the medical professional body or other oversight institutions you may be accountable to.

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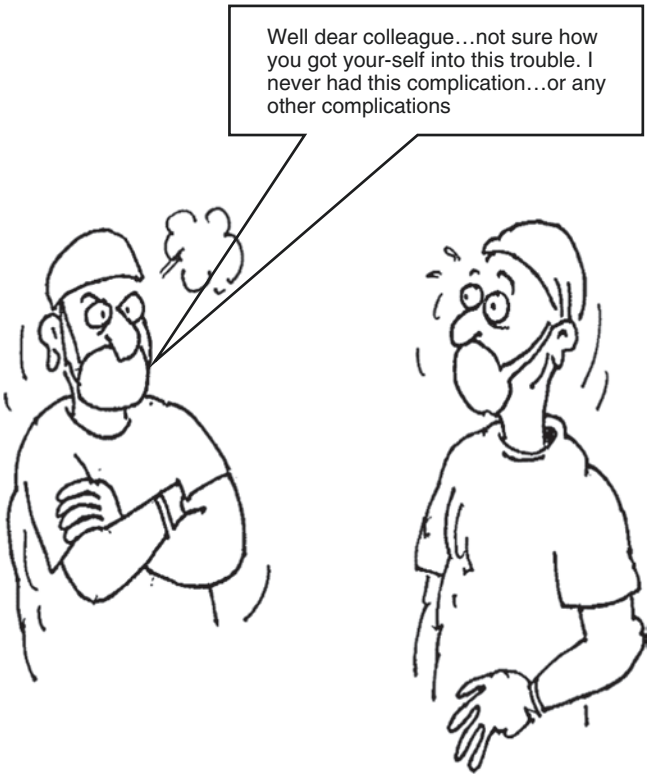
Well dear colleague…not sure how you got your-self into this trouble. I never had this complication…or any other complications

2.1 Offer Surgery for the Right Reasons

Do the right thing. It will gratify some people and astonish the rest.

Mark Twain [5]

As surgeons we are trained to operate, that's our main craft. But not one solution fits all, there is not a surgical solution for each disorder. Appreciating the role of surgery in the wider medical care is an important skill to develop. Just because we are surgeons it doesn't mean we have to operate, just because patients consult us it doesn't mean that they expect surgery or that we have to offer surgery.

Surgery may help to improve quality of life, extend or save life. Even when other management options are available, surgery may provide more speedy recovery, or enhance the effect of subsequently applied non-surgical interventions. But when faced with a particular condition, question as to whether surgery truly offers an advantage over other non-surgical treatments, any special gains, whether it changes the natural history of the condition. Could less invasive options have the same effect? Do the risks of an invasive intervention justify the gains? How does the surgical option fit with the patient's preferences or individual life circumstances?

One may consider a Ladder of Interventions, with the least invasive at the bottom, and the most invasive at the top (Fig. 2.1). In some situations it may be appropriate to climb up the ladder step by step, in other situations one may have to jump straight to the top.

Look at the whole patient, the whole situation, rather than simply concentrating on the bowel, the thyroid, the arteries, the bone. What may work in one context may not be applicable to another. Surgery offered in a chronic presentation may differ from what is done in an emergency or trauma. Availability of resources may also influence what you do, what may be routine practise in a developed country may be unheard of in less well developed societies.

Be pragmatic, don't exaggerate the benefits of surgery to promote a procedure, don't unnecessarily exaggerate the urgency to guide the way. Similarly don't dismiss the benefits of surgery when referring to procedures that you are not familiar or comfortable with.

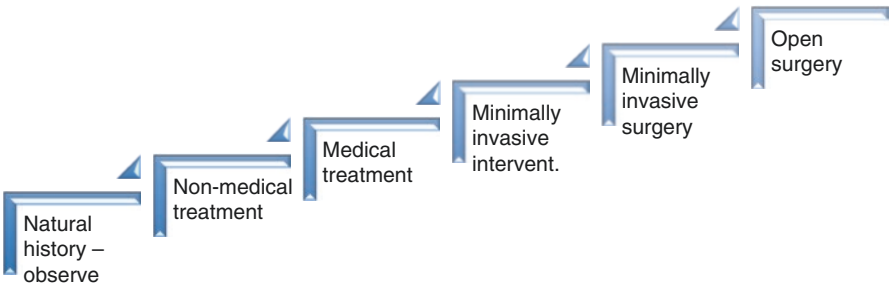

Fig. 2.1 Ladder of interventions

If we take our broken car to a garage we may want to know what the likely problem is and what any repairs may entail. We may like to know how significant the problem is, and whether we could leave it all alone. Would our safety be compromised if we kept driving with the flashing dashboard lamp, or could the car break down? We would expect to be given accurate and honest information, explained the various options in a truthful way. How would we feel if we are told that we have to make an immediate decision, leave the car in for extensive and costly servicing, as the car is about to fall apart, that the garage accepts no responsibility if we drove away, when we know that the dashboard lamp has been flashing for the last 5 years? And what would we think if a garage down the road sorts out the problem simply by changing the malfunctioned lamp?

Several studies have suggested a relationship between surgeon to population ratio and the number of surgical procedures performed, as well as between surgical fees reduction and the number of surgical interventions carried out. It has also been shown that cases treated in a fee-for-service system were significantly more likely to undergo invasive procedures as compared to those treated in salary-based settings. Previous authors have postulated that this was the result of a "provider induced demand", that is surgeons creating demand by changing their indications for financial or other incentives [6–10].

Geoffrey Davies, retired judge of the Supreme Court of Queensland, talks of the "scalpel happy surgeon". He postulates that reduction in surgeon fees, increased rates of legal action for negligence rates with consequent high damage costs, as well as the increased materialism encountered in modern societies, may be some of the factors that could lead to some surgeons offering surgery [4].

An article in the Times of India [11] warned patients to be cautious of surgeons offering surgery:

> *"Doctors are increasingly becoming scalpel-happy. If your doctor asks you to undergo a cataract surgery, hysterectomy, gall bladder or tonsils removal, or an operation of the lower-back, please take a second opinion, patients are forced to undergo unnecessary surgeries".*

The same article [11] reported that an Orthopaedic surgeon explained the reason behind the increasing surgery rates:

> *"We have a quota to meet every month. Many of us see patients as a potential candidate on our operating table".*

Propose surgery for the correct clinical reasons, for appropriate medical indications. Aim for the beneficial operation, for the right patient, for the correct reason, at the appropriate time.

Do not offer surgery to improve or maintain surgical experience, for financial gains, to gain reputation, to promote an innovation, because of pressures exerted upon you by other professionals, for your referral to surgery conversion rates to be in line with other practitioners, because someone else may offer surgery if you don't. Offer surgery for the right reasons.

2.2 Maintain the Trust of Patients

The best way to find out if you can trust somebody is to trust them.

Ernest Hemingway [5]

Maintain trust. Trust is defined in the Oxford Dictionary as the "firm belief in the reliability, truth, or ability of someone or something" [12].

Maintaining trust is vital in your professional relationships with patients, colleagues and other co-workers. It gives others the faith and confidence that what you say is what you mean, that your words are honest and truthful.

Trust of patients on surgeons forms the cornerstone of their relationship. The relationship between surgeon and patient is described as being fiduciary in nature. In fiduciary relationships one person is in a position of vulnerability and relies on another person for help, advice or protection. The fiduciary is required, expected and trusted to act at all times solely for the benefit and in the best interests of the one who entrusts [13–16]. The patient is considered as vulnerable at their time of need and turns to the surgeon who is in a stronger, more privileged position, for advice and support. Hence, the surgeon has the duty to maintain that trust, acting in the patient's best interests and doing no harm.

Beneficence and non-maleficence are actions in line with a fiduciary relationship. Beneficence refers to actions done for the benefits of others, the surgeon acting for the benefit of patients. Non-maleficence refers to doing no harm, the surgeon acting to prevent harm to patients [13–16] (Fig. 2.2).

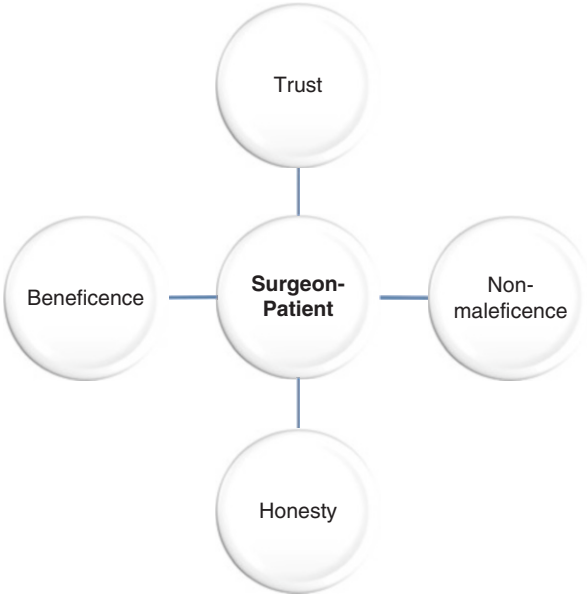

Fig. 2.2 Attributes central to surgeon-patient relationship. Adapted from Chamberlain et al. [13]

Giving an honest estimation of surgical risks and benefits, avoiding exaggerating or playing down the urgency of the need for surgery, acknowledging uncertainty, disclosing adverse events, and disclosing financial or other personal conflicts may help promote trust.

Loss of trust in the medical profession, may mean that patients shop around, take multiple opinions, compare them, weigh them up, trying to figure out who is trustworthy and who is not.

David Berger in an article in the British Medical Journal [17] on the administration of unnecessary treatments and tests, summarises the detrimental effect that loss of trust can have, based on his experiences as a volunteer physician in a small Himalayan hospital:

> *"A common complaint I heard from poor and middle class people is that they don't trust their doctors. They don't trust them to be competent or to be honest, and they live in fear of having to consult them, which results in high levels of doctor shopping".*

As Richard Lunniss (a father whose son had heart surgery at Bristol), told the Bristol enquiry (an enquiry into failures that led to unnecessary deaths following paediatric heart surgery at Bristol hospitals) [18]:

> *"You cannot trust people if you do not think they are being honest, even if they are being nice. Once you think that they might not say the thing as it is, then you can never believe quite — there is no working relationship from that point on".*

2.3 Maintain the Trust of Other Staff

Trust, but verify.

Ronald Reagan [5]

Trust is essential in your relationships with colleagues, co-workers and other staff. Professional trust is essential for a team to function, to thrive, to progress.

Professional trust is not about disclosing your private affairs, your personal life, what you did on your holidays or on your last night out in town. Professional trust refers to the ability of someone feeling that what you say can be believed, that you correctly portray the situation, that your words are true and accurate, that you have no secret agendas, that you don't say one thing but mean another.

Consider your actions, do they maintain trust, do they make you trustworthy? You may consider:

- Should you be reassuring a colleague that you will finish the outstanding ward tasks, simply to leave them untouched for when they return the next day?
- Should you be telling your seniors in the ward round that the blood tests are ok, when you actually forgot to check them on that day?
- Should you be exaggerating your surgical experience so your trainer lets you do more operating, when your real skills will be easily become apparent?
- Should be rubbishing a colleague who asks your advice about a case, or questioning their competency on unfounded grounds?
- If a co-worker confides to you their medical problems and the need to take time off for sickness, should you be sharing their misfortunes with others in the coffee room?
- If a colleague is worried about their complications, the high infection rate they have recently observed, should you be dismissive, denying that you have ever faced any, when the reality is very different?
- If in a leadership position should you be talking about engagement, when whatever your followers say is falling on deaf ears and all you are doing is simply informing them of your decisions?
- Should you be championing safety, but then ignore concerns about high infection rates, for fear of productivity and financial losses?
- Should you be championing teaching and training, but in theatre you find excuses to ensure you do the surgery rather than your resident?
- Should you be telling the anaesthetist that you estimate the next operation will take an hour, when you know that it will likely take all afternoon?
- Should you be telling your leaders that you fully endorse their actions, but undermine them by encouraging others to refuse their directives?
- Should you be trying to limit a colleague's practise simply to enhance yours?
- Should you be using pretexts of efficiency or quality to limit the practice of others?
- Should you be changing the rules of tenure simply to get rid of someone who disagrees with you in the committee?

- Should you be (in the name of quality) refusing to use certain equipment in one hospital, when you are prepared to use the same equipment in another hospital where such refusal may lead to personal financial loss?
- Should you calling an urgent meeting and promising that important decisions will be made, when you know that most of those you invite won't be able to make it at such short notice?
- Should you be making alliances to achieve majority decisions, when you know that individuals in the minority group may be disadvantaged by such decisions?
- Should you be turning up for an interview, and accept the offer, saying this is your "dream job", simply to turn it down a week later, when another post turns up?

Maintain trust. Trust lost may be difficult to regain.

2.4 Respect All Staff

Few people can see genius in someone who has offended them.

Robertson Davies [5]

As a surgeon you often have a central role in what goes on. You may be the one, or may be part of the surgical team, tying off the bleeding aneurysm, drilling the burr holes, ex-fixing the smashed pelvis, replacing the broken hip, suturing the prosthetic heart valve, inserting the transplanted kidney, taking out the gangrenous appendix, bypassing the obstructing coronaries. You may be the one operating the arthroscope, the laparoscope, the robot.

But a whole group of non-surgeons is usually essential for you to do these vital acts. For you to operate someone else may have to prepare the patient medically, give them details for their surgery attendance, ensure that necessary surgical instruments and equipment are sterilised, ready and available, that the patient gets into their gown and is brought to theatre on time. For you to carry out your high skilled operating your assistant may need to keep up the pace, the scrub nurse may need to know and anticipate what instrument to hand over next.

The administrators, the receptionists, the porters, the ward and theatre nurses, the scrub staff, the theatre runner, the recovery staff, and many of those others around you, they too have a vital role to play. Treat them with the respect they deserve. Be courteous, be polite. Respect their opinions, value their input. They may not be surgeons, but are professionals in their own right. Treat them as part of the team, make them feel at ease.

How you deal with other staff, how you exactly behave is a personal choice, and may be shaped by one's character, personality, values, previous experiences, and expectations. But try not to leave your humanity at the hospital gate, not to leave your interpersonal skills at the theatre suite door. Respect all staff, surgeons and non-surgeons alike.

2.5 Respect Colleagues

> *Colleagues should take care of each other, have fun, celebrate success, learn by failure, look for reasons to praise not to criticize, communicate freely and respect each other.*
>
> Richard Branson [5]

Respect your colleagues, respect your peers. Treat them in ways that you would like to be treated, like you would like them to treat you. Evaluate your actions, consider what effect they may have on others, their training, their clinical service, their work pattern.

You may consider:

- You may be the favourite of the head of training, you may be family friends or even ski together. Should you be trying to use this to ensure you get allocated the best training posts, when you know that would disadvantage your colleague trainees?
- Should you be jumping into the theatre lists of your fellow trainees, to improve your own training, when you know they would prefer to be on a one to one with their trainer?
- Should you be trying to squeeze a colleague out of their theatre sessions simply because it suits you better operating on that day?
- Should you be cherry picking patients from colleagues' waiting lists so that you can do "overtime", when you know that your colleague is able and keen to accommodate those in their normal working week lists?
- Should you feel threatened by the talent of colleagues or embrace them for it? Should you criticise and undermine them or be supportive to them? A talented colleague may help further improve the service you provide, rather than limit or reduce your practice. A skilled colleague may be someone you can rely upon to look after your service when you are not around, when on holiday or other leave.
- Respect your surgical colleagues with years of experience. You may be the fresh blood, the one with up to date knowledge, lots of energy and enthusiasm, they may have slowed down, become not so easily impressed and more cynical. Don't suddenly aim to push them out of the way, out of sight. You may have lots to learn from their years of practise, their words of wisdom. What you may be championing as novelty they may have repeatedly seen tried and failed.

Respecting your colleagues, being considerate to others could encourage long-term positive interpersonal relationships, which may be much more valuable than other short term gains.

In a competitive world, in a sometimes perceived competitive profession, one may advance and better own-self without obstructing the pathway of others.

2.6 Support Colleagues

Tis not enough to help the feeble up, but to support them after.

William Shakespeare [5]

Support your colleagues, your peers, juniors or seniors.

A colleague may be having difficult times at home, their husband, wife or mother may be ill. Their own health may be failing, the work pressures may be overwhelming. They may be facing a complex surgical case, having a spell of bad complications, they may have to answer to claims or complaints. They may turn to you for advice, for support, a listening ear, a comforting voice. You may be busy, have your own troubles, your own targets and deadlines to meet. Support your colleagues, devote time and stand by them at times of need.

You may be aware of a colleague's passion, of their interest in a surgical condition or technique, in leading a service, in teaching, in training, in researching, of their need for having Wednesdays off for child care. Should you be taking advantage of their soft spot? Should you be trying to wind them up? If appropriate and if you can support others in their goals, facilitate their ambitions, help them meet their needs.

A junior may just be starting training and have limited clinical or surgical experience, not much knowledge, all may seem strange and difficult to comprehend. They may have already sat the exam twice, but haven't been able to pass that hurdle. Support your juniors when they are starting, help them develop until they can stand on their own feet. The relation between junior and senior, trainee and trainer is often one of dependency; the junior or trainee seeks to learn, be taught, relies on the superior's help to develop and progress. It is not a sin to lack experience, knowledge, surgical skills. You may feel that you are carrying them on your shoulders, but did not some of us have, at some point, to be helped by others, saved by someone else?

Support those in need, rather than simply standing by the strong and powerful.

2.7 Consider Emotions of Others

Work dehumanises people.

Pope Francis [5]

We may find ourselves concentrating on the physical aspects of a disease, on the tasks or assignments we have to complete, the reorganisation in services we have to oversee, the targets we have to deliver.

However, even in highly demanding times, one may also consider the effect our actions, inactions, or reactions may have upon the emotional world of those around us, our patients, our colleagues, co-workers, our juniors or followers. This may help to remind us that we are dealing with human beings, individuals with emotions and feelings, with personal and private lives, rather than simply dealing with problems we have to solve, buildings blocks with which we may construct our ambitions, walls that we need to demolish to get our own way.

You may consider:

- Should you simply concentrate on the physical aspects of the disease you are treating, concentrate only on the technical complexities of the surgical intervention you are proposing or should you also be paying attention to the worries, concerns, and anxieties of your patients? There may be fear that one cannot take all the burden of others, a belief that one has to stay detached. But is it not that "all round care" encompasses both physical and emotional wellbeing? Can you fully ignore one for the other?
- Should you be looking at your followers as names or grades, that you can slot in your newly proposed rota, or should you be also considering what effect your reorganisation may have on their emotional world, as it may interfere with their training priorities, career development, ambitions or home circumstances? Should you be considering what emotional effect the proposal of changes may be having on them, as it creates a state of uncertainty, a state of limbo, a constant concern about the future? Could the "keep them on their toes" motto have the opposite effect, leading to less engagement, less enthusiasm, less strive, less productivity?
- Should you be looking at your colleague as someone you have to over shine, to get ahead of, to get an advantage over, in order to impress your seniors or your employers? How would your colleague or junior feel if
  - You ask them to stay quiet in the ward round so you do all the talking?
  - Collect all the information for you to stand up and do the presentation?
  - Complete the pre-op work up but being sent to the ward when the time comes for them to operate?

Could one not also shine by supporting others, helping them progress, evolve and develop?

Consider emotions, consider the humane aspects of your professional interactions.

2.8 Listen and Act upon Concerns

Chief Brody: This is a Great White, Larry, a big one. And any shark expert in the world'll tell ya it's a killer……..And there's no limit to what he's gonna do. I mean, we've already had three incidents…You open the beaches on the 4th of July, it's like ringing the dinner bell…. we have to close the beaches!

Mayor Larry Vaughn: ….Look, we depend on the summer people here for our very lives…. And if you close those beaches, we're finished…..I don't think either one of you are familiar with our problems…..Tomorrow is the 4th of July, and we are going to open for business. It's going to be our best summer in years…..with you or without you, those beaches will be open for this weekend.

Adapted from Jaws [19]

You may be asked to act upon concerns raised by your team, your juniors, your peers, the nursing staff, the administrative staff.

They may be truly concerned about how things are done, about the inadequate specialist medical cover in the ward, the stretching of resources, the delays in typing clinic letters, the rise in wound infections of the unit, the mixing of clean surgery patients with those admitted with chest infections, the unsafe handovers, the spread of your patients round the hospital, the poor training experience that an attachment provides.

Treat concerns with the seriousness they deserve, give ample time and thought, don't assume that this is simply another "moaning exercise", just another part of day to day complaining.

Look at the concern in a systematic way:

- What is the concern?
- Do the data justify the concern?
- Is safety compromised?
- Should we pause until data is gathered?
- What is the solution and how can I facilitate the solution?
- Whom do I need to involve to implement the solution?
- Can an interim solution be found?

Some decisions may be really challenging to make, the pressure may be high from all sites:

- Your surgical wound infection rate may have gone sky high, but cases are waiting, personal, institutional, or national targets are at stake, personal and institutional financial pressures may be mounting, how can you stop the flow?
- Your juniors may be reporting that they get no meaningful surgical training, that their logbooks are failing, that they simply keep holding retractors, but the rest of the team keeps insisting that you do the cases yourself to finish on-time, your cases may be pooled and never make it to your theatre, lack of beds means cases keep getting cancelled on the day.

Listen and act upon concerns, even when they come from those you never hear praises from, even when they come from those who constantly complain.

2.9 Stick to the Core Principles

Change your opinions, keep to your principles; change your leaves, keep intact your roots.
Victor Hugo [5]

Stick to the core principles of surgery, of providing safe high quality care, whilst wisely using resources, contributing to the advancement and progress of the profession, passing on knowledge and skills.

Aim to improve the overall experience of care you provide but avoid being distracted from your main goals and aims. There may be a need to improve your surgical skills, improve your surgical experience to advance and progress in your career, to gain reputation and status. There may be system pressures, targets to meet, cutbacks in resources. There may be competition with other providers, a need to attract referrals for your practise to survive. But even at difficult times, at times of turmoil, core principles remain the same.

When getting in a plane, one's priority is to get to their destination, and do so safely. Choosing an airline which has a user friendly website, easy to check in apps, shiny couches in its waiting lounge, comfortable seats with extra leg space, one which sends out regular newsletters, or allows three pieces of hand luggage on board, may be very welcoming, but would we exchange safety for any of these spoils? Even if we are in a rush and there are delays we may be forgiving once we safely land. And when at 36,000 ft, in bad turbulence, or facing strong head-on winds, would we really appreciate our low cost ticket, if the airline we chose was advising its pilots to keep any extra fuel on board to the bare minimum [20]?

Should you be sacrificing quality and safety for improving surgical experience, for financial gains, for pleasing an employer or a political master?

2.10 Go with the Flow

I go with the flow. Whatever music you play for me, I'll dance.

Gael Garcia Bernal [5]

In the workplace there are often different ways of doing things, different opinions in dealing with clinical or non-clinical issues, different approaches or different solutions. There may be various ways of investigating a particular clinical problem, various management options for a clinical presentation, various ways of setting up the order of the theatre list, various manufacturers from which to purchase surgical equipment, various ways of allocating resources or staff.

You may have strong views, be strongly opinionated, you may want things done your own way. Argue your case, try and find a preferable or acceptable midway solution.

But it is unlikely that anyone can win all battles, many situations are not even worthy battlefields. If it doesn't matter, if it won't affect the quality and safety of the care you provide, if it is not limiting your practise, if it is not detrimental on the service provision, training or patient care does it worth the confrontation, does it worth the conflict?

Develop the skill of recognising your priorities, the skill of knowing when to stand and fight and when to let go, when to go with the flow. It is not a failure not getting our way every time. If we fight for all, even those that don't really matter, how can we be really listened to when it comes to the vital issues?

Consider going with the flow if it doesn't matter, if it is an acceptable alternative to what you would really prefer, if what will be gained does not justify the conflict. It is professional to accept that for some things you have to give way and not demand that all goes your way. Go with the flow, but not for personal gains, not to attract gratitude, financial incentives, for fear of consequences, for keeping a peace of mind.

2.11 Swim Against the Tide

It's OK to not be fine.

Frasier Crane [5]

There may be times when you need to stand up and be counted. Just because many around you are going in one direction does not mean that has to be your way too. There are instances when groups of individuals, organisations, institutions, professions, or even whole societies go down an unwanted route, and may take time and even lone voices to bring them back to a better way.

Some of you may be practising in healthcare systems driven by targets put in place to mean good, but are consistently (consciously or unconsciously) misused. In the National Health Service (NHS) of the United Kingdom (UK), multiple targets were introduced, such as the 18 week target from referral to elective surgery and the four hour target for either admission or discharge from the Emergency Department [21, 22]. These aimed to reduce unnecessary delays in both elective and urgent treatment. However, as a surgeon, you may be aware that patients who breach their wait for surgery target are put on the site, with those waiting less brought in to be operated upon. You may see patients unnecessary admitted to avoid breaching their Emergency Department target stay, when they could be kept there a bit longer and be discharged once their tests are back [23, 24]. If you see the wrong, call it out.

Going against the tide can be tiring, wearing you out, unnerving, may feel threatening to your well-being, employment status, progression or career. It may feel like a constant struggle, like no one is listening, you may be made to feel as the one at fault, as the one to blame, as the argumentative, the one obstructing progress. Discuss your worries with those close to you, your professional support body, your seniors, your mentors. Evaluate your actions, question your reasoning, but if you still feel that you have to go against the tide then do so. If it matters stand up and speak out. Sometimes all it takes is for some to speak up.

2.12 Act More Than a Technician

The universe is not indifferent to our existence – it depends on it.

Stephen Hawking [5]

You may really enjoy the technical part of surgery, being scrubbed in theatre, cutting up or stitching, fixing the broken, putting them back together. But being a surgeon may not just be about the time you spend in theatre, the technical aspect of surgery, but also about the input you make to all else that goes around you.

Should you not be contributing to the shape of your society's healthcare, the design of a new operative theatre block, the development of perioperative pathways and protocols, the construction of you theatre list? Should you act as a mere technician that turns up, is given a theatre list and operates? You may enjoy being a technician, others may prefer you just being a technician,

Should you be a bystander when political decisions are made about which surgical services will remain and which will be centralised, when commissioning decisions are made about cost effective or not cost effective procedures, when ward management decisions are made as to whether your hip replacement case will be nursed next to a patient with a thigh abscess or in a ring fenced clean surgery ward, decisions about the procurement of cheaper but also poorer quality sutures, waiting list decisions as to who goes on next week's theatre list and who waits longer, who is classified as urgent and who as routine, decisions about shortening the length of training, the production of generalists rather than specialists.

Surgical care is not just about the patient and the surgeon. Healthcare has complex dynamics, may be subjected to political influences, subjected to organisational and non-medical professionals' motives and priorities. Systems that aim to facilitate the patient-surgeon relationship may not be functioning, may be consciously or unconsciously counterproductive. Your priorities as a surgeon, and what you perceive as your patients' priorities, may be different form the priorities of your colleagues or co-workers.

2.13 Stand Up for the Profession

I learned a long time ago the wisest thing I can do is be on my own side, be an advocate for myself and others like me.

Maya Angelou [5]

Healthcare is changing. There may be more political interference, the public may be, and rightly so, becoming more demanding. There is constant flow of information arguing for rapid, immediate actions.

The surgical profession may be challenged by attempts to shorten training to produce more generalists than specialists, by targets for productivity and delivery that threaten quality standards, by the lack of enough juniors to support senior surgeons, public and private commissioners limiting surgical funding, by moves to increase shift and weekend working with further disturbance of work-life balance.

Be an advocate for the profession [25], put forwards its case, argue and fight. You are in a good position to know what's needed for a safe, high quality surgical care. Whether it is by speaking out to raise concerns, promoting the good work delivered by the profession, changing misconceptions, advising commissioners and politicians, engaging in reducing waste and improving efficiency, acting as a follower or a leader. Stand up not only for issues that affect you in person, but also those that may affect your colleagues, your peers, your juniors. Vocalise your views, write emails or letters, complete surveys, demonstrate, support or vote for those that will stand up for the profession, in your department, your institution, locally, nationally or internationally. Act as part of a group, part of a professional body, or even act alone.

Be an advocate for the profession, not only in words, but also through your day to day actions, your personal conduct, your behaviour and relations with colleagues and other staff, by maintaining above all safe patient centred care. Be an advocate by avoiding behaviours that can question your integrity or motives as an individual, and which, through you, can also question the wider profession.

2.14 Declare Acceptable Conflict

If I, taking care of everyone's interests, also take care of my own, you can't talk about a conflict of interest.

Silvio Berlusconi [5]

Clinicians may depend on industry to develop surgical equipment, devices, procedures or technologies that can make surgical care simpler, safer, more reproducible. Industry may want to develop products that are user friendly, endurable, reliable, well sold and profitable. Industry and surgeons may have some diverse but also some common goals.

Surgeons may work with industry to design, develop, or assess new technologies, solely or as part of an extended group. They may be on the lecture circuit or have training roles, teaching other surgeons to use devices or surgical equipment. They may have a research role, evaluating the outcomes of an implant, in a research post funded partly or wholly by its manufacturer. Such roles may be demanding, time consuming, and reimbursement may be given, monetary or otherwise; royalties, licensing fees, hospitality, travel expenses, consulting fees.

Such relations with industry raise the possibility of conflict, if the surgeon is then making decisions or recommendations to institutions, patients or colleagues, as to which implant or device to purchase or use. Such relations may also raise the possibility of conflict if the surgeon presents research findings concerning implants or devices, obtained in a post funded by the manufacturer of those devices.

There may be concerns that physicians could be biased by industry consciously or subconsciously, and may even fail to recognise this vulnerability. Physicians may feel that the practice of others but not their own can be vulnerable to industry influences [26].

Relationships between doctors and the industry do exist. In 2007, a survey of about 3000 physicians in the Unites States of America (USA), showed that 94% of those responding had some sort of relationship with industry; 83% received food in the workplace and 28% received payments for services such as consulting or participating in research [27]. In the USA, the Physician Payments Sunshine Act was passed into law in 2010, in an aim to encourage transparency on financial interactions between producers and consumers (physicians, hospitals). It requires all drug, medical device, and biologics companies to report any transfers of value to physicians and teaching hospitals, on an annual basis. Companies began recording data in 2013 and the first report was released in September of 2014. First data reported on 4.4 million individual payments, worth approximately 3.5 billion dollars, made to 546,000 physicians at 1306 teaching hospitals [28, 29].

Cooperating or working with industry does not mean that such relationships have to cloud one's judgement, guide their actions, influence their preferences or choices. One may well be able to separate the two. There is evidence that patients approve of financial relationships between physicians and industry that support innovation and research, and trust their surgeons in making patient-centred choices [30].

However, declaring such relationships and any potential conflict when it exists, can help clear the air, minimise the doubts as to the exact surgeons' reasoning, thoughts or motives. Okike et al. [31] analysed the self-disclosure statements of authors of a scientific presentation and committee members at the 2008 Annual Meeting of the American Academy of Orthopaedic Surgeons, to determine whether payments received from the manufacturers of hip and knee prostheses were disclosed. The overall rate of disclosure was about 70%. In a subsequent survey exploring the reasons for non-disclosure, factors cited by surgeons included a lack of relation between the presented topic with the payment received, and misunderstanding of the disclosure requirements of the scientific meeting.

Follow the rules of your institution, the rules of the scientific meeting or journal at which you may be presenting your research, the guidelines of your professional or regulatory body, the law of the land. Declare acceptable conflict, get it out first before others do.

2.15 Stir Well Away from Unacceptable Conflict

The end may justify the means as long as there is something that justifies the end.
Leon Trotsky [5]

Don't let financial or other interests erode your trustworthiness in referring on, in accepting referrals, in recommending devices or implants. Stir away from inappropriate or illegal practises, from unacceptable conflict.

Transparency International, a non-governmental organization set up to combat corruption, defines corruption as 'the abuse of entrusted power for private gain' [32]. In a 2006 publication [33], it refers to corruption in the healthcare as the

"bribery of regulators and medical professionals, manipulation of information on drug trials, the diversion of medicines and supplies, corruption in procurement, and overbilling of insurance companies",

and stresses that

"society frequently entrusts private actors in health care with important public roles. When hospital administrators, insurers, physicians or pharmaceutical company executives dishonestly enrich themselves, they are not formally abusing a public office, but they are abusing entrusted power and stealing precious resources needed to improve health".

Transparency International refers to facilitation payments as a

"small bribe, also called a 'facilitating', 'speed' or 'grease' payment; made to secure or expedite the performance of a routine or necessary action to which the payer has legal or other entitlement"

and describes that in healthcare

"medical staff can charge unofficial fees to attend to patients. They may demand bribes for medication which should be free. Or they may let patients who bribe them queue-jump" [32].

It is a type of corruption not hidden behind doors, but one that patients may face day in day out.

Inappropriate or illegal practises unfortunately do exist round the world. David Berger, in his article in the British Medical Journal [17], described his observations of such practices:

"Investigations attract a 10-15% kickback to the referring doctor. One day, the marketing executive for this clinic had turned up at the hospital with an envelope full of cash—the commission for investigations ordered in the past few months".

Helena Smith, the Guardian's correspondent in Greece, in a 2014 article [34] describes the practice of "fakelakia", or bribe little envelopes, well known of in Greece:

"This summer, a lift at Athens's largest public hospital broke down. When a repair technician arrived he couldn't believe his eyes: knee-deep at the bottom of the shaft were hundreds of envelopes, the vessels for bribes to doctors who then dispensed with the telltale fakelakia".

Interestingly a Transparency International 2012 National Survey on Corruption in Greece [35] suggests that even little envelopes could not stay immune to the country's financial troubles:

> *"The average bribe to a public service cost €1228 in 2012. However, the bribes paid to public services have also been affected from austerity, as there is substantial reduction in their average amount from 2011, when the average bribe cost €1399. A bribe to get"… .."surgery in a hospital can cost between €100 and €30.000".*

Charles Piper, a Healthcare fraud investigator in the USA, author of the Healthcare Fraud Investigation Guidebook, describes common encounters in falsifying healthcare insurance claims, including billing for services never delivered, billing for non-covered services, misrepresenting dates, locations, or providers of a service [36].

Stir away from such practices for financial or other gains, even if asked by patients to help them inappropriately claim, to alter the details of the person you treated, the type of procedure, the cost, the date. Stir well away from inappropriate or illegal practises, from unacceptable conflict, from actions that can impair your individual integrity, but can also undermine the wider profession, question its honesty or challenge its trust. Stir away from such practises, even if practising in unhealthy systems, even if doing the right makes you the exception.

2.16 Gather Experience

We are all apprentices in a craft where no one ever becomes a master.

Ernest Hemingway [5]

A surgeon's professional life is one of constant evaluation and learning, a constant strive to learn new skills, maintain skills, refine skills learnt, keep up with the progress. Aim to actively seek the acquisition of experience.

Clinical experience may refer to history taking, examinations skills, formulation of a working diagnosis, consideration of differentials, treatment strategy, technical skills, communication skills, the whole spectrum of surgical clinical professional life.

Experience requires devotion of time, requires one to be present, rather than simply reading or thinking about an event. However, experience is not a passive process, a mere presence in a situation, but an active participation along with a reflection upon what occurred. In this way, as summarised by Kolb's cycle of experiential learning [37], one may re-adjust their actions to help improve performance if a similar situation is encountered in the future (Fig. 2.3).

Aim to gain knowledge, but also the ability to acquire principles and concepts that could be used to solve newly encountered problems, deal with situations you haven't previously faced.

Learn from all, whether senior or junior; do not be put off by their titles, grades, or professional status. Surgery is a craft, the master of which may be improved through repetition. One may not have progressed in professional status or in career pathways, but may have mastered that craft, may be really skilled in what they do, and you may have lots to gain by joining them. Your junior may have acquired concepts from other trainers that you haven't really considered, you may still listen and learn.

Learn from experts in their fields; some may be skilled in a specific surgical procedure, some may be skilled researchers, excellent communicators, some may have clarity in their thought process and in formulating of clinical diagnoses. Aim to learn and gain from all.

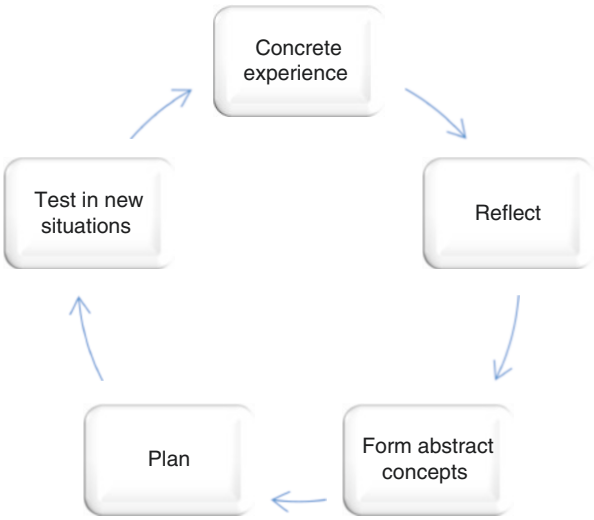

Fig. 2.3 Kolb's cycle of learning. Adapted from Kolb [37]

2.17 Seek Continuity of Care

80% of health apps are abandoned within two weeks.

Marco Della Torre [38]

Aim for continuity of care, aim for following a patient through their treatment journey, whether that journey involves surgical or non-surgical treatment. Continuity of care may facilitate inter-personal relationships between patients and surgeons, and be of direct benefit to both.

Patients may prefer to be seen by a familiar face, someone who knows their story, someone who is likely to catch up from where they last left. They may feel more reassured that they are seeing someone that knows their case first hand, someone who was physically present at their surgery, rather than someone who transmits messages relying on records and notes.

Surgeons may similarly feel confident that they are dealing with a familiar case, more certain of the information they are relaying, more able to assess their patient's progress since their last encounter. Surgical learning may also be facilitated by directly observing changes that occur with time; how a disorder deteriorates or improves, the milestones through which a patient recovers post-surgery, how the bone unites radiologically, how a huge open wound heals with vacuum dressings. Such first-hand observations may give you the confidence to anticipate what will likely happen in the future, much greater confidence than simply reading about it in books or hearing seniors say so.

Continuity of care is even more important in those cases where difficult decisions had to be made:

- Was your diagnosis of acute appendicitis correct or did it turn out to be a non-inflamed appendix?
- Was it truly a pseudo-obstruction or did it turn out to be a mechanical block?
- Were you right to accept the not so well perfused bowel anastomosis or should you have opted for a stoma?
- Did the mal-united fracture remodel like you had counselled the child's parents?
- Were you right to fix the fractured hip or should you have replaced it?
- Were you right to plate the fractured tibia or should you have nailed it?

Maintaining continuity of care in modern healthcare delivery is often an uphill struggle. High turnover of patients, shift working patterns, healthcare systems that place greater emphasis on the timing of physical interventions rather than the context in which such interventions are delivered, transfer of patients between teams without clinicians' input in order to meet elusive (and sometimes unjustified) targets, are only some of the challenges surgeons may face. Despite the difficulties, appreciate the value of continuity of care, and seek it as much as possible in your practise.

2.18 Don't Make Speed Your Sole Aim

Time me, gentlemen, time me.

Robert Liston [39]

Dr. Robert Liston was a London based surgeon, practising in the eighteenth century. He was considered one of the finest of his time, a really fast pair of hands, a very quick surgeon. Legend has it that once he was moving so fast that he even took off the fingers of his surgical assistant [40, 41]. His speed may sound careless but he was carrying out leg amputations in the pre-anaesthetic era, when speed was essential to minimise patients' pain and agony.

But even now, in the era of sound anaesthetic techniques, and effective pain control measures, minimising surgical time may confer a clinical advantage, reduce the risk of complications such as surgical wound infections or venous thromboembolism [42–45].

Improve your practises and techniques, cut unnecessary steps, to help minimise your operating time. However, do not compromise on quality simply in pursue of speed.

The world is moving fast. Healthcare time is expensive. Pressures may be mounting for fast turnovers. You may hear of surgeons referred to as "fast" or "slow", according to their operating times. You may be aware of "fast" surgeons being more popular amongst co-workers, as the list can finish early, more popular amongst employers as more cases can be squeezed on the list.

There may be times in theatre when things don't work out, operations don't go according to plan, your assistants may sound tired of the prolonged standing and retracting, the scrub staff may want to plan their lunch, the theatre coordinator may be eager to know if you will have sufficient time for the next case, times when you may feel that you have had enough. Avoid losing your nerve, rushing the job and compromising quality. Devote the time that's necessary, devote the time that's needed.

And even in clinics you may hear of surgeons that tend to "finish early" or of others who religiously "overrun". But consider the patients who took time to come and see you, got time off work, took the bus or drove from the other end of town, struggled to park, and have being waiting all this time in the waiting room to consult you, in search of information, solutions or help to their problems. You may be running late, the clinic may be overrunning, but don't look at them as just another appointment to get it done and over, devote the time needed. One may forget and forgive the wait if it was worthy waiting for.

You are more likely to be judged on the outcomes and quality of your work by those who matter the most, rather than the time it takes you to get there. Be fast, but don't make speed your sole aim.

2.19 Understand Your Limitations

Refusing to ask for help when you need it is refusing someone the chance to be helpful.
Ric Ocasek [5]

Understand your limitations in terms of clinical skills, surgical skills, diagnostic ability, your ability to communicate, to persuade.

Understand your own personal limitations:

- You may have taken an adequate history, performed a thorough examination, carried out several investigations, but still you are unclear as to the working diagnosis. A second opinion, may help see or hear what you may not be able to do. Seek further opinion, even if you know it is highly likely the further opinion will be in line with yours.
- You may be a skilful surgeon, a specialist in an area, but a patient presents with a severe form of a condition and you feel this will be a challenging, demanding case. If needed, ask for another surgeon to join you in the surgical theatre for help and support. It is not weakness to scrub for surgery with another senior surgeon, no matter how senior one is; instead, it may be considered a sign of strength to recognise own limitations and put egos on the side in the name of quality and safety.
- You may be practising in an advanced healthcare system, but faced with a condition which is rare in your country but much more common in another country, where surgeons may be treating in a week what you may see in a year. If needed, refer patients on to those who may be able to do a better job.

Appreciate the limitations of your team. You may have just visited a centre of excellence in joint replacement surgery and impressed by their high turnover, their ability to perform six hip replacements in a day. Aspire to improve your team's performance, to reduce theatre time loss, enhance patient flow. But recognise what may be easily achieved by other teams may not directly apply to yours. You may face high turnover of scrub staff, inexperienced staff that are still learning, processes and regulations by which you have to abbey.

Recognise the limitations of your institution or the healthcare system you are working in. Your institution may be having difficulties with bed availability, theatre time availability, organisational structures, too many cooks spoiling the broth. You may not be able to immediately influence what is going on. Work hard, engage, argue to change things, but you may appreciate that change takes time, that there is so much that can be achieved. If you feel that your patients may be served better by being referred or directed to another provider then consider that option.

You may be under pressure by patients, relatives, colleagues, nursing staff, clinicians from other specialties, or management, to make a quick decision, to admit or discharge, operate or mobilise. If you feel that what you are being asked is beyond your own limits say so, seek advice and help. Don't stretch your limits simply due to external pressures. One may be initially praised for quick, decisive actions, simply to be later condemned for acting out of their safe zone.

Knowing your limitations doesn't mean to be defensive, indecisive, refusing to take anything risky on, but acting within your safe, high quality boundaries. Seek help as you need it. You are likely to be judged by the outcome and not by whom you listen to or whom you consult in the process of getting there.

2.20 Walk Before You Can Fly

He who would learn to fly one day must first learn to stand and walk and run and climb and dance; one cannot fly into flying.

Friedrich Nietzsche [5]

As a surgeon you may find yourself in new situations. As a junior you may be moving from hospital to hospital, from one team to another. But even if you have completed your training and you are independent practising you may find yourself operating for the first time in a new hospital, in a new theatre, with anaesthetic or scrub staff you haven't worked with before. Others may not have come across the ways you do things, and may even be surprised with what you are doing. You may be asked "why are you doing things this way", rather than "do you really know what you are doing?".

All eyes may be on you, trying to work out what you are made of, whether you can really rise to the challenge. Your senior may be keen to see if you can really fix unaided the nasty hip fracture (as you have already claimed in your log book), the waiting list coordinator may be really keen to get that long awaited cases operated. But should you be rushing to take them on, or should you go at your own pace?

You may have the skills to take really complex cases on, but should you be rushing into doing those if they can safely wait? Performance in the operating theatre may be influenced by many factors, not just knowledge, technical abilities, decision making, and endurance, but also by our relations with the rest of the team, the confidence they have in us, the trust we put upon them.

If you end up struggling to reduce a fracture in an environment you have not worked in before, can the rest be assured it is the fracture complexity rather than you to blame? If you keep asking for the fracture reduction rod but you are told there isn't one, can you be assured that's the case rather than it being shelved somewhere difficult to find?

Should a singer going to an audition pick a really hard song to sing, one that would really challenge their vocals, or should take it easy, and pick one that can allow their voice to be heard, one that can allow their voice to shine? Should an athlete turning up for international games high jump with the bar set at the 2.4 m barrier from the beginning, or start from lower heights, get used to the track, and then attempt the big jump?

Walk before you can fly. A pilot doesn't suddenly get in front of the controls of an Airbus 380, and it is unlikely that one can go straight from medical school to carrying complex neurosurgical, cardiac or other surgical procedures.

Understanding your limits is vital when working in a new environment, a new team, under a new senior. Is it better to stay within safe limits and gain trust or take unnecessary risks and end up losing face? First impressions may matter, and acting within limits may help an initial good impression to be made.

2.21 Seek and Give Feedback

It is impossible to begin to learn that which one thinks one already knows.

Epictetus [5]

Feedback needs to be exchanged between team members, between colleagues, seniors and juniors, trainers and trainees, amongst surgeons, between surgeons and other medical or non-medical specialists.

Seek and give feedback. Learn and educate; for what went well, for what could have gone better. Establish well intended, constructive feedback channels between you and the professionals with whom you routinely collaborate. Exchange feedback soon after an event, whilst memories are still sharp and facts are still clear. Use feedback not for criticising or getting at others, but for promoting your own and their professional development.

A surgeon may exchange feedback from a variety of sources as summarised in Fig. 2.4.

- You may receive feedback from a radiologist about the cruciate ligament you clinically suspected had ruptured; you may inform the radiologist of your arthroscopic findings of a meniscus reported on Magnetic Resonance Imaging as having a large tear.
- You may receive feedback from the pathologist about the margins clearance of a breast lesion you considered fully excised; you may inform the pathologist of your surgical findings based on an initial aspirate that was reported as possibly malignant.
- You may receive feedback from a physiotherapist about the effects of your prolonged postoperative immobilisation regime on wrist stiffness; you may inform the physiotherapist of how well their early rehabilitation techniques speeded recovery and return to play.
- You may receive feedback from your anaesthetist about the effect of your intra-articular local aesthetic infiltration; you may give feedback to the anaesthetist about the effectiveness of the regional block they employed.

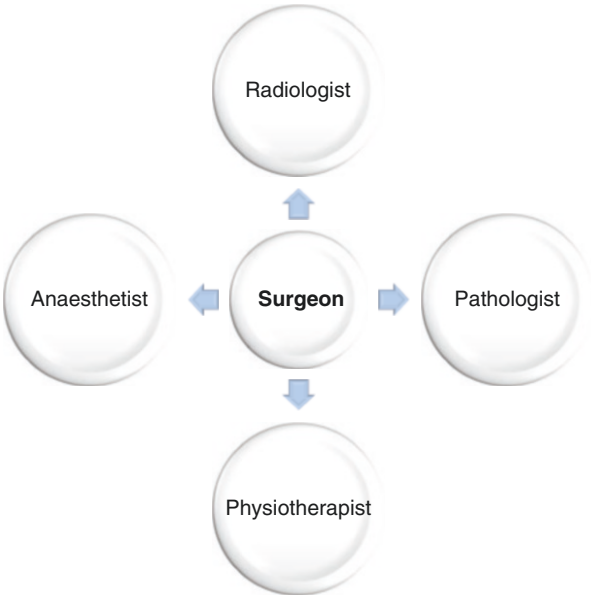

Fig. 2.4 Surgeon exchanges feedback with collaborating professionals

2.22 Self-Reflect

If I speak of myself in different ways, that is because I look at myself in different ways.
Michel de Montaigne [46]

Self-reflection refers to one looking at own self and evaluating own actions, beliefs, or motives [47]. It may allow one to evaluate whether they communicated effectively, evaluate their clinical decision making, diagnosis, investigations and treatment choice, prescription patterns, technical actions.

Self-reflection is increasingly recognised as an important component of personal professional development for the training surgeon, and a requirement of surgical portfolios [48]. However, self-reflection shouldn't be looked at as just another tick box, another entry in your portfolio, but a way of practise, a way of constant evaluation and development.

Self-reflection doesn't mean that you did things wrong, it just asks could I have done better? Self-reflection does not imply weakness, but strength, as it is an indication of a constant strive for improvement. It takes maturity, self-consciousness and self-confidence to recognise that our actions may have been different, to learn and adjust from previous experience.

You may consider:

- You may have picked an argument with a casualty doctor trying to refer an abdominal pain case to you. It might have been an inappropriate referral but could you have handled it better, rather than ending up shouting "NO" on the phone?
- Could you have explained better to the ward sister that you will be there as soon as you finish clerking the new admissions in casualty? Should you have raised your voice? Should you have slammed the phone down?
- You may have just had a consultation that you thought went well, but as soon as the patient goes home they ring to complain. Could you have done anything else, could you have communicated better?
- A patient may still be asking you the same questions even after you explained all—why is your message not getting across? Should you reconsider how you explain things?
- You may have just spoken to a patient about a complication they developed, but it was a struggle to vocalise that an error occurred. How could you be more upfront next time?
- You may have been unhappy about an anaesthetist's decision to cancel your case, but would your interpersonal relations been served better if you spoke to them directly and argued your case, rather than complaining to their director the next day?
- You may have opened up a shoulder fracture with the intention to fix it but you find that it cannot be put back together; should you have anticipated this and made sure that the replacement equipment was available?
- You may have tried to remove an appendix laparoscopically but it was just not happening due to multiple adhesions; should you have converted to an open procedure earlier?
- You may have encountered a high rate of post-operative surgical complications in your practise. Is it just bad luck or could you have been doing something differently?

Self-reflect, learn and get better.

2.23 Acknowledge Uncertainty

There is no such uncertainty as a sure thing.

Robert Burns [5]

As surgeons we may have strong dogmatic views as to how things should be done, demand our own ways—which prep to use, which venous thromboprophylaxis to instate, which fractures to fix and which ones to treat in plaster, which surgical procedure to choose out of the many, how many screws to use and in what form and shape, whether to glue, stitch or clip the skin, which postoperative analgesia to prescribe. Strong views often based on previous practise and experiences, our training and teaching, on trial and error; strong views occasionally based on high quality evidence and research.

We may discuss, argue, or even give elaborate explanations as to why our approach is the preferable one, the right one.

However, in many aspects of your work you may be faced with uncertainty. You may consider:

- Recognising uncertainty in clinical diagnosis may allow one to reach a plan of action and initiate treatment, rather than unnecessarily waiting until all pieces of information are gathered and a definite conclusion reached.
- Recognising uncertainty of outcomes may allow you to communicate realistic expectations to patients as part of shared decision making and the consent process, rather than painting an over-optimistic or over-pessimistic picture.
- Recognising uncertainty as to which treatment method is best, may allow one to appreciate that what other colleagues follow may be an accepted alternative option.
- Recognising uncertainty in the effectiveness of treatment methods we employ may allow one to set up research trials or recruit patients for such trials.

Acknowledge uncertainty and keep an open mind.

2.24 Aim for Accurate Communication

Accuracy is the twin brother of honesty.

Nathaniel Hawthorne [5]

Be truthful, honest and accurate in communication with colleagues, co-workers, or other professionals. Avoid over exaggerating, or playing things down. You may consider:

- "How long will surgery take?" The anaesthetist needs to know to adjust the muscle relaxants, use a laryngeal mask or intubate, whether to administer more anaesthetic. Enquiring about how long you will take, how long more to go, is not a criticism of your speed. Simply stating "it won't take long" or "not too long to go" will not decrease your operating time. Take into account how long to close and dress the wound, come off the operating table.
- "How much blood has been lost?" The anaesthetist needs to know to explain the observed hypotension, to guide the need for haemoglobin testing, fluid resuscitation or blood transfusion. How much is in the wound, in the swabs, on the floor? Simply stating "just a bit of oozing, not much at all" will not reduce the volume of actual blood loss.
- "Is your patient unwell enough to justify jumping the queue on the shared emergency list?" Is your case really unwell or can it wait? Enquiring about the urgency of your case, may not be an attempt to avoid operating or postponing your case, but of prioritising amongst several cases that are waiting.
- "How painful will the procedure be?" The anaesthetist needs to know to adjust the intra- and post-operative analgesia, consider regional blocks, continuous or regular painkillers. Enquiring about pain is not a criticism of your surgical technique or soft tissue handling. Simply stating "not very painful" or "some local anaesthetic will be ok" will not reduce the post-operative pain.

Nurok et al. [49] surveyed surgeons and anaesthetists in the USA enquiring how often they intentionally mis-reported information in the peri-operative setting. Seven percent of the responding surgeons admitted to such intentional mis-representation at least once a month, with two percent of the responding surgeons reporting that patients came to harm due to them representing the truth. Justifications for such mis-representation included that the other party would not understand, or that they would demand unreasonable actions. Almost 70% of anaesthetists were concerned that surgeons mis-reported information to them at least once a month.

Aim for accurate and honest communication.

2.25 Follow Procedures

If I'd observed all the rules, I'd never have got anywhere.

Marilyn Monroe [5]

There may be established procedures in your working environment, existing policies, rules, protocols, pathways. There may be procedures about ordering surgical equipment for theatre cases, how to trial new theatre kit, procedures about on call allocation, job planning, overtime pay, referrals to other providers, admissions from the community.

Such procedures may have been set up with or without your knowledge or contribution, they may seem out of touch or out of date, bureaucratic, slowing progress, unnecessarily labour consuming or expensive. Question the procedures, fight to change them, make your views heard, but try to follow these whilst in place.

- You may be overwhelmed with admissions; should you suddenly send an ultimatum saying that you no longer accept referrals from the Accident and Emergency Department?
- You may feel that your juniors should be more ward based rather than being in theatre; do you just inform them one morning as to where they are now rostered?
- You may feel that your juniors are not delivering the work they get paid for, that their on-calls are not busy enough, should you simply write to them and inform them of your decision to cut their pay?
- You may be the rota master and you are not happy of the rolling rota that is already in place. You feel that all should be on call on one of the upcoming festive days. Do you simply inform them of the new on call allocation?
- You may have just been to a course and you really liked the bowel stapler exhibited. Do you just tell the manufacturer's rep to bring it along to your next theatre list to try?
- You may need a new junior in the department, do you just ask for your friend's cousin to be added to the payroll?

McDonald et al. [50] evaluated the views of doctors and nurses to guidelines and rules in the operating department of a teaching hospital in the North of England. Unlike nurses, who viewed adherence to guidelines and written procedures as essential for professionalism, doctors seemed to reject written rules and be more inclined to follow what they considered to be the unwritten "norms" of the profession.

For a team to function, an institution to thrive, procedures are to be followed, rules to be obeyed. Any change you may want to bring, sound or noble, well-motivated and worthy, may struggle to make it through if procedures and rules are not abided.

2.26 Welcome Innovation

The arrogance of success is to think that what you did yesterday will be sufficient for tomorrow.

William Pollard [5]

We live in a fast changing world, a revolution of innovations. Healthcare and surgery cannot stay immune from such change. We are constantly faced with new ways of doing things, new practices, new techniques, implants, devices. We are faced with innovations aimed at improving outcomes, improving safety, making operative procedures more reliable and reproducible, making surgical instruments and devices more user friendly, allowing treatments to be accessible to the wider community, to the wider world. Innovations that aim to streamline flow, reduce hospital stay, improve efficiency, or reduce costs.

You may face ward rounds with electronic tablets rather than paper lists, electronic radiographs rather than printed films, laparoscopic rather than extensive open surgical techniques, mini rather than lengthy incisions, custom made rather than off the shelf implants, 3D printed rather than factory manufactured splints, electronic rather than hand written records, robotic arms rather than human hands.

Welcome innovation than can improve care, innovation that can enhance the quality of service you provide. Avoid simply staring in the past, refusing to look forwards to the future.

As a surgeon you may have a key role to play in identifying the need for such innovations, in their design, testing, use and dissemination. Try and be the one who can shape innovation, the one who can set the priorities, show the direction. Innovations are likely to happen one way or another, try and be an active participant rather than a bystander.

2.27 Question Innovation

It would be a terrific innovation if you could get your mind to stretch a little further than the next wisecrack.

Katharine Hepburn [5]

Innovations may come about for noble reasons, to improve, to better. Nevertheless, despite their good intentions, question innovations, question their effectiveness, their benefits, their costs, their added new risks. Don't just take them for granted. Something new may not always be so much better, or even just better.

There may be moves to minimally invasive surgery, laparoscopic, arthroscopic, endoscopic, computer assisted, robotic. What is the gain they confer, do they justify any extra costs or time that such procedures may entail? There have been moves to smaller incisions, tiny cuts, but are multiple incisions so much smaller than a single one when you add them all up? Question innovations:

- What is their real aim, their real benefits?
- Do they have improved outcomes, do their improved outcomes matter? If their main outcome is equivalent to existent technologies, could they be better in secondary outcomes?
- Do they get rid of old recognised complications? Do they bring new complications?
- What follow ups do they have? Do we really know what their long term outcomes are?
- Do the described outcomes originate from the innovators or the wider community?
- Is the promised better performance based on simulation, laboratory data or real life outcomes?
- Upon what numbers are the reported outcomes and complications based? Could we just not be fully aware yet of their potential complications?
- What were the characteristics of the population upon which the innovations were tested? Are those results applicable to your patients, to the wider community?

The IDEAL framework [51] is used to describe the stages of innovation in surgical procedures or interventions and gives guidance as to research design types that are appropriate for assessing each stage (Fig. 2.5).

In the idea stage a concept is proven, by describing a case-report to demonstrate that it is possible. In the development stage the number of cases is increased with the aim to demonstrate the safety and success or failures of the procedure. This is further expanded in the exploration phase with prospective studies that have even more cases. In the assessment phase one aims to compare the innovation to another current acceptable intervention through randomised controlled trials. Once the benefits and advantages of the innovation are established and it becomes part of regular practise, long-term surveillance studies (through large registries or databases) may look for rare events or long term outcomes. You may critically examine your practise and question how many of the innovations you encounter have gone through these stages.

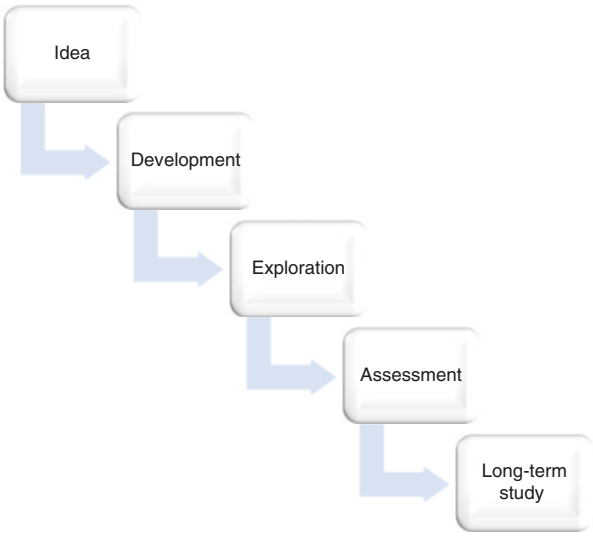

Fig. 2.5 IDEAL pathway to innovation

Listen to the promoters of innovations, to the manufacturers and their sellers, read the promotion leaflets, but also examine the wider literature, speak to colleagues who have used and tried the new proposals. What difficulties did they face? What complications have they seen? How does the new really compare with the old?

If you are satisfied with what you use, if what you use has been tried and tested, has proved the test of time, should you be changing for a promised yet unproven future? New innovations may solve old problems but may also introduce new ones, new risks, new troubles.

If you are flying to the other side of the world would you like to be on a plane design that has done the miles, flown through storms and turbulence, by experienced and not so experienced crew, one that has a safe track record, or would you choose a plane that has just come out of test flights but promises bigger leg space and an uninterrupted smooth flight? The wing cracks that the giant Airbus A380s initially faced [52], and the easily inflammable lithium batteries that the Boeing's Dreamliners initially battled [53], may help focus minds. The choice is personal but at least consider what you are getting into.

Nieuwenhuijse et al. [54] carried out a systematic review to assess the safety and effectiveness of five recently introduced innovations in joint replacement (hip replacement ceramic-on-ceramic bearings, modular femoral necks, un-cemented monoblock cups, high flexion and gender specific knee replacements). They examined published research studies and national joint registry data, but could not find high quality evidence supporting the use of these innovations. In contrast, the authors reported that the available evidence suggested that existing hip and knee replacement implants may be safer than the newly introduced innovations.

You may decide to err on the cautious site, and wait for long term results before you make the transition. But, even if you make the jump early on, do so in a controlled way, explaining the limitations of the new innovation to your patients, closely monitoring your results and the results of your peers.

2.28 Choose Implants Wisely

If we choose, we can live in a world of comforting illusion.

Noam Chomsky [5]

As surgeons we may insert implants, joint arthroplasties, tendon substitutes, hernia mesh grafts, vascular synthetic grafts, cardiac valves, breast implants, fracture fixation devices. Sometimes you may be spoilt for choice—multiple implant types, multiple manufacturers, variable costs. Which one to choose, which one is better, it can be a real challenge.

Be considerate in implant selection, look at their specifications, long term outcomes, complication profile, and make informed choices. Even if your options are restricted by the institution you practise in, by your partners or colleagues, be an active contributor to any choice made.

A new implant based on a previously successful one, made by the same company, may not confer the same results. An implant made by one company that is similar (but not identical) to an implant of another company, may not give the same outcomes. Changes in material composition, geometry, surface finish, shape and size, may exert substantial effects on an implant's behaviour. Small design or manufacturing changes may have profound effects on durability or longevity.

Hip replacement surgery is a commonly performed procedure, which gives reliably good results. There are multiple hip replacement implants available, some of which have been in use for more than 20 years and have been shown to have successful outcomes. Sir John Charnley is considered one of the fathers of hip replacement surgery, with his hip replacement design showing long lasting successful results with more than 90% survival rate at 10 years, and more than 70% survival at 20 years following implantation [55, 56]. In the early 1990s the company 3M Health Care Ltd. introduced a new hip implant, the Capital hip design. The Capital hip was described as a low cost copy of the Charnley hip replacement implant. However, there were minor differences between the two, with regards to surface roughness and geometry. These differences were small, but critical enough to lead to early stem loosening, 16–26% at just over two years, a catastrophic high early failure rate. The capital hip was withdrawn from the market in 1997 but before its withdrawal, almost 5000 such prostheses were implanted in multiple centres throughout Britain [57].

High failure rates have also been observed more recently with metal on metal hip replacement implants. Traditional hip replacement prostheses involve a metal ball articulating with a polyethylene cup. In an attempt to reduce wear and increase implant longevity, metal on metal implants were introduced, which involved a metal ball articulating with a metallic cup. Mr. Derek McMinn, an Orthopaedic surgeon,

introduced the Birmingham hip metal on metal replacement system, which has been shown to confer good long term results, with an estimated ten year revision rate of 4.5% [58]. Another company, De-Puy Orthopaedics introduced its own version of metal on metal replacement, the ASR, which although similar, had critical geometrical differences. The ASR led to a high failure rate, 5.6% to 31% at four to seven year follow up, and was withdrawn in 2010 [59–61].

Similar troubles have been seen for breast silicone implants made by Poly Implant Prothèse, a French company. Inferior silicone was used, leading to higher than expected rupture rates, causing anxiety and fear in thousands of patients who had these implants [62, 63].

Be cautious in implant selection. Choose implants based on their record, their long term outcomes and results. A proactive or persistent manufacturer's salesperson, aggressive marketing, low cost, or use by folks or rivals are not appropriate selection criteria.

2.29 Appreciate the Limitations of Technology

It's supposed to be automatic, but actually you have to push this button.
John Brunner, Stand on Zanzibar [5]

Recent years have seen a technological explosion with high resolution cameras for minimally invasive surgery, computer assisted or computer guided surgery, or even robotic surgery. Technologies that aim amongst others to improve visualisation during surgery, allowing one to get to spaces that haven't been scoped before, fine tune the traditional eye-balling of jigs and cutting blocks to facilitate implant positioning and alignment, or to improve hand steadiness and dexterity. Embrace technology but appreciate its limitations.

Appreciate that in some cases the output of electronic devices may depend on your input. If your entry is incorrect, the complex calculations and instructions that the device provides may also come out wrongly. A computer may be able to fly the plane, but relies on the correct destination coordinates being keyed in. Too much reliance on technology may lead to unwanted results. Faulty instruments, complex situations, over reliance on default values, may lead you in the wrong direction.

In computer assisted knee surgery an electronic stylus that can record 3D position in space may be used by the surgeon to record the spatial position of bony landmarks around the knee, as well as lower down the ankle. These landmarks are then used to calculate the optimal alignment axes of the leg and guide as to the direction and orientation of bone cuts, in preparing the bones for prosthesis implantation [64]. But if the initial stylus marking of landmarks is not accurate, then subsequent calculations and directions may be wrong [65].

Get familiar with the devices you employ, know the technology you use. You may find yourself in the surgical theatre, with staff that are inexperienced, who haven't joined you before. They may not be familiar with the equipment used, and their supervisor may be out on a lunch break. Know how to set up the arthroscopy pump, the laparoscopy camera, the diathermy, the tourniquet, the shaver or the drill. Be able to recognise an equipment failure, know how to deal with it, how to take over, or adjust course if technology were to let you down. What does the beep from the diathermy mean? Why are the bright lights on the laparoscopy stack flashing?

Pilots recognise the limitations of technology and are prepared to take over, to fly the plane if the autopilot were to disengage. Shouldn't be that surgeons appreciate the limitations of technology and train to adjust if technology let you down?

2.30 Pass on the Craft

If I don't have wisdom, I can teach you only ignorance.

Leo Buscaglia [5]

Aim to pass on knowledge, clinical and surgical skills. Train your juniors, your seniors, your colleagues, you peers. For a profession to survive, skills must be passed on.

You may not have a formal trainer's role, you may feel that you are not a skilled lecturer or teacher, but you may still try in every opportunity, no matter how short that is, to pass on skills. You may not feel that you have something innovative to say, that your students may have heard it all before, but repetition reinforces knowledge, may confirm that what is known is correct, that it is main stream practise.

Even if you don't communicate knowledge, how to handle the scalpel or use the robot, one may pass on skills of decision making, critical thinking, questioning mind, coping under pressure, the skills of acceptable professional conduct.

In a fast demanding world of pressurised healthcare care systems one may be absorbed in productivity, financial or other targets. Co-workers may simply want you to finish the clinic early, avoid overruns in theatre. Teaching or training activities may not be formally recognised, or co-workers may even complain that time spent teaching your juniors is under-used time.

Pass on the craft. One may achieve much more by training others who then go on and successfully practise, rather than simply through their own personal surgical practise.

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Chapter 3
Communication in Surgery

Communication is defined as the "exchanging of information by speaking, writing, or using some other medium" [1].

However, communication is not simply the exchange of information, the sole passage or receipt of facts and knowledge. Communication also forms the cornerstone of interpersonal relationships [2], the ways in which we interact with our patients, colleagues, juniors and peers.

Communication is a two way process whereby we speak and talk but also listen and hear. Communication may be verbal or written but also expressed through body language, facial expressions, attitudes and gestures. Communication may be emotional, transmit or carry emotions.

Understanding the importance of communication in our daily surgical practise and recognising the need to communicate effectively are important skills to develop. The first part of this chapter discusses some basic concepts of communication and ways in which one may improve their communication skills. The second part focuses on the process of communicating to patients surgical treatment options, shared decision making, and obtaining consent for surgical interventions.

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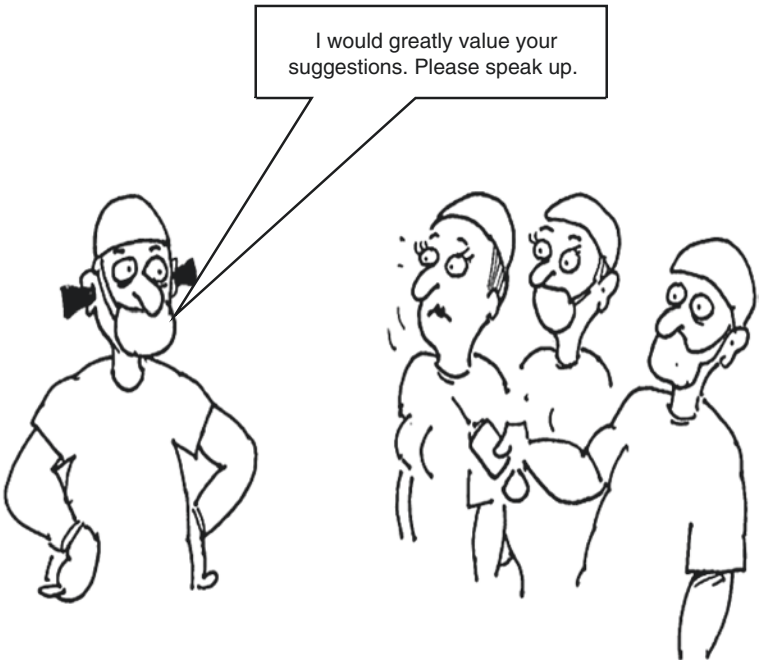
I would greatly value your suggestions. Please speak up.

3.1 Basic Concepts in Communication

In considering communication you may consider the following basic concepts that may help critically question and possibly improve your communication skills. These may be applied in your interactions both with patients but also co-workers.

3.1.1 Introduce Self and Get to Know Others

> *Lesson one, introduce yourself to everyone when you walk into a room. Don't act like you're too bougie to say,* 'Hello.'
>
> Estelle [3]

State who you are, what your role is, why you are there. Ask who you are dealing with, who they are, how they happen to be there.

Should you be spending the whole day in the theatre without knowing the name of the anaesthetist putting your cases to sleep, the name of your junior holding the pelvic retractor, the name of the radiographer trying to give you a sharper image intensifier picture? They may be agency rather than regular staff, they may have been dragged in because your regular co-workers are on leave, they may have just started a new post, or you may be operating in a new hospital and haven't met them before. You may end up spending years as co-workers or just a few hours together. Should you not know who they are, should they just assume as to who you are?

3.1.2 Choose the Words and Tone

> *People may hear your words, but they feel your attitude.*
>
> John C. Maxwell [3]

Choose the words wisely, based on the situation, based on those you are communicating with. Choose the words that will allow you to clearly transfer the message across, ones that can be easily understood by the other party, words that will help strengthen relationships and build bridges rather than construct walls.

- Consider the complexity level of your speech; will others understand what you are trying to say?
- Avoid jumping into saying just for the sake of telling; will what I say upset the other party? Can I be more courteous in what I say?

Use simple language. Avoid technical terms, medical, surgical or managerial jargon, abbreviations, terms that even technocrats may have difficulty to grasp; they may sound clever but may not mean much to your listeners [4]. Tailor your language to your audience. Start with the basics and then build up. The aim is not to impress with your knowledge but to pass a message.

It may also be important as to how we say things rather than simply what we say. Ambady et al. [5] looked at the relationship between the voice tone of general and orthopaedic surgeons whilst conducting clinic consultations and related that to their malpractice history. Surgeons were taped whilst speaking to their patients and voice tone only recordings were then rated for several parameters including dominance and concern/anxiety. They reported that surgeons rated as more dominant and less concerned/anxious on their voice tone were more likely to have had malpractice claims against them rather than those rated as less dominant and more concerned. The authors of that study suggested that voice tone dominance (characterised by loud, fast, clear, unaccented speech) and lack of anxiety in the tone may indicate to patients lack of empathy and indifference by the surgeon, hence leading to a higher chance of getting sued.

3.1.3 Body Language

> *What I really like doing is storytelling, finding the body language that is necessary for the story.*
>
> Patricia Birch [3]

Use body language [6–9] appropriately.

- Maintain eye contact, avoid distractions such as speaking whilst simultaneously typing on the computer, writing notes, reviewing radiographs or scans.
- Face the patient when talking—turn your chair, adjust your seat.
- Be at the same level as the patient—sit down, on the bed or chair, it doesn't take long to stand up again.
- Use appropriate body cues—head nodding, direct body orientation, maintaining eye contact, leaning forwards.
- Avoid distancing behaviours—absence of smiling, avoiding eye contact, crossing arms.
- Be close to the patient—avoid simply standing at the other end of the consultation room, looking distant and detached, looking as if you are about to open the door and get out.
- Make it clear that you attempt to minimise distractions—close the door, draw the curtain. Give the impression that any time spent is truly devoted to the individual, is not a rushed consultation.

3.1.4 Listen

> *Two monologues do not make a dialogue.*
>
> Jeff Daly [10]

Communication is a two way process and it's not just about talking but also about listening.

Listen to all. Listen to those who are well spoken, who are articulate with high pitched voice. But listen equally to those who are not great masters of the spoken word, who may stumble, who may be soft spoken. Tell them that you are not dismissing anything, make it clear you are listening to their worries or concerns.

Listening is not just about receiving information, or acknowledging the receipt of such information, but also about acting based on that information, rather than just putting it on the side. What may sound trivial to you may be vital to your patients or your co-workers. Listening is more than mere hearing.

Many of us like our coffee in a specific way, with no sugar, skimmed milk, no cream, with an extra shot, half full cup, not too hot or on the ice. And even though the menu just says "coffee" we still expect the barista to listen to our small but so vital special requests. And how does one feel if our requests are dismissed or told "it's not possible", when we have had our "custom made coffee" over and over again? How does one feel if the barista looks at us, hears what we say, nods, and still makes us a "coffee" rather than our "individualised coffee"? How do we feel if the barista sounds abrupt or dismissive? Do we enjoy the rest of our coffee shop visit, or do we regret stepping in there in the first place?

If we expect to be heard at the coffee shop, should one not expect to be listened to and their individuals circumstances accommodated at their clinic visit, at their surgical consultation? Should one not expected to be listened to by their leaders, seniors, colleagues, juniors, or followers?

3.1.5 Repeat in Different Ways

Repeat in order to get a message across. Repeating in the same or different words, may help re-inforce what you are trying to say.

And if you are asked a question in an unclear way, you may unpick the question and repeat it back so you all understand the question correctly, rather than simply jumping straight into an answer.

3.1.6 Do You Have Any Remaining Questions?

It's one of the last chances not to leave anything unanswered. It shows that you are not there just to talk but also listen, it is an opportunity to clarify any unresolved issues. It may also show that you are not rushing to get out of the consultation room, to go and do something else. And if after you walk out of that door, you still feel that the consultation didn't go as it should, that you may have been abrupt, cutting the conversation short, that your patient may have felt rushed, nothing stops you from going back, and asking once more

- "Is there anything else you would like to know, anything else to be discussed?"

3.1.7 Check that Information Has Gone Across

We often pass information but are not really sure if it has gone across, if it has been understood and registered.

Checking that information has gone across, can help ensure that everyone is on board, all share a common understanding. In doing so you may consider:

- Warn the other person that you will ask them to repeat the information they are about to receive.
- Ask the receiver "What is your understanding of what I have just said?".

3.1.8 Summarise

- You may explain to your patient the pros and cons of surgery, the risks and benefits, the multiple treatment options.
- You may give a long history about the patient's presenting complaint and examination findings to your senior.
- You may provide your junior with a detailed analysis of your thought process in coming up with your management plan.
- You may have written a long letter to a referring physician to explain the need for the patient's medical condition to be optimised prior to surgery.

There is so much attention one can pay to what we say, so much information one can process, understand and easily recall. Develop the ability to try and summarise what you have said, to give a succinct snapshot of what has just been heard. Once you go through all the information, try and summarise as to what it all comes down to.

3.1.9 Pick the Cues

The most important thing in communication is hearing what isn't said.

Peter Drucker [3]

Sometimes others don't come out with what really concerns them, don't vocalise their worries, and simply try to give verbal or no-verbal cues. They may leave what they want to say behind, with the hope that you will somehow work it out, that you will be sensing their anxiety.

- A patient may be asking you about the usual length of stay following a knee replacement, but may be worried of going home early as they won't have anyone to look after them.

- A patient may be asking you about the type of anaesthesia they will be having, but may be really worried about getting sick like last time they had a general anaesthetic.
- A junior may be showing you a fracture on a radiograph asking you what to do, but is really worried about the possibility of this being a secondary given the history of prostate cancer.
- A junior may be enquiring your management decision trying to put across that there may be facts that you have overlooked.
- You may be introducing a new pattern of ward based working for juniors. You explained to all, you feel it's all well laid out, but someone keeps enquiring about what it will all mean. Are they simply being awkward or should you be rethinking your proposals?
- Someone may read by mistake the wrong hospital number whilst checking a patient for surgery. Was it a slip of the tongue or have they just identified an error?

It may be unusual that someone directly says that "I'm really worried" or "I'm really anxious", but it may be said by the tone of their voice, their facial expression, the hesitation in their speech, the pause in their talk, their deep thought. They may keep revisiting a subject, asking an unusual question or a question out of context, repeating a question, looking unsure, avoiding eye contact, sitting with arms crossed, keep nodding, covering their mouth, rubbing their neck, lowering their tone, slowing down, not saying many words or staying silent. These are just some cues that may make you think, is there anything else going on, anything else I should know? An open question along the lines of:

- "Why are you saying that?"
- "What are you worried about?"

may help them open their heart and express their worries.

Sometimes, the cues are not so obvious for us to recognise. An ending question may help gather important left out information:

- "Is there anything else you are concerned about?"

3.1.10 Empathy

No one cares how much you know, until they know how much you care

Theodore Roosevelt [3]

In our out of work interactions with friends, relatives or acquaintances, we often acknowledge the suffering of others, their concerns, the difficult times they are going through. We may do so because we feel that recognising such difficulties is part of human courtesy and may help strengthen our inter-personal relationships. We may also understand that even though we cannot take over their worries, a

comforting word and an acknowledgment of the troubles others experience can give hope in times of despair.

Similarly, we often acknowledge the enthusiasm, joy and happiness our friends feel when things are going well, when getting a new job, moving into a new house, passing a difficult exam, getting married, having a new-born baby. We may feel that acknowledging success may be just as helpful as sharing troubles.

In dealing with patients we may be taught as part of our training, in medical school and afterwards, to distance ourselves, not to get too close, not to get involved emotionally with other people's suffering, to help avoid psychological overloading, excessive stress and burnout. But one may still express empathy whilst not taking someone else's weight on their shoulders. Steinhausen et al. [11] showed that physician's empathy was the strongest predictor of a better subjective evaluation of treatment outcomes by patients at 6 weeks and 12 months following general surgical trauma. Empathy has been also associated with adherence to treatment and overall satisfaction [12, 13]. However, Levinson et al. [14], in a systematic review of studies evaluating surgeon-patient communication, reported that even though surgeons were thorough and devoted ample time in providing information to help patients decide about treatments, they did not perform well in exploring the concerns or emotions of their patients or in expressing empathy.

Although patients seek consultation about their own health problems, in their conversation with doctors they may mention other events happening in their life, positive or negative. One may decide to ignore these if not relevant to what the consultation is about, or listen and respond appropriately. You may acknowledge the pain of a patient losing a close relative, the financial hardships due to their recent job redundancy, or you may congratulate them on mentioning that they just got back from their honeymoon, that their daughter has just started university.

Similarly, in our communication with colleagues and co-workers, we may consider their emotions and feelings, rather than simply focusing on emotionless exchange of work related information.

- We may acknowledge the stress, worry and pressure a colleague faces due to an unexpected complaint or medico legal suit, rather than just sticking to the technical advice as to how to construct a reply letter or which lawyer to consult.
- We may acknowledge how hard it must be for a colleague returning to work from a personal bereavement, rather than just advising them on ways to reduce their follow up clinic appointments.
- We may acknowledge how difficult it must be for our junior to keep studying for the upcoming fellowship exams whilst caring for an unwell parent, rather than simply stating possible viva questions they may be asked.

We may sometimes hear of the "nothing personal, it's just business" [15] but one may consider that humanity and professionalism are not mutually exclusive.

3.1.11 Communicating Urgency

Lightning shall be slow to my hasting.

E.R. Eddison [16]

Communicating urgency or how critical a situation is, may be vital when other members of the team do not have all the knowledge, training or skills to see the full picture.

Rather than simply stating the need for urgency, explaining the reasoning for such urgency may help. Explain the dangers from not acting quickly, and the gains from acting promptly:

- You may have a patient with a nasty elbow fracture with a pulseless arm, or an acute appendicitis case who is becoming septic and you need to take them to theatre for immediate surgery. You ring the emergency theatre bleep holder to book the patient and ask them to send for the case. Explain why the case has to take priority, why it has to be dealt with straight away, the grave consequences if you don't get them to theatre on time.
- You may need to send a referral letter to the oncology team based in a different hospital, for an urgent case review. You ask the secretary to send the letter through. Explain why the patient has to be seen promptly, to allow the secretary to fax the referral, ring through and confirm an early appointment date, rather than just putting the letter in the routine post.
- You may be asking the on-call physiotherapist to see your post-laparotomy case for chest exercises. Explain the need to be seen over the weekend rather than waiting for Monday, as the patient has signs of atelectasis and it is only a short window before developing a full blown chest infection.

3.2 Shared Decision Making

My job is to make images and leave the decision-making and conclusion-drawing to other people.

Laurie Anderson [3]

In clinical practise decisions may have to be taken with regards to investigations or treatment. Reaching such decisions requires close communication between patient and surgeon.

Shared decision making involves a bi-directional exchange of information between surgeon and patient, to help reach a mutually accepted decision with regards to investigations or treatment, rather than simply the surgeon disclosing information and recommending a line of action.

Shared decision making, refers to approaching each case in an individualised way, as well as communicating and considering those unique factors that come into play. It involves exploring the preferences of the patient, and their special circumstances that may influence the intervention or treatment choice [17, 18].

Shared decision making may facilitate communication, increasing patients' knowledge of risks and benefits, allowing more accurate risk understanding, recognition of any uncertainty that may exist, helping patients reach a decision, and leading to greater acceptance of the decision. Decision sharing may involve questions and answers which can take place over multiple meetings. It starts at the first encounter in clinic and up the point where the patient has the investigation or intervention. It is often said "never talk a patient into surgery" [19] as those who may have hesitations about proceeding but who are eventually persuaded, may look back with regret, more likely to be unsatisfied or have poorer outcomes [20, 21]. Shared decision making involves reaching a mutual decision with which both parties are comfortable and accept.

An integral component of shared decision making is the consent process, and this is discussed next. Risks and benefits which may be acceptable to one patient may not be acceptable to another and this must be carefully considered.

3.3 Consent

Consent is defined as "permission for something to happen" [1], a prior agreement as to what will occur. Informed consent in surgery is considered as permission to proceed with a surgical procedure, given in knowledge of the possible consequences. Obtaining informed consent is an integral part of a surgeon's practice and one that combines communication as well as documentation skills.

Even though the exact rules and regulations around consenting may vary between institutions, regulatory bodies, states or countries, the principles of obtaining informed consent are similar and the ability to obtain such consent is an important skill to develop.

Like in other forms of communication, use plain language, easily understood by the patient, avoid medical jargon and any abbreviations. "Translate" to the patient any medical terms you use or write down; a laparotomy may be described as a "cut though the tummy to open up and have a look at the internal organs" or arthroscopic surgery may be described as "keyhole surgery".

Informed consent may be documented using a pre-designed form of your institution. It is important to adequately fill those forms, and any parts of the form which are not applicable to the specific case marked as such, rather than simply left blank, to avoid confusion. If adequate space is not provided on the form to document all that has been explained, additional information may be recorded on institution headed paper which can then be attached to the consent form and filed in the patient's notes. Inadequate space on the form is not a reason for not documenting communicated information. In completing the consent form it may be better to use capital letters, and write clearly so there is no doubt as to what is documented.

In addition to the above, there is a need to consider what information needs to be communicated to the patient, who can obtain informed consent, who can provide informed consent, and the timing of obtaining consent in relation to surgery. These considerations are discussed next.

3.3.1 Information to Be Communicated in Consenting

The following information may be communicated to the patient as part of informed consent.

The surgical procedure to be performed: state the exact procedure to be performed (the one that will definitely be carried out) and any procedures that may be performed (depending on findings).

Be specific in describing the procedure: e.g. if one describes a "total knee replacement" but the patella is not routinely replaced then explain that to the patient. Document that it will be a "knee replacement +/− patellar replacement" to avoid someone having a "total knee replacement" only to find out later that their patella was not replaced.

If one is not certain of the exact procedure to be performed, as that may depend on the intra-operative findings, this needs to be communicated and documented appropriately: e.g. you may state "arthroscopic evaluation of the knee + proceed depending on findings" or "exploratory laparotomy of the abdomen + proceed depending on findings". Alternatively, you may state the procedure options: e.g. a patient may be consented to have a uni-compartmental knee replacement but if at the time of surgery they were found to have extensive arthritis then that will be converted to a total knee replacement.

Describe the mode of anaesthesia, and any anaesthetic risks. Often the anaesthetist explains the exact anaesthetic measures to be employed, as well as the specific risks associated with anaesthesia. However, the surgeon can still confirm that this explanation has taken place and help clarify any remaining queries. The patient should have a clear understanding as to whether the procedure will be carried out under a local anaesthetic, under a regional block, under spinal or epidural anaesthesia or under a general anaesthetic (GA). The possibility of having to revert from non-general anaesthesia to GA intra-operatively also needs to be discussed. Patients may have strong preferences for one type of anaesthesia over the other, and this should be taken into consideration. If the patient is refusing to accept the possibility of GA you may come to the shared decision that you could attempt to perform the surgery under regional or local anaesthesia (if feasible) but the procedure may have to be abandoned if adequate pain relief could not be obtained.

Potential benefits of the procedure: state why the procedure is performed and what the potential gains are. This may be amongst others to help diagnose a disorder, to improve pain, to improve function, to improve mobility, to prolong survival, to save limb or life. Explain to the patient the potential benefits in a balanced way, without exaggerating the benefits or playing down any potential gains.

Risks of surgery: state what could go wrong, what complications could arise. Explaining risks is vital, as it allows the patient to appreciate what they are getting into, and further helps in making an informed decision. You may be more forgiving for those plane bumps or shakes if the pilot warned you of some expected turbulence ahead (even though deeply inside you hoped they wouldn't be encountered) rather than if you were promised clear skies and a smooth flight simply to be thrown off your seat halfway through.

You may divide complications into:

- Intra-operative, early post-operative, and long term complications.
- Generic complications (such as infection, failure of surgery to improve symptoms, neurovascular injury, bleeding, wound healing problems, haematoma formation, tender scar, prominent scar) versus procedure specific complications.
- Complications associated with the underlying condition itself versus those directly related to surgery e.g. avascular necrosis is a recognised complication of intra-capsular hip fractures, even when these fractures are perfectly fixed, as this complication is related to the vascular disruption which occurs at the time of the bone fracturing rather than being due to the surgical fixation per se.

It may be useful to have a list of the various risks to be explained, to avoid relying on memory, as the day you forget to mention the risk may be the day that a complication arises.

Give adequate information about the risks of surgery, but also explain the probability of such events occurring. Explain the individualised risk that may exist in some cases, such as the increased likelihood of diabetics developing infection or wound healing problems, or a history of keloid scars predisposing to further prominent scars.

There is debate amongst the surgical world as to what potential complications should be explained to the patient; one may consider that in addition to explaining common complications, any rare but important complications should be described. In the UK, this follows a case law judgement (Chester vs. Afshar), whereby the patient was not informed with regards the risk of cauda equina during spinal surgery (a very rare complication) and was left partially paralysed [22]. It was concluded that failure to warn the patient of the risk related to surgery, no matter how rare the risk is, could deny a patient the ability of making a fully informed decision.

Explain what the potential complications mean, what may happen if those occur, what their impact could be.

- Infection following knee replacement may be perceived as a "superficial wound infection that settles with few days of antibiotics", but may also mean the need of revision surgery, whereby implants have to be removed, a spacer implanted and further implants inserted at a later stage, a long protracted and painful course.
- Instability following hip replacement may be perceived as "a bit wobbly" which is different from the hip coming out of joint and needing further revision surgery.
- Arterial damage may sound like "a bit of bleeding", but in severe vascular injury it could lead to someone losing a leg.

It may help to remind patients that you are not trying to scare them by explaining these risks, but it is part of your professional obligation, and that you tend to explain such risks to all patients having a particular procedure.

In explaining the risks of surgery one may consider the benefits of the surgical procedure versus the possible consequences if a complication arose. You may be questioned as to whether it is worthwhile having surgery and taking the risks. What the author uses is that:

- "It is almost equivalent to considering whether to cross the road; if we need to cross the road then we do so with the understanding that there is a risk of being run over by a car, a tiny but recognised risk that accompanies this frequent activity of daily life. If we do not need to cross the road, then, of course, we would not unnecessarily take the risk of getting run over".

You may be questioned whether the procedure you are describing is a "big" or "small" operation, "minor" or "major" surgery. You may consider that any surgery is "big" or "major" enough for the individual having the procedure. Describing a

procedure as a "routine" versus "infrequently performed" or "short" versus "lengthy", a "low risk" versus "high risk" may be more appropriate.

Post- operative course: State what will happen post surgery if all goes as planned, the expected course of improvement and rate of recovery, the need for gradual adjustment and rehabilitation, the possible need for splintage, length of hospital stay, weight bearing status, return to work, return to drive. State as to whether any follow up procedures may be needed such as removal of metalwork inserted to fix an ankle fracture, reversal of an abdominal de-functioning stoma, as well as the timing and the factors that may guide to performing those. Explain the possibility of needing an intra-operative or post-operative blood transfusion and discuss alternatives in those who object, such as Jenovah's witnesses.

Operating surgeon: State who will be doing the procedure, especially if trainees will be involved. The patient may have strong preferences as to who will be the surgeon. You may be working in an institution where trainee surgeons may perform surgical procedures under the direct supervision of their seniors. Explain that to the patient prior to the procedure and respect their wishes. If applicable to the procedure in question, it may be useful to explain to patients that there is evidence that a trainee doing the operation under direct supervision is not associated with substantially more complications or greater length of surgery [23–25].

If you are not the person directly in charge of the patient's care (you may be a trainee or a more junior level staff) and you are to perform a procedure in the absence of direct supervision by the surgeon in charge, explain that to the patient. If applicable, you may explain to the patient that you are confident in performing that procedure, that you have performed that procedure multiple times previously, even though you are not "the boss". You may explain the possible delay that may occur if they want to have surgery by a specific surgeon, that they may have to be cancelled on that day, or postponed. Nevertheless, it would be unwise to pressurise in order to convince a patient otherwise, once they have decided that they want the particular procedure to be performed by a specific surgeon.

The same may also apply to more senior surgeons, if the patient is enquiring about whether you are highly experienced in a particular procedure as they are looking for a super-specialist. It is better to be open and transparent early on about your experience with the procedure in question, rather than having to explain in retrospect after a complication occurs. Being questioned about your level of experience should be understandable and acceptable; after all, isn't it that when booking a flight some of us would like to know how experienced the pilot will be, how may flying hours they have clocked in that type of aircraft, how many storms they have flown through?

3.3.2 Who Obtains Consent

In an ideal practise, if you are performing the procedure it is better to obtain the consent yourself. Nevertheless, in a busy surgical practice you may delegate the task, but ensure that your delegate is able to obtain adequate consent.

If you are going to delegate consent to another professional, you may still explain yourself the benefits and risks at the time of the initial clinic consultation and go through the consent again just prior to surgery, to ensure that all relevant information has been communicated and thoroughly explained.

If you will not be performing the procedure and you are only obtaining consent make that clear to the patient. If you are not able to answer all the patient's queries, accept your limitations and offer to find and provide that information.

Follow the rules of your institution, your regulatory body, the healthcare system you are practising in. In the UK, the General Medical Council (GMC) advises that informed consent should be obtained by someone who is appropriately trained and qualified, someone who has adequate knowledge of the proposed procedure, its potential benefits and risks, to provide an adequate explanation as to what the procedure entails [26].

3.3.3 Who Can Provide Informed Consent

Consent to surgery may be given voluntarily by an individual who is adequately informed, and who has the capacity to do so.

What constitutes capacity to give Consent, may vary in different countries, but in the UK the Mental Capacity Act of 2005 [27] states:

"a person lacks capacity in relation to a matter if at the material time he is unable to make a decision for himself in relation to the matter because of an impairment of, or a disturbance in the functioning of, the mind or brain".

The act [27] also describes that a person is considered as not able to decide for themselves if unable to:

1. Understand the information needed in deciding.
2. Retain the relevant information.
3. Use the relevant information in making a decision.
4. Communicate their decision by any means.

Mental illness does not necessarily preclude from being able to make an informed decision. Similarly, young age does not preclude from providing informed consent if one has the capacity to do so.

If an impairment of capacity exists and one is unable to make informed decisions other arrangements may need to be made. It is important to understand the regulations of the regulatory body and legal framework in which you practise. In cases where there is lack of capacity the GMC, in the UK, advises that in your considerations you should have above all the patient's care, treat them as individuals, respect their dignity, support them in getting involved as much as possible and as much as they wish in decisions about their care, and not discriminate against them [26].

The individual may have previously expressed what would have liked to happen in such circumstances, and stated such preferences in an advanced directive, or relatives and friends may be aware of such wishes. Discuss with the individual who has

legal authority to decide on the patient's behalf, and try and reach a consensus about any proposed treatment. In many cases consensus will be reached but you should be aware of the escalation pathway in your healthcare system if there were to be disagreement. In cases where agreement as to the proposed action cannot be reached, one may consider involving an independent advocate, more experienced colleagues, or mitigation services. Legal advice and court rulings may have to be sought and obtained.

In emergency situations whereby the patient cannot consent, and their exact wishes cannot be promptly obtained, one may act in what they consider to be the best interests of the patient, without obtaining consent. Again be aware of the legal framework in which you are practising but in the UK the GMC states [26]:

> *"when an emergency arises in a clinical setting and it is not possible to find out a patient's wishes, you can treat them without their consent, provided the treatment is immediately necessary to save their life or to prevent a serious deterioration of their condition".*

Other issues to consider include the legal age of consent, how is consent obtained in people younger than this legal age but who have the maturity and capacity to consent, who gives consent on behalf of young people who lack the capacity to do so, and refusal of a child's parents to treatment.

In the UK young people are presumed to have capacity to give consent at 16 years of age [28, 29]. Nevertheless, children younger than 16 may have the capacity to give consent and they should be assessed on an individual basis. A young person under 16 who is considered capable of consenting, is referred to as being "Gillick competent". This is based on the Gillick vs. West Norfolk and Wisbeck Area Health Authority (1986) case whereby Mrs. Gillick challenged the relevant health authority about the practise of doctors to provide contraceptive advice and treatment to girls under 16 without parental consent. The House of Lords concluded that a doctor could give contraceptive advice and treatment to a child younger than 16 without the parents' consent or knowledge, if this is in the best interests of the girl, the girl can understand the advice and cannot be persuaded to tell her parents or to allow her doctor to tell them [30]. Young people can be encouraged to involve their parents in making important decisions but one must follow their decision if they have the capacity to decide themselves. It is of note that although the Gillick case was specifically about contraceptive advice and treatment, the judges also spoke more generally in reference to competence of children in deciding medical treatment [31]. The situation whereby a child is able to consent but refuses treatment is particularly challenging, and seeking legal guidance is advised.

When a young person is not competent to provide informed consent, follow the regulations of your healthcare system as to who needs to be involved in such a deci-

sion. In the UK when a child under the age of 16 lacks the capacity to consent, consent can be given on their behalf by a person who has parental responsibility or if there is disagreement with the proposed intervention, legal advice and court input are sought [26].

Even when a person has capacity to give informed consent ensure that they fully understand the information you are providing. If there is a language barrier, a translator can facilitate communication. If your accent can not be easily understood ask someone else to help, a nurse, other professional or relative, someone who is able to explain in a clearer way.

3.3.4 Timing of Obtaining Consent

Discuss any benefits and risks of a procedure with the patient well in advance to surgery, to allow adequate time to consider those in detail before proceeding. It may be better to consent the patient several days before the operation, allowing them time to take away the information, consider it and if necessary change their mind [26, 32]. This may not be possible in emergency surgery but is usually feasible in elective procedures.

Avoid leaving the consent process to just a few minutes prior to surgery, just before the patient is about to put on the surgical gown. If you are to leave the completion of the consent form for the day of surgery, give the patient verbal or written information about the risks and benefits well in advance, so that they can consider it with a cool mind. In that way, signing the consent form on the day of surgery has a more confirmatory role.

If you have obtained consent prior to the day of the surgery, then on the day of surgery run through the consent form again, to ensure the patient is still agreeable to what has been previously said and that nothing has changed.

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Chapter 4
Organising a Surgical Theatre List

Putting together a theatre list is a task surgeons are called upon to complete on a regular basis. Organising an elective, semi-elective or urgent list, for inpatient or day surgery attendants, requires organisation skills as well as the ability to prioritise. It involves consideration of what goes on the list and in which order, taking into account, amongst others, clinical priorities, safety factors, and available resources.

This chapter discusses some of the factors one may consider in successfully organising a theatre list and in improving surgical theatre list efficiency, to facilitate patient flow. The patient's journey from deciding to operate to reaching the surgical theatre is initially discussed, along with the parameters that need to be communicated in listing a case for surgery. Considerations in constructing a theatre list are then presented, followed by ways in which theatre time utilisation may be enhanced.

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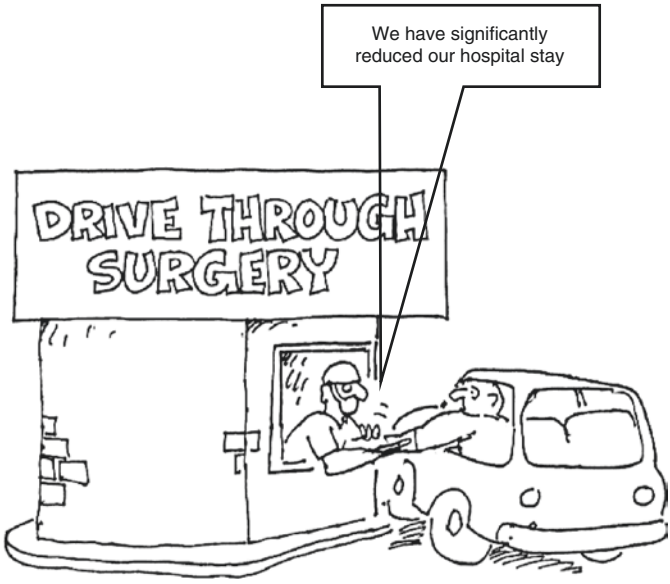
We have significantly reduced our hospital stay
DRIVE THROUGH SURGERY

4.1 The Patient's Journey to Surgery

The patient's journey for elective surgery may be divided into various steps as shown in Fig. 4.1.

Patients are increasingly admitted for elective surgery on the same day of surgery—this aims to minimise hospital length of stay, minimise hospital bed usage, reduce associated costs, and reduce hospital infections such as acquired pneumonias.

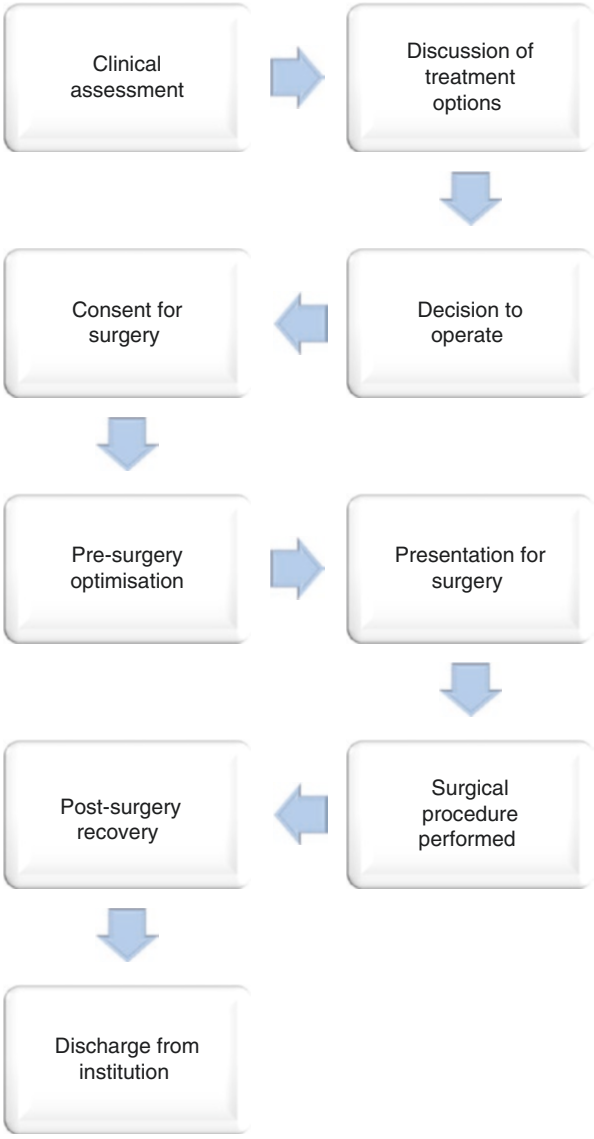

Fig. 4.1 Patient's path to elective surgery

As part of good surgical care the following may be performed along this pathway to surgery:

1. Maintain continuity of care from clinical assessment to post- operative management, with active involvement of the same surgeon or surgical team. Surgeon and patient establish a relation, a shared understanding of treatment, that can see them through the surgery journey ahead. Continuity of care may help strengthen such a bond, ensuring consistent communication and exchange of information [1, 2]. There may be pressures in some healthcare systems in meeting targets, need for pooling cases to match demands, patients passed between teams. Evolving working patterns, with working hour restrictions, may mean that none of us can be available all the time, day or night. Nevertheless, recognising the need for continuity of care, may help you achieve effective handover between surgical teams, whilst at the same time actively involving and updating patients in any transfer of care. Don't leave patients wondering as to who is looking after them, as to who will perform their surgery, or confused by being told one plan of action when initially listed and then told something completely different by someone else.
2. Carry out a final check of the need for surgery—by questioning patients on the day of surgery, to ensure the patient is still symptomatic, and still keen to go ahead. In some elective cases symptoms may have improved between getting listed and presenting for surgery, and even though patients turn up on the day, they may be unsure as what to really do. Questioning about current symptoms may help guide them through such uncertainty, helping some to avoid surgery and some to reaffirm that this is what they really want to do.
3. Carry out a final check of fitness for surgery—by assessing patients on the day of surgery to ensure there are no medical factors that could necessitate postponing or avoiding surgery. The patients may be reviewed by the anaesthetist for anaesthetic fitness but there are also others factors a surgeon may have to consider:

    - Is there any focus of infection, such as a skin boil, close to or distant to the surgical field, that may prohibit the safe implantation of a prosthesis?
    - Has the patient suffered a further, recent injury to the knee that you are planning to replace, and you may need to allow time for the acute inflammation to settle down before going ahead?
    - Is the patient recovering from a recent deep venous thrombosis?

4. Consent patients well before the day of surgery, to allow them sufficient time to consider all pros and cons. Even if not able to go through the full consent documentation and get them to sign the form, describe the risks and inform. Would one be really able to make an informed choice if simply told of the risks just before or just after changing into their theatre gown in the surgical admission suite?
5. If practicalities allow, see the patient in the recovery suite, post-surgery, to ensure there are no immediate post-operative complications:

    - What are their overall observations?
    - Are they coming round from the anaesthetic?
    - Is the limb neurovascularly intact?
    - Is there any staining of the dressing to suggest oozing from the wound?
    - How much is in the drains?

6. See the patient in the recovery suite to ensure the immediate post-operative plan has been followed:

    - Are the prophylactic antibiotics prescribed?
    - Are the thrombo-prophylaxis stockings on?
    - Is deltaparin prescribed in the correct dose?
    - Is the elevation sling applied?

7. See the patient in the post-operative ward, prior to discharge, when they are more alert, to explain the surgical findings, what was done and any further plans. Information exchanged with the patient in the recovery suite, whilst the patient is coming round, may not be registered or recalled, hence better to see them later in the ward or clinic to explain what was found, what was done, and what happens from then on.

4.2 Listing for Surgery

A list is only as strong as its weakest link.

Donald Knuth [3]

Listing for surgery refers to documentation of the need to proceed with surgery for a case, and the plan as to what will be done. Depending on the healthcare system, or institution you are working in, this aims to inform the waiting list coordinator, the theatre staff, the pre-operative assessment staff, the anaesthetic team. Clear, thorough documentation is essential in encouraging safety, avoiding confusion and interruptions to the patient's journey to surgery. The following describes some the information that you may need to provide in filing such a listing:

1. Patient details.
2. Dates of non-availability for surgery.
3. Ensure that the correct contact details are up to date.
4. Procedure to be performed.
5. Side of the procedure.
6. Surgeon in charge of patient's care.
7. Estimated time needed for procedure (taking into account anaesthetic time, positioning time, time for other activities such as awaiting the results of an intra-operative biopsy).
8. Specific anaesthetist to be present—such as one who has the skills of administering a regional nerve block, managing a difficult airway.
9. Proposed type of anaesthetic: general, regional or local.
10. Urgency of time to surgery—state the required time frame for surgery rather than simply stating urgent.
11. Surgical equipment or instruments that will be needed.
12. Special surgical equipment or instruments which will need to be ordered, their provider, and whether the company representative will be required to attend.
13. Whether the patient is a day case or an inpatient.
14. Date and sign entry.

4.3 Putting Together a Theatre List

My to-do list is so long that it doesn't have an end; it has an event horizon.

Craig Bruce [3]

Organising a theatre list forms a big part of a surgeon's working life. Acquiring the ability to organise the theatre list to allow the provision of high quality surgical care, but also efficient and cost effective utilisation of theatre time, is an importance skill to develop. It requires surgical knowledge, understanding of the theatre environment in which such lists are performed, organisational abilities, leadership as well as team working.

The theatre list refers to a specified theatre space, time and location used for performing a particular surgical task. This may be to accommodate emergency or elective patients, to accommodate patients operated upon as day cases, hospital in stays or a combination of both. In planning a theatre operating list the aims are to:

1. Ensure the list will provide high quality care, both anaesthetic and surgical.
2. Allocate patients to the appropriate list.
3. Allow efficient and cost effective utilisation of theatre time, to allow maximum care provision and avoid wastage of resources.

4.3.1 Ensuring Good Surgical Care

The first essentials, of course, is to know what you want.

Robert Collier [3]

In planning a list, one must consider the availability of essential clinical skills, (anaesthetic, surgical, nursing, pre and post- operative care). Carrying out surgery involves having a surgeon along with necessary assistants who are able and well skilled to carry out the surgical procedure, an anaesthetist along with anaesthetic assistants who are able to provide the necessary anaesthesia and analgesia, theatre scrub staff who are familiar with and able to support the procedure, ward or admission suite staff who look after the patient pre-operatively and prepare the patient for theatre, recovery staff who provide care in the early post-operative period, as well as ward and nursing staff who look after the patient up to safe discharge.

Surgeons' increasing subspecialisation may mean that as the depth of their skills increases the breadth of their skills diminishes. In a similar way, non- surgical medical staff may be subspecialised and one grade does not fit all. It may be that only a particular anaesthetist can provide specialised intubation techniques for the difficult airway, or administer specific regional blocks to avoid a general anaesthetic or aid post-operative analgesia. A scrub nurse who has trained in arthroscopic shoulder surgery may not be familiar with various jigs and implants to allow scrubbing for a knee replacement procedure. A cardio-thoracic recovery nurse, highly competent in looking after chest drains and monitoring arterial pressures, may feel unsure as to how to manage an abduction wedge following hip replacement. Along similar lines,

a low grade assistant may suffice in soft tissue retraction during open hernia repair, but a more experienced, skilful assistant may be necessary in open oesophagectomy. A junior assistant may be competent at retracting the open shoulder, but may still be struggling to hold steady the camera to allow suturing in arthroscopic shoulder surgery.

Hospital ward staff numbers may fluctuate with less staffing at nights, weekends or bank-holidays. Hence, the ability of ward staff to closely monitor patients returning from surgery may be better early on in the day and less late at night. Similar considerations may apply to medical staff—if there is leakage from the bowel anastomosis will the shift breast surgeon be able to return the case to theatre or will a more specialist colorectal surgeon be needed? If a complex hip replacement is carried out in a patient who has substantial medical comorbidities on a Friday afternoon, will there be sufficient numbers of adequately skilled medical staff to look after the patient over the weekend?

4.3.2 Surgical List Location

Mr. Breton didn't know about location, location, location.

Daniel Pinkwater [3]

Consider whether the proposed procedure will be performed as elective inpatient surgery or day surgery. Day surgery refers to admission and discharge on the same day. Improvements in anaesthetic techniques as well as advances in minimal invasive surgical procedures mean that an increasing number of operations can be performed on a day case basis rather than patients having to stay in hospital. Cost of hospital beds, hospital related post-operative complications (such as acquired pneumonias) have led to a drive to encourage the utilisation of day surgery. Guidelines by the British Association of Day Surgery [4] suggest that cases meeting the following criteria could be considered for day surgery care:

- Patient consenting to day surgery.
- An adult can escort the patient home and look after them for the first 24 h.
- Medically fit to undergo the procedure.
- Surgery not associated with a significant risk of complications that require medical input (such as haemorrhage).
- Post-surgery symptoms (such as pain, sickness) should be controllable with oral agents or local anaesthetics.
- Patient able to restart oral intake within a few hours post-surgery.
- Patient should be able to at least partially mobilise.

Hence, it is important to identify those patients that potentially could be done as day surgery, and place them on the appropriate list.

In cases where the theatre list is mixed including both inpatients and day surgery cases then the order of the list may influence whether a patient will be able to be discharged safely home on the same day. A patient operated last on the list may not have sufficient time for safe recovery to allow a same day discharge, hence another factor to consider in the list order.

4.3.3 Order of the Surgical List

Like it or not, the world evolves, priorities change and so do you.

Marilu Henner [3]

The main priority in guiding the order of a surgical list, should be clinical urgency or other clinical factors to ensure safe, high quality care. Emergency, life-saving or limb-saving procedures take priority over more semi-urgent cases. Assuming these factors are equal then other parameters may be taken into consideration:

- Diabetics have traditionally been operated first on the list, to avoid extensive fasting and consequent blood glucose derangement. However, it is increasingly recognised that such a strict approach may not be essential [4], but where possible this is accommodated.
- Children are preferably done first on the list, again to avoid unnecessary periods of fasting. If a child cannot be accommodated early in the morning, then a plan may be made for later on in the day, at a predetermined time, and the child fasted in reference to that. Hence, if a child cannot be operated first on the morning list, may be better operated first on the afternoon list and fasted for that.
- Latex allergy—patients who have such allergy, should be done first (after theatre cleansing) on the list, with the necessary precautions taken to provide a latex free environment [5].
- Infected cases should be done last on the list, rather than prior to procedures involving insertion of implants, provided that they can wait. If they are to be done prior to clean procedures, adequate time should be given for thorough theatre cleansing prior to the next case.
- Complex cases:
  - Medically complex cases are better done early in the day to ensure adequate anaesthetic support in the post-operative period.
  - Complex surgical cases preferably done early in the day when the staff are at their best, rather than towards the end of the list when some of us may be getting tired and our concentration may decrease [6, 7].

4.4 Improving Theatre List Utilisation

I'll take fifty percent efficiency to get one hundred percent loyalty.

Samuel Goldwyn [3]

Theatre time is valuable both with regards to opportunity for delivering surgical care but also actual monetary costs. It is estimated that in the UK an hour of operating theatre suite utilisation costs about £1200 [8]. Hence theatre time wastage should be kept to the minimum, but too often this is not happening.

Sultan and the current author [9] evaluated prospectively theatre time utilisation in a district teaching hospital in the UK. They reported that only 54% of theatre time was utilised for operating, whilst 21% was utilised for anaesthetic time, positioning and draping. In addition, 25% of operating time was not utilised due to delays in starting the list and turnover time. At the same institution Singhal et al. [10] reported a 10% same day cancellations in elective orthopaedic cases for patient reasons (such as medical fitness, symptoms improving).

Similar results were reported on the other side of the world, at the Ipswich General Hospital in Australia [11], where it was reported that only about 50% of theatre time was utilised for actual operating, with 16% of time wasted due to late starts, early finishes or as changeover time. Of 3014 elective procedures, 14.3% were cancelled on the day of surgery due to lack of surgical fitness or due to lack of operative time.

In principle, theatre time wastage may be minimised by:

1. Prompt start.
2. On time finish.
3. Avoiding in between interruptions.

4.4.1 Prompt Start

This may be ensured by several factors such as:

1. Having as first case on the list a patient who is medically fit and worked up for surgery.
2. Ensuring the admission suite prepares the patient for theatre on time.
3. Prompt arrival of anaesthetic and surgical staff to theatre.
4. Carrying out the consent process and pre-operative medical assessment prior to the day of surgery.
5. Avoid putting first on the list cases for which specialised equipment must be checked on the day of surgery.
6. Ensuring bed availability for inpatient cases, to avoid delays in starting the list.

4.4.2 Avoiding Early Finishes

This may be achieved by:

1. Avoiding same day cancellations occurring due to various reasons including:
    - Patients not turning up for surgery.
    - Patients found medically unfit on the day of surgery.
    - Clinical symptoms having improved or settled.

Contacting patients, in the week prior to surgery, to ensure they are still symptomatic, to check that they do not have any new onset medical symptoms that would make them unfit for surgery, and confirm they are aware of the arrangements for presentation for surgery, may help reduce the rate of same day cancellations. The above may be achieved through a phone consultation [10], or by brining patients to a pre-operative clinic [12, 13].

2. Having an adequate number of theatre trays and equipment, along with adequate back up, to avoid relying on same day turn around in sterilisation of equipment.
3. Allocating the right number of cases to the time available. Regular evaluation of theatre lists may help identify ones that repeatedly finish early, or have long break interruptions with the aim of adding more cases.
4. Having some flexibility in allowing overrunning of the lists (on the unusual situations that is necessary), to avoid same day cancellations. This can be a challenging arrangement as different staff teams have to be agreeable and on-board.
5. Avoiding compartmentalisation—if one is very rigid into what procedures can be done on a list, then those lists may be under-filled if those cases are not available.
6. Allowing a mixture of long and short cases—even though it may be difficult to squeeze a hip replacement at the end of the list, it may be possible to add a couple of carpal tunnel decompressions; even though it may be difficult to add another laparotomy it may be possible to add a hernia repair.

4.4.3 Avoiding Interruptions

Several factors may account for interruptions including:

- Availability of theatre scrub staff—may be helped by staggering of lunches.
- Availability of anaesthetic assistants—may improve by having one anaesthetist anaesthetise a patient whilst another is recovering the previous case.
- Availability of surgical staff—may be helped by having a surgeon carrying out the full day list or a surgeon staying on until another one arrives to take over. However, there may not be much scope in ensuring that a full day surgeon is available, if other staffing levels do not allow an uninterrupted running of the theatre list.

- Order of the list that requires changing equipment or moving around equipment—may be helped by planning the list to avoid having to change from arthroscopic to open procedures and then back to arthroscopic. May be also helped by avoiding having to swap from a left to a right shoulder and then back to the left.
- Delays in patients arriving to theatre from the ward—may be helped by anticipating the finish of the current case, and sending for the next patient on time, or warning the ward that you will be sending shortly to ensure the patient is ready.
- Delays in patients transferred from the recovery suite to the ward—may be helped by adequate staffing of recovery, and by utilising anaesthetic and analgesia techniques that allow early recovery. In addition, it may be helped by identifying patients who may need high dependency or intensive care and pre-arranging beds in those settings prior to surgery, to avoid having to stay in recovery awaiting for a bed on the day. On occasions, if recovery is blocked then theatres may have to pause.
- Lack of hospital beds—in some institutions or healthcare systems there may be fluctuations in the availability of in-patient beds (due to winter or other pressures) which may lead to same day cancellations. This may be helped by having adequate number of beds, ring-fencing beds (reserved or protected for elective surgery), ensuring that there is a clear process in confirming the availability of beds on the day to allow surgery to proceed promptly, having day case patients on standby who can be brought in at short notice if overnight beds do not become available.
- Nevertheless, the planning of operating theatre lists is not an exact science, and may be influenced by the surgical and overall theatre team, as well as the operative environment and institution in which such surgery is carried out. What applies to one institution, one surgeon, one surgical specialty, one group of patients, may not apply to another. Comparing surgeons and institutions with regards to crude number of cases per theatre list, may be an over-simplified approach, but one should look into and learn from better practices.

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Chapter 5
Technical Skills in Surgery

Much of surgery is operating, a technical craft. Much of what we do is with our hands, whether it's using the scalpel, the scissors, the forceps, the needle, the drill or saw, the endoscope, the arthroscope or laparoscope, the robot or microscope. Technical dexterity is an important skill to develop. At the same time the ability to plan for surgery, and the ability to be movement and time efficient, are important skills to acquire.

This chapter discusses the considerations in planning for a surgical procedure, the challenges faced in surgical training, ways of maximising surgical learning opportunities, ways of improving and maintaining surgical motor skills, learning a surgical technique, and improving surgical efficiency.

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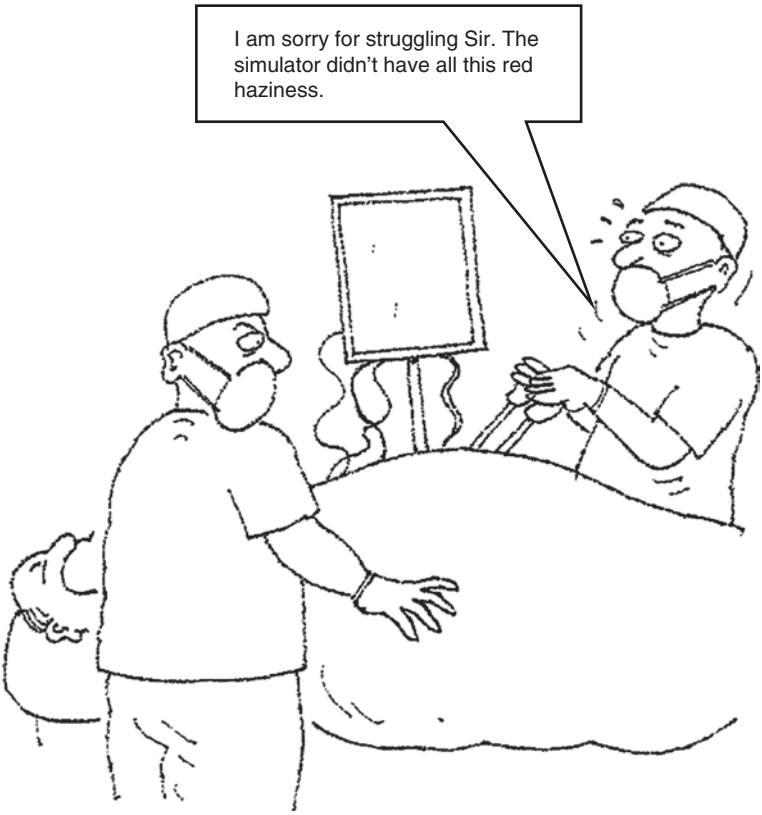
I am sorry for struggling Sir. The simulator didn't have all this red haziness.

5.1 Planning for Surgery

Adventure is just bad planning.

Roald Amundsen [1]

In planning for a surgical procedure, consider the actual surgical steps to be performed, but also all the factors needed to allow successful completion of those surgical steps. Some of these are described below:

General considerations

- Type of anaesthesia
- Analgesia
- Intra-operative monitoring (vital signs)
- Intravenous access
- Antibiotic prophylaxis
- Temperature control
- Glycaemic control
- Thrombo-prophylaxis
- Urinary catheterisation

Personnel choice

- Surgeon
- Surgical assistants
- Scrub staff
- Theatre runners
- Anaesthetist
- Recovery staff
- Equipment support staff

Theatre choice

- Airflow system—for clean surgery
- Spacious to accommodate personnel and equipment

Equipment choice

- Prepping, draping, scrubbing, gowning
- Theatre table to allow positioning, facilitate intra-operative imaging, support patient's weight
- Surgical instruments for performing procedure
- Equipment for performing procedure
- Equipment for supporting patient during procedure
- Equipment for haemostasis
- Sutures
- Implants
- Grafts

Patient positioning

- To allow access
- To minimise bleeding

Equipment positioning

- Position theatre table so it is within the clean area, and to allow access to anaesthetic machine, image intensifier or other equipment
- From the ceiling—theatre lights to allow illumination of the surgical field taking into account where the surgeon and assistants stand so no obstruction
- Surgeon's eye level—camera screens, image intensifier screens to allow easy visualisation
- Surgeon's elbow level—diathermy and suction. Where will the tray with instruments be in relation to the surgeon so you don't need to keep turning round to get instruments from scrub nurse?
- On the floor—diathermy pedals, arthroscopic shaver pedals, to allow easy foot access
- Image intensifier, fluid pressure pump, laparoscopic stack

Staff positioning

- Surgeon
- Assistants
- Scrub
- Anaesthetic

Prepping and draping

- Extensive prepping to allow good access and appropriate draping
- Draping to allow access to incision area taking into account the possibility of extending the incision

Incision

- To allow adequate visualisation and access to perform the procedure
- One that minimises damage, less risk to surrounding structures
- Can be extended

Procedure

- Steps
- Sequence
- Beginning
- End

Wound closure

- Sutures
- Drainage
- Dressing
- Splinting

Post-operative care

- In recovery
- In ward
- Post-hospital discharge

5.2 Developing Surgical Skills

The most complicated skill is to be simple.

Dejan Stojanovic [2]

Developing surgical technical skills is a challenging task. Restrictions in weekly working hours and increased utilisation of shift patterns, may lead to reduction in surgical exposure with fewer training opportunities. But even when one manages to make it to theatre, learning can still be difficult.

Learning in the surgical theatre often has to be achieved under time constraints, having to keep watching the clock; not only due to the need to balance service provision with delivery of training but also to potentially minimise the time patients are kept under anaesthetic. The time left to surgical training may be additionally limited by having multiple teams in theatre, which may have different hierarchies, time constraints, working patterns, responsibilities. The surgical team often has to conform to such patterns, rather than setting the time frames.

Hence, trainers may be under triple pressure; pressurised by their institutions to accommodate more cases on their list, under pressure by co-workers for lists to finish on-time and not to overrun, and by their trainees for devoting time in quality training (Fig. 5.1).

Increased medico-legal challenges and public reporting of surgeon-specific outcomes, may make trainers anxious and nervous of letting trainees operate due to fear of complications and the consequences that may entail. There is sometimes a tendency for "the more you can do the more to be allowed to do". But then we all have to start somewhere.

Learning may also have to be achieved whilst under high levels of stress, when dealing with familiar or unexpected conditions, whilst faced with anticipated or unanticipated events. Each case is different, has unique characteristics, which may deviate from the textbook norm, and one has to learn how to adjust for those. The ability to deal with intra-operative complications rather than simply with cases where all goes smoothly, means there is need to encounter these, to get involved in complex cases.

Hence, learning and developing surgical skills is a demanding task. A trainee needs to maximise all opportunities, to make the most of this challenging task. In improving your surgical skills and increasing your operating opportunities you may consider some of the approaches described next.

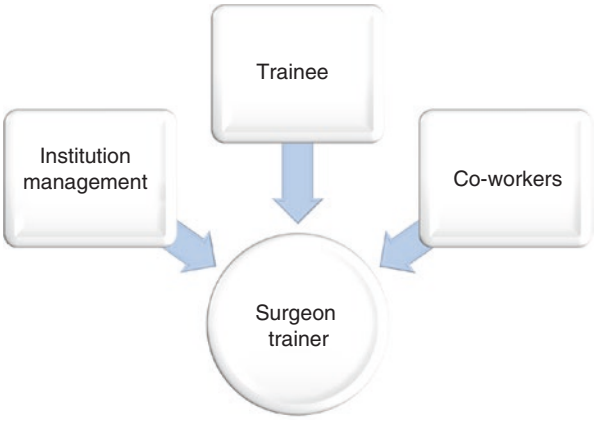

Fig. 5.1 Surgical theatre pressures that may influence delivery of surgical training

5.3 Get Accustomed to the Operating Theatre Environment

You are affected by the surroundings, the mood of people, by confidence. I am no different.
Michael Owen [1]

Get used to the surgical theatre environment. Spend time in the surgical theatre, even if you are not operating or assisting. No theatre time is a waste of time. Being in theatre may increase your familiarity with the environment, give you confidence of how to act and behave in such an environment, how to cooperate with other teams and theatre participants.

Find your bearings. Get to know where the patient is brought and checked in, where the anaesthetic is administered, where recovery is located, where is the theatre manager's office, the stores' room, the coffee room. Get to know where you scrub, where the gowns and gloves are shelved, where the theatre table side supports are stored, where the arthroscopic stack or radio-protection gowns are kept.

Get used to common surgical theatre activities, learn how you dress, prep, glove and gown, what you change into if you want to go out of the theatre suite, how you transfer the patient to and from the operating table, what the buttons on the table's remote control mean, how close to the surgical field you can get, where you can stand, what's sterile and what you can touch, how you position your arms whilst standing and waiting, how you move the heavy theatre lights around.

Get used to the roles of all your co-workers, the anaesthetist, the scrub nurse, the theatre runner, the radiographer, the perfusionist, the operating department practitioner, the theatre coordinator, the theatre sister. What do they do, what are their responsibilities, whom do you need to ask to help solve a specific problem?

When learning to swim you may stick to one pool, swim by the side, just in case, and then gradually move away towards the centre of the water. But even when you can confidently go up and down that pool, swim multiple laps, you may still feel out of your depth and need time to settle in if you find yourself in new, un-accustomed waters.

Likewise, initially each surgical theatre may look strange, but as you become familiar with the environment, theatres will look similar whether in the same block, one hospital or in different institutions.

Every moment in theatre is valuable, even the times when you don't scrub, when you scrub but don't touch, even those long lists of "lumps and bumps", those abscesses that need to be drained. Spending time in theatre can give you confidence, help you get used to a challenging environment, get used to how theatre staff act or behave. Once the theatre environment becomes part of you, carrying out the procedure per se may be much easier.

In improving your exposure to the operating theatre you may consider:

- Join additional lists taking place in your department. See which lists may need an extra pair of hands and offer to join.
- Ask your seniors or colleagues to let you know if any unusual cases come during out of hours, you may be living on site and able to attend to those at short notice.
- Make the most of attachments where you can get to spend ample time in theatre and get to operate. In an ideal situation each training post should offer similar operating opportunities, but this may not be the case. Hospitals vary in number of cases they can put on a list due to organisational factors, seasonal or other external pressures (with winter cancellations at short notice), there may be a run of complex cases, trainers may differ in experience, confidence, willingness to let you do things. In some attachments you may find yourself doing most of the operating, in some mostly holding the retractor. But even if you end up simply assisting, you can still gain lots from being there. You may see how things should be done, or how they shouldn't be done, what to avoid.

5.4 Developing Technical Skills

Technique is noticed most markedly in the case of those who have not mastered it.
Leon Trotsky [1]

In developing your surgical motor skills you may consider various models and parameters previously described as able to facilitate motor skills acquisition. These are presented next.

5.4.1 Model for Progression of Motor Skills Acquisition

Fitts and Posner [3] described the three stage model of motor skill acquisition (Fig. 5.2).

In the cognitive stage the learner tries to understand the task, has to think what they are doing, analyse the actions, how to position or move the hands; the task is carried out in separate steps, going back and forth, often in an irregular pattern. In the integrative stage the learner understands the task and the movements of carrying it. Hand motions are more fluent and faster but the learner still has to think about the task.

In the autonomous stage the task is carried out with little if any thinking, fast and effectively, in an automatic mode.

This model may allow you to appreciate the gradual process of acquiring motor skills, and hence view your performance and progress in the context of this process.

Fig. 5.2 Three stage model of motor skill acquisition. Based on Fitts and Posner [3]

5.4.2 Learning Curve

Learning is not attained by chance, it must be sought for with ardor and diligence.
Abigail Adams [1]

Motor skills or tasks have a learning curve that describes the relationship between performance and exposure [4–12]. As one does more and more, performance improves, initially rapidly, but then more slowly. Eventually, a plateau may be reached where it is more about staying good rather than getting better.

Appreciating the learning curve may allow one understand the difficulties faced when beginning to learn a new skill, but also seeing that there can be light at the end of the tunnel, that one may be able to reach their peak. It may also remind the need for support, time and resources (assistants or supervisors) whilst at the ascending part of the curve.

Recognising that each part of the procedure, each hand movement, use of each surgical instrument, or use of each surgical kit has a learning curve may help one appreciate the need for trying to find and settle into a routine. It may allow one to be more critical as to the need to keep trialing new instruments or techniques.

And even when reaching the plateau phase of the learning curve, one may need to keep practising skills to maintain performance. Several studies have correlated surgeon procedure-specific experience (as described by procedure volume—the number of specific procedures performed annually) to improved outcomes in laparoscopic cholecystectomy [11, 12], colorectal surgery [13], thyroid [14] and cardiac surgery [15, 16].

Ascending the learning curve does not simply refer to getting better at operations where all goes well and smoothly, but also facing and dealing with complications. Flying through smooth conditions is different to dealing with bumpy turbulence, dumping fuel for an emergency landing or averting a landing at the last minute.

5.4.3 Deliberate Practise

Every artist was first an amateur.
Ralph Waldo Emerson [1]

Acquisition of motor skills and ascend of the learning curve are not just about exposure to an action or task. Improvement of surgical skills requires seeing more but also seeing wisely. Experience is achieved through a high volume of exposure, but also by each exposure challenging the learner, and hence acting as a learning event. The aim is not simply to do more, but also to do better.

Anders Ericsson, a Swedish Professor of Psychology at Florida State University, describes that the difference between experts and normal practitioners is the constant deliberate effort of the former to improve their performance in a particular task. Ericsson reports that performance is not so much influenced by mere repetition of an action but by deliberating trying to improve performance in that action, and trying to go beyond one's comfort zone in carrying out a particular task. This may be achieved by

breaking down the task in its components, concentrating on one component at a time, putting more emphasis on components that have not been fully mastered [17, 18].

Deliberate practise also involves:

- Coaching—with a trainer setting goals of performance, providing guidance and support.
- Immediate feedback—on performance to build on strengths and address deficiencies.

Acquisition of motor skills may be more closely related to time spent in deliberate practise rather than any practise. During surgical training you may focus on specific parts of a surgical procedure, concentrating on the steps you need to get better at, such as specific hand movements in which you need to improve. As you get competent in carrying out a procedure in straightforward cases, without much mental effort, you may seek to progress to more complex cases, get better and better.

5.4.4 Piecemeal Learning

I have never met a man so ignorant that I couldn't learn something from him.
Galileo Galilei [1]

Learn is steps, bit by bit. In learning a surgical procedure one may wonder whether doing just part of the procedure is of value, or whether only those cases where the whole procedure is performed (skin to skin) are of benefit. In the surgical environment a trainee and trainer may face the pressure challenges described earlier in this chapter, and the ability to allow a trainee to go through the whole of the procedure may be limited.

There is no convincing evidence that carrying out wholly tasks is better than doing parts of the procedure, and doing parts of the procedure may help in the same way as doing the procedure from start to end [19, 20]. Early on, in learning a surgical procedure, one may aim to learn doing each individual step [21]. As skills develop and confidence grows, doing the full procedure, from start to end, is preferable.

Break the operation into multiple steps. Do parts of the operation at a time, with the rest performed by your senior. As you get better at one step, you may swap that step with your senior and get to carry out another step, before eventually being able to carry out the whole procedure. You may initially do one step at a time, and then multiple steps before proceeding to the whole procedure.

- In training to do laparotomies for bowel resection, you may start by opening or closing the abdomen and once you master that you may move into dissecting and resecting the bowel, and then onto fashioning a stoma.
- In doing a hip replacement you may master the approach, before learning how to prepare the femur or the acetabular components.

Discuss at the beginning of the list as to which cases or which parts of those cases would be appropriate for training. Identify which steps you need to get better at and concentrate on those.

5.4.5 *Distributed Practise*

We hear and apprehend only what we already half know.

Henry David Thoreau [2]

Distributed practise refers to having periods of practise separated by periods of rest, whereas massed practise refers to having periods of continuous practise with little if any rest in between. Distributed practise may allow more effective acquisition of surgical skills than massed practise [22–24]. This may be related to activation of certain parts of the brain that aid consolidation of learning and to the mental rehearsal as well as retrieval from memory required in each episode of practise [24–26].

Moulton et al. [24] compared the two in a randomised trial whereby 38 surgical residents were assigned to distributed (weekly) or massed practise arrangements in learning microvascular anastomosis. Even though both groups improved their performance by practising, the distributed practise group scored much better in the retention of skills gained.

Hence, you may aim to have repeated exposures in a particular task rather than trying to get it all in at once; any exposure to a surgical procedure may facilitate learning.

5.4.6 *Mental Practise*

Practice doesn't make perfect. Practice reduces the imperfection.

Toba Beta [2]

Mental practice refers to mentally rehearsing a task prior to carrying it out physically [27–29]. It aims to help learn a motor skill or a surgical procedure without physically carrying it out.

Mental practise is not just about thinking of the steps of the procedure, but carrying out the procedure mentally, equivalent to cognitive simulation. It is thought that mental practise may activate motor networks in the brain that overlap with those activated during physical execution of motor activities which can lead to motor skill acquisition [30, 31].

Arora et al. [32] examined whether mental practise can enhance performance in laparoscopic surgery. They randomised 18 novice surgeons to performing 30 min of mental practise or watching an online lecture prior to carrying out laparoscopic cholecystectomies on a virtual simulator. Although there was no difference in baseline technical ability between the two groups, learning curves were significantly better in the mental practise group. Mental practise has also been shown to aid medical students develop basic surgical skills [27, 33] and crico-thyroidomy [34].

Hence, you may facilitate your surgical learning by mentally rehearsing certain actions or whole surgical procedures; you may rehearse how to position yourself, how to move your hands, even imagine the tactile feedback you may experience.

5.4.7 Simulation

For the things we have to learn before we can do them, we learn by doing them.
Aristotle [2]

Learning means doing. Motor skills are thought to have a learning curve. A surgical procedure has an overall learning curve but each of its individual steps has to be mastered and has its own unique learning curve.

Simulation offers the ability to practise motor skills without time pressures and without fear of causing harm to patients. Simulation may help ascend the first part of the learning curve, grasp the basics of the skill, upon which one can further build in the surgical theatre. Simulation may also allow practise in handling rare events, unusual intra-operative complications; like pilots who may train to deal with a stall or an engine failure well before they ever encounter one.

Simulation may be in the form of:

- Mannequins, synthetic models or body parts (such as bones)
- Animal models
- Human cadavers
- Virtual reality simulators
- Theatre environment

Simulators may vary from simple and low cost, to advanced, high cost, almost real life simulations. One may develop basic surgical skills on synthetic or animal models; knot tying, suturing, drilling, sawing, inserting bone screws, fixing fractures with plates or nails, undertaking arthroscopic or laparoscopic tasks are only some of the skills that can be learned and developed. Cadaveric training allows near life exposure, better grasp of anatomy and the handling of soft tissues, clearer appreciation of the whole 3D orientation. Virtual simulators use the last edge of technology, to match a real life surgical procedure, incorporating visual, auditory, and tactile cues; one may see the effect of their hands moving on the screen but also feel resistance to using instruments or handling tissues, getting to know how much force to exert for a specific task. Virtual simulators may give a running commentary on how the operator is doing, or a summary performance feedback after task completion. And once individual motor skills or procedures are mastered, simulation may help prepare for the real surgical experience, in enacting the whole surgical theatre environment; one may simulate the whole surgical theatre team in expected and unexpected scenarios.

Several studies have examined the role of simulation demonstrating their benefit in acquiring surgical skills, but also the transferability of such skills to the real life surgical theatre [35–40].

Make the most of any simulation you can get your hands on. Maximise your learning opportunities out of the surgical theatre. Simulation may not substitute the real theatre experience or real surgical procedure, but they may help you get faster there.

5.4.8 Feedback

A man only learns in two ways, one by reading, and the other by association with smarter people.

Will Rogers [1]

Seek feedback to help you reflect and further develop your surgical skills. Feedback is not just about what to do but also how to do it. Feedback may be concurrent, given whilst the task is carried out, or terminal, given at the end of a task. Feedback may be part of a computer or simulator response or given by an "expert" such as your senior or supervisor directly observing you during surgery. Porte et al. [41] demonstrated, in a randomised trial, that verbal feedback from an expert is more effective than a computer based motion efficiency feedback (self-accessed) in the retention of suturing and knot tying skills amongst medical students.

Self-reflect, but also aim to carry out tasks under the direct observation of someone who can comment on how you are doing. Even when you feel competent in carrying out a procedure, an "expert's" observation and words may help to further refine or fine tune your skills. Previous studies have highlighted the role of both concurrent and terminal feedback [42, 43]. Xeroulis et al. [42] compared concurrent and summary expert feedback in a randomised trial of medical students performing suturing and knot-tying skills. They demonstrated that both methods were effective for the initial instruction of these skills to novice students, but only summary feedback improved retention of superior skills. Walsh et al. [43] assessed novice endoscopists in performing simulated colonoscopy tasks. Both the concurrent and terminal feedback groups performed similarly at post-practise and in retention of skills, but the terminal feedback group performed significantly better on transfer of skills.

In the early stages one may benefit from getting feedback with each step as they go along (addressing the individual hand movements or other actions). In later stages, when proficiency develops, terminal feedback, may be of greater use. Depending on the stage of your surgical development you may ask your senior to give you feedback as you go along, or at the end of the procedure, go through what went well and what could have improved.

5.4.9 Progress in the Levels of Participation

I am still learning.

Michelangelo [1]

As one improves their surgical skills and gets more competent, may progress to operating under less and less supervision (Fig. 5.3). Operating with a senior unscrubbed or in the absence of a senior, are important steps in gaining technical confidence, and at some point you will have to make that jump, if working towards independent practise.

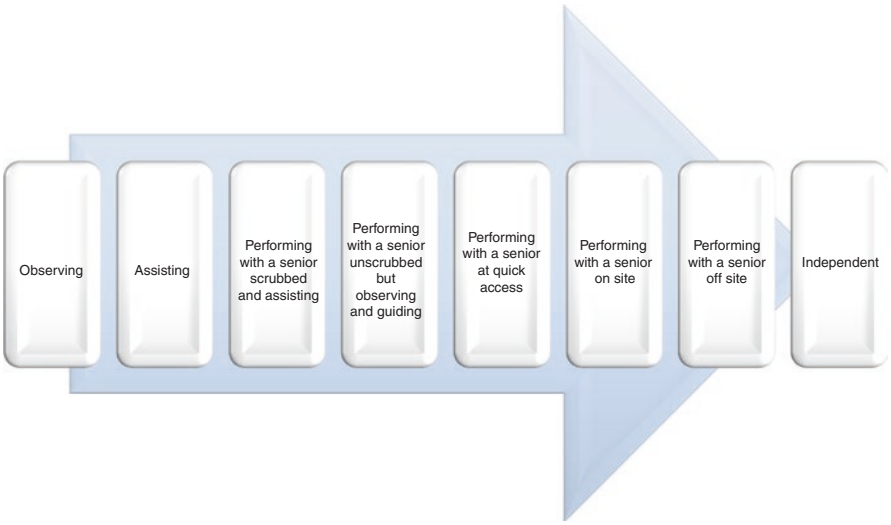

Fig. 5.3 Progress of surgeon's participation in surgery

Finding yourself with no senior in theatre for the first time can be a taunting experience. Follow the regulations of the healthcare system you are practising in, as some training programs may not allow unsupervised operating until fully qualified for independent practise. If you have to make the step only once you are fully qualified, then consider asking a colleague to support you in those initial stages.

5.4.10 Be an Active Assistant

Learning without thought is labor lost; thought without learning is perilous.

Confucius [1]

Sometimes we may have to assist and assist, clock the hours, before we get the driving seat. But learning is not just about doing it yourself, you can also learn by being an engaged assistant, by following the procedure through, anticipating the next step, questioning what was done and how else you could have approached it.

Discuss with your trainer the procedure and its steps, confirm that you understand what they are doing, that you are keeping up with their pace, show you recognise the anatomy and the dissection planes. Offer to retract before being asked, or, once you know what is expected, carry out the task without having to be asked. Show that you have thought about the procedure, you studied, you checked that the patient and theatres are ready. Demonstrate to your senior that you know the basic but essential steps of the procedure, how to position, drape and prep. This may give more confidence to your trainer about your abilities, help them take you over to the next step.

5.5 Learning a Surgical Technique

The beautiful thing about learning is nobody can take it away from you.

BB King [1]

Learning a new surgical technique and getting better at it, is often a challenging and demanding task. Once a technique is learnt it may still not be fully mastered, and the skills may need to be refined. LOAD [44] describes the essential steps in learning a new procedure and stands for:

L-earn about the procedure.
O-bserve the procedure.
A-ssist in the procedure.
D-o the procedure.

You may read up the procedure, hear about it in lectures or from peers, study the relevant anatomy. You may watch the animation or video, observe or assist in the simulator or real life, before undertaking the procedure with or without supervision, in full or in small progressive steps. But this is not a one way process, and you can go back and read more once you have attempted it, again observe and assist others to fine tune and further develop your technique (Fig. 5.4).

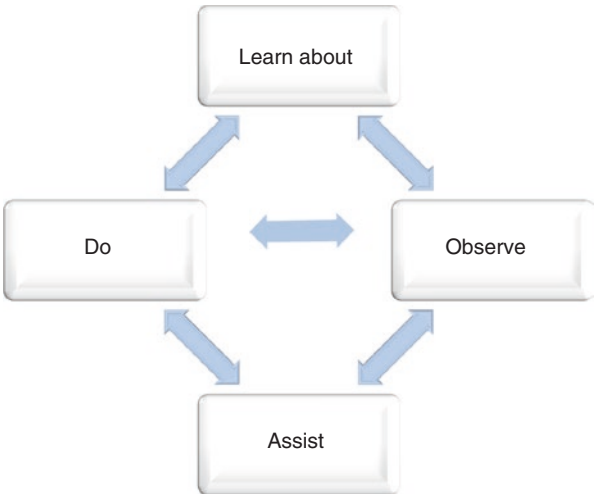

Fig. 5.4 Procedural learning cycle—LOAD. Adapted from Charalambous CP [44]

5.6 Getting Technically Fluent

The noblest pleasure is the joy of understanding.

Leonardo da Vinci [1]

In increasing your efficiency you may improve your manual dexterity, speed of movements, knowledge of what the steps involve and their exact sequence. At the same time you may also consider:

- Plan what you will do, and how. Perform a mental rehearsal. Run the operation through your mind before you set off.
- Have a logical sequence. So that one step leads to the next, avoid having to go back and forth.
- Eliminate unnecessary steps, unnecessary movements.
- Keep it simple.
- Know when to stop, know what you can accept.
- Know when to change course, if a plan does not work use another, if one approach fails use an alternative. Be able to adapt your actions in the context of each patient and each procedure.
- Work with your assistant, so they can facilitate your actions. Explain what you are asking them to achieve, for them to try and help you out. Delegate tasks:
  - "Look after the nerve whilst I put the plate on".
  - "Show me a good view with the camera whilst I tie the knots".
  - "Retract this muscle so you can show me the bleeding vessel".
- Engage other team members, so the whole team is focused on the task. Engage your assistants, who may be getting anxious or bored, especially if it is felt that all they are doing is holding the retractor. Explain your reasoning as they may be wondering what you are up to if the technique you are using is slightly different from what they have seen before; this may help encourage confidence and hence active participation. Inform of encountered difficulties, describe why you are taking longer than expected for a particular step (such as in harvesting a tendon graft which feels tight and you don't want to prematurely lacerate it). If anxiety and boredom set in, the level of engagement and hence their ability to effectively contribute may wear out.
- Ensure you have the necessary support before you start–staff, instruments, equipment. Ensure the equipment is ready to use. Have a list of instruments and equipment you use, to ensure they are all ready.
- Know how to use the equipment or handle the instruments. Do not assume others will know how to use them or that they will know what to do if they malfunction. Don't wait until the equipment fails to find out that the personnel who normally bail you out are on holidays.
- Check the experience of the scrub nurse and your assistant; not just their general theatre experience but also their experience in carrying out the required tasks for the operation concerned. Know what you can expect from them.
- Have pictures or photos showing how you aim to position the patient, and how you expect the image intensifier to come in, to facilitate communication to the rest of the team as to what you are trying to achieve.

5.7 Limitations of Surgical Skills

It is not that I'm so smart. But I stay with the questions much longer.

Albert Einstein [2]

As surgeons we often place much emphasis on the need of improving our surgical skills, getting better and better at what we technically do. However, being good with our hands may be only one of the parameters necessary in enhancing our surgical practise.

Regenbogen [45]examined the characteristics of technical errors in malpractice claims of four liability insurers. They found that most technical errors occurred in routine operations carried out by experienced surgeons, rather than in advanced procedures or in procedures carried by less experienced or in-training staff.

Hence, addressing technical experience could address only a minority of deficient surgical care. As surgeons we may also need to consider other parameters such as situation awareness and decision making which can affect our technical performance, and these are addressed in subsequent chapters.

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Chapter 6
Situation Awareness in Surgery

Surgeons practise under constantly changing conditions that require fast and accurate decisions, correct and precise actions. In achieving appropriate decision making, and desirable performance, it is essential to initially understand the context in which one operates.

Situation awareness may be described as the ability to read the situation, the ability to see the bigger picture.

Understanding the process of situation awareness and recognising the factors that may assist or impair reaching that state are important skills to develop. This chapter describes the levels and components of situation awareness, looks at how situational awareness may fail, and considers measures for improving situation awareness. Ways of identifying lapses in situation awareness are also presented.

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I keep pressing the button but is not doing much. Put it to maximum.
DIATHERMY

6.1 Levels of Situation Awareness

Anyone who isn't confused really doesn't understand the situation.

Edward R. Murrow [1]

Dr. Mica Endsley, an engineer and former Chief Scientist of the United States Air Force, published extensively in the 1990s on situation awareness (SA) [2–7]. SA was described as a "state of knowledge that individuals operating in demanding and dynamic situations should aim to achieve".

Endsley defined SA in the form of three levels [2–7] (Fig. 6.1):

- Level 1—Perception of elements in the environment
- Level 2—Comprehension of the situation
- Level 3—Projection of future status

Level 1—Perception refers to seeing or noticing all the information/data relevant to the task in hand. Such information may be perceived by visual, auditory, tactile, or even olfactory means. One may be presented only with the relevant information, but often one may have to sieve information to obtain the relevant parts.

Level 2—Comprehension refers to combining all relevant information, to help understand the overall situation; putting together all available pieces of the jigsaw to see the overall picture. This requires having predetermined mental models or patterns of potential situations, and selecting the one appropriate for the information received; like having a library of jigsaw puzzle pictures and based on the pieces gathered, to work out which puzzle picture it is likely to be.

Level 3—Projection refers to considering the various pieces of information gathered, along with the understanding of what they all together mean, to help predict what may happen in the future. It requires thorough understanding of the various situations that may be encountered, and knowledge as to where these situations could lead.

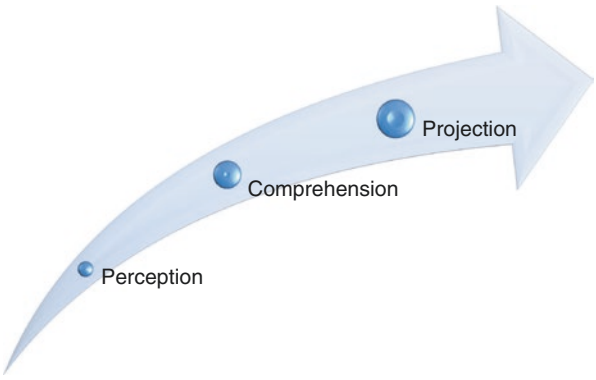

Fig. 6.1 Levels of situations awareness. Based on Endsley [2]

Hence, SA refers to gathering information, and based on the information gathered recognising as to what you are dealing with; once you recognise what you are dealing with, predicting what will likely happen next (in the immediate or near future) based on knowledge about such situations and experience of previous similar encounters.

The concept of SA refers mainly to dynamic situations [2], such as those encountered in the surgical theatre, whereby the pieces of data keep changing or some data only become apparent with the passage of time, requiring constant re-evaluation and understanding of the new picture. Hence, SA is often not acquired instantaneously, but over a period of time as more and more pieces of the jigsaw are added. The dynamics of the situation may also mean that time pressures exist for establishing full awareness, to allow prompt decision making and initiation of action [2–7]. If the required actions are delayed then such responses may cease to be relevant to the current situation.

6.2 Components of Situation Awareness

Harwood et al. [8] described four domains of situation awareness:

1. Spatial awareness (where)—knowledge of one's location in space and spatial relationships between components
2. Temporal awareness (when)—knowledge of dynamics, sequence and evolution of events, time availability
3. Responsibility awareness (who)—knowledge of who is in charge for what (including operator vs. automated system)
4. Identity awareness (what)—knowledge of the presence of threats and operating system variables

In performing surgery you may need to maintain:

- Spatial awareness—in choosing the correct dissecting planes, identifying the correct anatomical structures, retracting carefully without stretching the underlying nerves, drilling without lacerating the vessel under the bone.
- Temporal awareness—in knowing the time left for the task, how more to go before the cement sets, how more to go before the tourniquet has to be deflated.
- Responsibility awareness—how are the roles distributed, who is looking after the nerve, who is retracting, does the surgeon set the fluid pressure settings or are they automatically adjusted by the fluid management pump?
- Identity awareness—recognising the threats, in knowing that the appendix is gangrenous and it may burst whilst dissected, the hip fracture configuration makes it unstable and may spin whilst inserting the screw, that the nerve may be stretched if extensively retracted. It may also involve recognising the system variables, the diathermy readings, the significance of the laparoscopy console displays, the configuration of the screw head holes on the fixation locking plates.

6.3 Situation Awareness Versus Decision Making

You can't do anything sensible until you know what the situation is that you're in.

Julian Assange [1]

SA can influence decision making and performance, but is different from either of those [2]. Once you work out what you are dealing with, and what is likely to happen (that is once you become aware of the situation) you then go on to decide what to do.

If your understanding of what you are dealing with is correct, and your prediction as to where it could lead you is right, then you may make the appropriate decision for the situation encountered. However, it is also possible for your SA to be correct and still make the wrong decision, if the decision making process is impaired.

Alternatively if your understanding of what you are dealing with is wrong, or your prediction as to where it could lead you is incorrect, then you may make the right decision for the situation you think you are dealing with, but this would be the wrong decision for the real situation you are actually facing (but which you misread). Even the best decision makers may make the wrong decisions if faced with an incomplete, inaccurate, or wrong SA. Hence, achieving correct SA is the first step in appropriate decision making and desirable performance (Fig. 6.2).

Fig. 6.2 Relation of situation awareness to decision making and performance

6.4 Barriers to Situation Awareness

I am very short-sighted, and if I don't like a situation I take my glasses off.
Jenny Éclair [1]

Failure to acquire the correct SA may occur at one or multiple levels, due to various factors (Fig. 6.3) [7].

In level 1 the necessary information may simply not be available (it doesn't exist, is not captured or is not presented), you may fail to see it (you are not paying attention, the monitor is not user friendly, you are distracted by other stuff, you are fixated on another task, you are bombarded with tons of information and you cannot see it all), you may see it wrongly (the measurement units are not stated and your assumption is wrong, displays are unclear), or see it but forget about it (you are stressed, physically or emotionally exhausted).

In level 2 you may not be able to combine all pieces of information together into a pattern, you may not be aware of the correct pattern, you may pick the correct pattern but not fully understand it, or you may pick an incorrect pattern; you may lack knowledge or experience to allow you to develop a correct pattern, you may have lots to do and something has to give, or you may prioritise another task.

In level 3 you may not have recognised the true situation, you may lack knowledge as to where things are heading or have a wrong understanding as to where things are going; you may lack experience or knowledge, or faced with too many tasks.

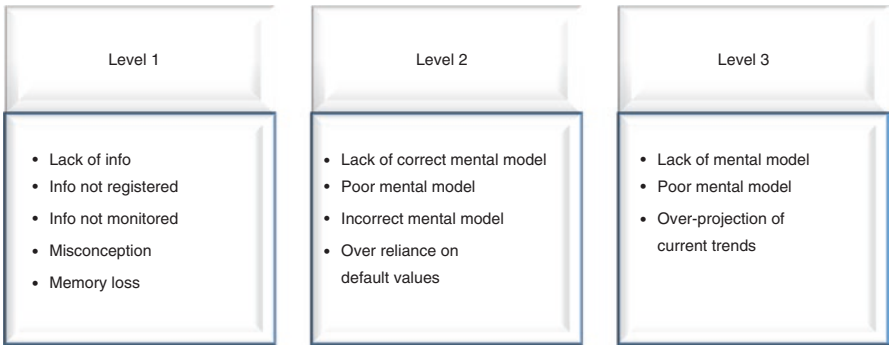

Fig. 6.3 Potential causes of failure of situation awareness at each level. Based on Endsley [2]

6.4.1 Failure of Situation Awareness in Aviation

It's not the situation... It's your reaction to the situation.

Robert Conklin [2]

Situation awareness has been extensively studied in aviation, from where we may draw examples as how things could go wrong.

Planes need fuel to fly, and a pilot must ensure they have enough fuel for the journey ahead. Fuel requirements depend on the weight to be transported, the distance to be travelled, the front or rear winds, parameters which may be changing during a journey. The pilot is required to be aware as to what the fuel situation is and predict as to whether it will suffice. One would think that having adequate fuel for a flight duration is a given fact, and that running out of fuel would be a non-encountered event. Yet, there are multiple reports of flights running out of fuel, some of which with devastating consequences. Failure of SA may have contributed to some of these events as described below.

Air Canada Flight 143, a Boeing 767 flying from Montreal to Edmonton, ran out of fuel whilst at about 35,000 ft half way through its journey. The experienced captain was able to glide and safely land the plane at Gimli, a closed air-force base whose decommissioned runway was used as a motor sports race track. The subsequent investigation found that the plane had been refuelled with about a quarter the amount of fuel necessary, due to wrong fuel calculations (a result of a mix up between the newly introduced metric system and the previously used imperial unit system meaning that fuel was calculated in pounds rather than kilograms). In this situation, valuable information about the actual fuel on board was not available due to malfunctioning of the cockpit fuel gauges. Unaware of the true fuel on board, and not having live information due to the blank gauges, an initial alarm indicating low engine fuel pressure was inadvertently attributed to fuel pump failure [9].

United airlines flight 173, a Douglas DC8, flying from New York to Portland, Oregon in 1978, developed a landing gear malfunction during an attempted landing. The crew, and its experienced pilot, became fixated on the landing gear and did not effectively pay attention to information about fuel levels, leading to the plane running out of fuel and crashing at a short distance from the airport [10].

Air Transat Flight 236, an Airbus 330 flying from Toronto to Lisbon, run out of fuel whilst over the Atlantic Ocean, due to a fuel leak caused by an incorrect part installed during maintenance. The plane was glided for about 75 miles landing in Azores. However, the situation was initially misread, and although initial cockpit warnings about a lower than expected fuel quantity were recognised, they did not lead to initiation of the "FUEL LEAK procedure, until later in the flight". The crew "continued to believe that the low quantity indications were caused by some type of computer error" and continued with this mental model up to and even beyond one of the engines flaming out [11].

6.4.2 Failure of Situation Awareness in Vehicle Driving

It is not only pilots that have to be aware of the fuel situation. Whenever in our car we consider the fuel in the tank and the distance we have to travel, to predict whether we need to refuel or not.

We take into account as to whether we are on the M6, one of the major motorways in England with frequent petrol stations on the way, or on the Route 23 in Chile's Atacama desert. Similarly, we may take into account as to whether we are driving our own car with its predictable fuel consumption and reliable fuel indicator, or a rental car with a shaky fuel gauze and uncertain fuel economy.

But on occasions we may get it wrong. The fuel indicator may be broken giving no reading. We may not look at it, or we may look at it but forget about its low reading after getting pre-occupied with the possible cause of the traffic jam we have just hit. We may notice the fuel indicator going down rapidly but attribute this to the aged engine, rather than recognising that the fuel pipe has burst. The low fuel warning light may have just come on but we may consider there is still a large reserve. Hence, we may wrongly predict that the fuel will last till our destination.

Driving is also a dynamic situation with events changing fast. We may plan to refuel at the next station, but it may have shut down, or we may simply pass it whilst daydreaming with no near exit on the motorway ahead.

6.4.3 Failure of Situation Awareness in Surgery

In surgery, one must keep re-evaluating the patient's intraoperative haemodynamic status and haemoglobin level. But how could you mis-read the low blood pressure occurring whilst plating a femoral shaft fracture, not considering the possibility of excessive bleeding and ending up with low haemoglobin and haemodynamic collapse?

Level 1—you may lack information of the low pre-op haemoglobin level because it wasn't checked, you did not look at the results, the measurement was wrong. You may lack information on the current haemoglobin level because it's not monitored regularly during surgery, or is checked on a blood gas sample which gives an inaccurate reading. You may be fixated on trying to reduce the fracture (which is very unstable and keeps slipping) and not notice the constant dribbling of blood from the bone ends, your assistant may be struggling to retract to help you see better and forgets to mention the red pool on the floor, the scrub nurse may be looking for a bigger bone holder to help your reduction and puts the used swabs on the site without considering how damp they are, the anaesthetist may be separated from the surgical field by drapes, concentrated on the new anaesthetic machine monitor.

Level 2—The blood pressure may start dropping but the anaesthetist is junior and puts this down to a spinal effect. The anaesthetist mentions the drop in blood pressure but your assistant feels it's the blood pressure tablets the patient took this morning starting to kick in, whilst you feel that it's probably small fat emboli due to moving the fracture about, in trying to achieve reduction.

Level 3—Hence you all predict that the situation will soon stabilise.

….and you decide to administer intravenous fluids and observe the response, leading to further haemodilution and further drop in haemoglobin.

In literature there are multiple reports of surgery going dramatically wrong, with the surgeon operating upon or removing the wrong structure. There are published reports of harvesting the median nerve rather than the palmaris longus tendon, excising the scaphoid rather than the trapezium in treating thumb arthritis, ligating and dividing the hepatic ducts rather than the cystic duct in laparoscopic cholecystectomy [12–15]. One may question how it is possible to go so wrong, and the answer is probably multifactorial. Although it would be difficult to know the exact reasons for the reported situations, one may postulate that loss of situation awareness could lead to similar harmful events.

Dekker and Hugh [15] explored the factors leading to bile duct injury during laparoscopic surgery, encountered even amongst experienced surgeons. They reported that duct mis-identification is the cause of most cases of such injury; they postulate that construction of a wrong mental image that convinces the surgeon that the common bile duct or the hepatic duct is the cystic duct has a major role to play. They suggest that visual perception is not necessarily a replica of what is truly seen, but a mental model based partly on what one expects to see. Wrong perception can be perpetuated, whereby new information or cues suggesting that one is dealing with the wrong structure are dismissed. The authors state that.

> *"once surgeons have committed them-selves to a particular course of action they will build an explanation that justifies that action and that also guides further action. This explanation tends to persist and gets transformed into an assumption".*

You may assess a patient presenting with a hip injury after a fall. They complain of hip pain, have limited painful hip movements, you feel you are encountering a neck of femur fracture. You look at the hip radiograph, you identify a possible hair-crack line and, although there is a similar artefact line on the opposite hip, you consider this to be an un-displaced neck of femur fracture, the more you look at it the more you get convinced, it fits the story. Based on your working mental model, you decide to proceed with screw fixation of the fracture, only for the patient to continue with post-operative pain. You initially attribute the ongoing pain to recovering from a fracture, but when eventually you arrange an MRI scan you find no femoral neck fracture but identify an acetabular fracture, not evident on the initial plain radiographs.

6.5 Improving Situation Awareness

Let us train our minds to desire what the situation demands.

Lucius Annaeus Seneca [1]

Given the ways in which SA could fail, we may look at measures to try to improve our ability of being situation aware during surgery. These are described next.

6.5.1 Improve Information Gathering

- Gain familiarity with your operating environment so you know where to find relevant information.
- Aim for user friendly information sources such as monitors, consoles, displays.
- Arrange your working environment to facilitate access to information—
  - Placing monitors or image intensifier screens so they can be easily seen.
  - Raising alarm volume of devices so they are easily heard in the noisy theatre environment.
- Distribute attention, so that you keep looking at the whole picture, avoiding narrowing all your attention to one task and ignoring others.
  - You may develop a system where by you concentrate at the task at hand, but at regular intervals you consciously aim to scan all other parameters—haemodynamics, blood loss, tourniquet time.
  - Share the role of attention; if all are staring at the fracture ends who is looking at the rest of the patient? Who is looking after the nerve whilst you are freshening the bone ends?

6.5.2 Aim for Manageable Workload

Workload may impair the ability of SA both during routine but also unexpected events [2, 16].

Consider a situation whereby a pilot has to deal with the auto-pilot dis-engaging in a bad bout of turbulence, and has to keep scanning the cockpit displays for information to help understand what is going on, remembering what the indicators say, co-ordinating the activities of the co-pilot, communicating with the air traffic control for a possible altitude climb, informing the cabin crew to fasten the seat belts, deciding what measures to take, whilst at the same time keep flying the plane.

Similarly, consider a situation whereby a surgeon faces a rush of blood whilst trying to fix a pelvic fracture, and has to minimise the bleeding whilst directing the junior assistant to retract and use the suction effectively, communicating with the anaesthetist about the blood loss and need of transfusion, scanning the diathermy

displays to see why it is not working, directing the theatre coordinator to contact the vascular surgeons, recalling the proximity of the sacral vessels to the fracture on the pre-operative CT scan, whilst trying to develop a mental model as to where the bleeding is coming from.

The level of workload may be reduced by:

- Reducing systems' complexity—user-friendly equipment, eliminating unnecessary steps of surgical procedures.
- Pre-planning—pre-operative planning, minimising the steps that will need careful thoughtful consideration.
- Matching staff to workload—having more experienced assistants or more assistants in complex cases.
- Distributing workload—assigning specific roles to specific team members, such as asking an assistant to keep an eye on the tourniquet time, the scrub nurse to inform you of the cement setting clock during arthroplasty surgery.

6.5.3 Improve Memory Utilisation

A great memory does not make a mind, any more than a dictionary is a piece of literature.
John Henry Newman [1]

Appreciate the influence of memory on SA, and hence aim to maximise memory utilisation for effective SA. Human memory can be divided into:

- Working memory (short memory)—utilised in the conscious awareness and processing of information
- Long term memory—the storage of information and skills gained over the years. In relation to SA, long term memory may store mental models or patterns along with their projections, which are then identified and retrieved from long term memory and transferred to working memory [2]

Working memory has limited storage capacity and when it gets full an individual may not be able to process new incoming information. Hence, short term memory space should not be wasted but used effectively to facilitate SA by:

- Focussing on the essential inputs.
- Cutting down on background noise (turning the music off).
- Refusing interruptions (reassuring your assistant that you will answer their constant, knowledge gathering, questions at the end of surgery).
- Gaining experience so that more and more tasks become familiar and automatic (thus occupying a smaller amount of your working memory).

St-Martin et al. [17] describe the need to be able to slow down during a surgical procedure and move from an automatic mode to a more focused, effortful mode. The authors describe that slowing down may be pre-planned in anticipation of challenging steps of the procedure or in dealing with a challenging case. Alternatively, slowing down

may be in response to the encounter of an unanticipated event. Slowing down may involve:

- Stopping—to re-assess or inform the team of any critical steps, to ensure that all is ready for the critical step.
- Removing distractions.
- Focusing intensely—withdraw from conversations, stop teaching.

With regards to long term memory you may aim through knowledge and experience to gain a large bank of mental models or patterns relevant to your practise, which can then be retrieved as required. Zheng et al. [16] evaluated the role of mental workload on performing secondary tasks (such as monitoring activities in the surgical theatre) other than the main action surgeons worked on. Surgeons were asked to perform as many laparoscopic sutures as possible within 6 min, whilst an adjacent monitor displayed a random sequence of true and false visual signals. Surgeons were asked to identify the true visual signals whilst they kept suturing. The rate of suture completion and correct identification of true visual signals was higher amongst experienced surgeons as compared to novices. They postulated that practise and experience leads to automaticity which in turn reduces the mental workload needed for suturing, hence freeing mental resources to attend to a secondary task.

6.5.4 Minimise the Effect of Stress on SA

I'm picking and choosing in terms of the stress factor. If it's not fun, I'm not going to do it.
Anita Baker [1]

Situations which individuals perceive as stressful may reduce SA by narrowing attention to few central sources of information (cognitive tunnel vision), and also by reducing the capacity of working memory [2, 18, 19]. The effects of stress on SA may be reduced by:

- Simulating for difficult situations—anticipating what may go wrong and pre-enacting your behaviours may help minimise stress when such conditions are encountered
- Recognising the potential adverse effects of stress on SA—to develop and pre-plan coping mechanisms to help maintain SA when faced with stressful circumstances (such as actively scanning for all information rather than fixating on one task)
- Minimise stressors—if you find the actions of a junior assistant (who keeps putting their hands in your way) very unsettling, the actions of a scrub nurse (that starts shouting every time you ask for an instrument) very disruptive, or the action of a radiographer (who keeps moving the image intensifier in a purposeless way every time you ask them to screen) very un-easing, should you be starting a complex case with them?
- Develop techniques to improve resilience to stress, and help maintain composure and self-control when unexpected situations arise. Appreciate that loss of either is more likely to make matters worse rather than help a difficult situation.

6.6 Team Situation Awareness

I get nervous watching teammates. I get nervous for them. Late in the game, pressure situation, I'm nervous for them.

Derek Jeter [1]

A special situation of SA is team SA [2]. Complex dynamic situations, such as surgical operating theatres, involve the close interaction between various team members, surgeons, anaesthetists, scrub nurses, perfusionists, radiographers. Such team members have different responsibilities, parallel roles and individual sub-goals, but are also working towards a shared task, a shared overall goal, the team's goal.

Team SA is essential for the performance of the team as a whole, and has been described as the "degree to which every team member possesses the SA required for his or her responsibilities" [2]. This refers to each team member having the necessary SA for achieving their own sub-goal. By meeting their own sub-goals team members contribute to the team's overall goal [2, 20].

However, the sub-goals of some team members may partly overlap, hence part of their SA may also overlap (shared) to facilitate these common requirements. It should be noted that this is sharing SA, rather than giving it completely away, as that could compromise their own sub-goal, making them the weak link in the chain (Fig. 6.4).

The surgeon and anaesthetist are part of the same team and are working towards a common overall goal, but it is essential that some data or information are received by both in order to allow them to perform their individual sub-goals; just the

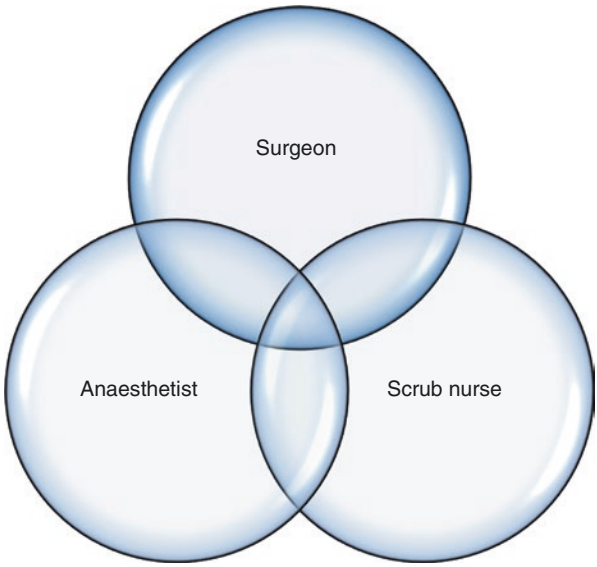

Fig. 6.4 Situation awareness sharing by the surgical team members—part overlaps between team members, part is limited to individual team members. Adapted from Endsley [2]

surgeon or the anaesthetist knowing may not be enough. Both may need to be aware of the case's previous medical history of cerebrovascular disease which may limit the ability to drop the intra-operative blood pressure to achieve a bloodless field, or both may need to be aware that the gall bladder looks gangrenous, and the laparoscopic attempt may need to be converted to an open laparotomy half way through.

Hence, team coordination involves SA sharing which may be achieved by exchange of information between team members, or by team members receiving information from a common source (such as displays accessible to all). The team needs to recognise what information needs to be shared, and how this can be achieved.

Information may be shared by explicit communications during pre-operative team briefs or intra-operatively, but other less direct means of communication are also possible. Gillespie et al. [20] looked at the effects of various aspects of communication on shared SA between surgical theatre team members. They reported that strategies that enhanced shared SA included:

- "Self-talk"—the surgeon talking though critical steps of the operation, telling the rest of the team what is doing, and what care needs to be taken.
- Closed loop communication—repeating the message received, to confirm that it has been understood or that the required action has been performed.
- "Overhearing conversations"—between other team members in close proximity, to help one stay in the loop, and coordinate their actions according to the need of the situation; such as the scrub nurse overhearing the surgeon and assistant discussing how complex the case is, or the surgeon overhearing discussions between scrub nurses about staff shortages that may influence the smooth running of the list.

If you closely pay attention next time you are in theatre you may notice the scrub nurse trying to hear what you are telling your assistant or senior surgeon, trying to work out how the operation is going, and then communicating that to the fellow scrub staff. Alternatively, you may notice your-self "thinking aloud", trying to let others know as to what you are doing.

Sharing of communication can directly impact patient outcomes. Mazzocco et al. [21] examined the relationship between certain team behaviours and patient outcomes, and reported a greater risk of complications or death when encountering less information sharing intra-operatively and at handovers. Along similar lines, Siu et al. [22], in an observational study, examined the behaviours associated with intra-operative incidents in general and vascular surgery at the Royal Infirmary of Edinburgh. Poor SA, poor communication and poor teamwork across the whole surgical theatre team were closely related to such intra-operative events.

Aim for functional communication, functional SA sharing.

6.7 Recognising Loss of Situation Awareness

Exploring how you could make a bad situation worse can sometimes tell you what not to do.
Harvey Mackay [1]

The ability to pick cues that your SA may be incorrect, is an important skill to develop. You may consider that your impression of the big picture is wrong if:

- Getting conflicting messages—
  - "The bone must be very weak to have broken so easily but it feels really hard to drill through".
  - "The diathermy is set to maximum, the suction is working, but it is not coagulating the vessel".
- Pieces of information do not fit to a recognisable pattern—
  - "Does not look like a tendon—can't follow it through to a muscle".
  - "The nerve is passing vertically rather than crossing horizontally –is it the main trunk or an unusually large branch?".
- You feel confused as to what is happening—
  - "Does not make sense, it looks like bursa rather than tendon but it merges with the muscle".
  - "Not sure what dissecting plane I am in".
- All teams members seem to be concentrating on one task.

If the received information does not fit with your expectations, consider the possibility that a different situation may exist to the one that you assumed and try to:

- Re-evaluate the information received—what else could it be?
  - "Is it possible this is the medial knee ligament rather than the hamstring tendon?"
  - "Could the drop in haemoglobin be due to taking blood from the cannulated limb with fluids going in?"
- Look for more information with an open mind—
  - "Let's screen with a radiograph to ensure this is the correct fracture level".
- Avoid trying to make the information fit the model, concentrating only on what fits with your assumption, and ignoring or disputing the rest. Recognise that once an interpretation of the situation is made and a mental model is established there may be a tendency to look for and preferentially select information that supports that mental model (confirmation bias) [23, 24]. Go back to the basics and reconsider [2, 7].

- Review the existing model and adjust it according to what may be the current true situation. Go back to the beginning, start again from a definitely accurate stage, and re-evaluate what you are facing:
  - "The hip hemi-arthroplasty is not reducing; but we did a reduction trial, the stem is still at the correct height, no swabs or soft tissue in the acetabulum, could it be that the spinal is wearing and need some muscle relaxation?".
- Adopt a new mental model.
  - "This is not a gangrenous appendix, we are dealing with a perforated caecum".
  - "This is not an isolated fracture of the capitellum, we are dealing with a fracture involving the whole of the distal humeral articulation".
- Change the initial goals to allow for the new situation
  - "The bone is too weak to fix the fracture, lets replace the hip".
  - "The anastomosis is poorly perfused, let's convert to a stoma".
  - "The wound is too tight to close, let's leave it open and try again in 48 h".

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Chapter 7
Decision Making in Surgery

As surgeons we are often faced with a constant need for making decisions; decisions in the surgical theatre, the clinic, the ward, in consultations, in meetings. We are faced with situations where fast decisions, immediate decisive actions are demanded, but also situations where all facts must be carefully considered so that balanced, well measured decisions are made. Decisions can influence our performance, our patients' outcomes, our relationships with colleagues, our professional standing.

Being aware of the process of our decision making, and understanding the biases and other factors that may influence our decisions are important skills to develop. They may help us achieve greater mental influence on our decision making, and enhance our ability to self-reflect, improve, learn from successes and errors.

This chapter discusses intuitive and analytical decision making, and explores the various decision biases that a surgeon may face. It also discusses some of the factors that may influence our decision to offer surgery, and considerations that may influence our decision making in the absence of strong scientific evidence. The ability of a surgeon to alter their decision once that is taken, is also discussed.

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You are right that we would be better off positioning on the side, but I can't change my decision. I must stick to my guns!

7.1 The Spectrum of Surgical Decisions

Sometimes you make the right decision, sometimes you make the decision right.
Phillip C McGraw [1]

As a surgeon you may face multiple decisions in a normal working day. You may face multiple clinical decisions in formulating a working diagnosis, choosing the appropriate investigations, coming up with a management plan, whether and when to operate, how to position the patient on the operating table, selecting a surgical approach to get adequate exposure, the anatomical plane in which to dissect, whether to accept the less than perfect achieved fracture reduction, when to change course and convert the laparoscopic cholecystectomy to an open one, how to close the surgical wound, what dressing to apply, what restrictions to initiate post-surgery, when to discharge home, when to review in clinic.

At the same time you may have to decide about the choice and allocation of resources, how to organise the working environment and allocate available time. You may have to decide what assistance you need in theatre, what advice to give to a colleague asking for help, whom to consult for a further opinion.

You often have to make individual decisions, sometimes collective decisions in collaboration with colleagues, patients, relatives or other staff. You may have to decide on the spot, within tight deadlines, or you may have ample time for consideration.

Part of surgical training is to develop appropriate decision making, alongside skilful surgical techniques as on occasions decision making may be more important than the sleekest of surgical skills.

7.2 Types of Decision Making

I think there's a difference between a gamble and a calculated risk.

Edmund H. North [2]

Several decision making models have been described [3, 4] including:

- Intuitive—the problem is identified and the solution is chosen based on recognition of a pattern in which the problem fits. The solution may be based on procedures, or previous experience (of actions taken and the resultant outcomes).
- Analytical—the problem is identified, different options are compared, alternative solutions are weighted up, to carefully select the preferable one, to make a rational decision.
- Rule based—the problem is identified and rules that apply to the situation are recalled or looked up. This type of decision making requires awareness of the rules and also knowledge as to how to apply them.
- Creative—when faced with a rare problem, one comes up with a novel solution; make it up as you go along.

Decision making may be looked at as a broad spectrum process, ranging from the conscious and analytical based approach at one end, to the subconscious, intuitive, automatic approach at the other end (Fig. 7.1). Hence, at one end decision making is slow, thoughtful, requiring large mental concentration whereas at the other end it is fast and conscious-less, requiring minimal concentration. Somewhere in between these extremes is the rule based decision making.

Fig. 7.1 Spectrum of decision making

7.3 Effect of Experience on the Choice of Decision Model

Good decisions come from experience. Experience comes from making bad decisions.

Mark Twain [5]

A problem that initially requires analytical decision making, may be solved by intuition as one develops experience and knowledge. Intuition may be considered pattern recognition, which doesn't consider rules or analyse deeply. Based on knowledge and previous experience, important cues are picked from the problem or situation, from the clinical history or examination findings to reach a decision.

Intuition occurs fast, at a subconscious level, but knowledge and experience are needed to allow this instant recognition. Hence, at the beginning of learning and training a novice surgeon may mainly utilise analytical processes, looking at each component in detail, analysing each in turn, and trying to determine how they relate and how they fit together.

However, as more cases are encountered, and one develops greater knowledge and expertise, and as the "mental database" of previously seen clinical presentations expands, there is increased utilisation of intuition, without a need to break down each problem into its sub-components. In this way, a repeated presentation of the same problem may help one to convert from analytical to intuitive decision making for that particular problem [4].

- At the beginning of learning, in dealing with a patient with a hip fracture, a surgeon may need to consider in detail the fracture pattern, previous medical history, pre-fracture mobility, and various treatment options in deciding which treatment to choose. In contrast, with more experience, one may be able to quickly decide how to treat the patient, by examining the radiograph and hearing the history summary.
- At the beginning of learning, in dealing with acute abdominal pain, a surgeon may consider in detail the nature, location, radiation, duration of pain, associated symptoms, previous medical history, haematological and other investigations to come up with a list of possible diagnoses. In contrast, with increasing experience one may be able to come up with an "end of bed" spot diagnosis utilising much less clinical information.

7.4 Switching Between Decision Models

If you do not change direction, you may end up where you are heading.
Gautama Buddha [1]

Under certain circumstances one may need to convert from intuitive to analytical decision making, and the ability to recognise the circumstances where this may be essential is an important skill to develop.

A component of intuition is to see when a situation does not fit with the expected, in order to allow one to consciously pause and think, that is to convert to more analytical decision making (Fig. 7.2). If what you see does not match what you expect, or if substantial pieces do not fit into the jigsaw you just put together, then you may need to reconsider. If what you see does not really fit into a pre-stored mental model or pattern, decision making may need to be slowed down, for a careful analysis to be performed [6].

- You may have just assessed a patient with a hip fracture, reviewed the radiographs, and be convinced this is just another case on the list for a Dynamic Hip Screw (DHS) fixation. But then, as you are writing your clerking notes, you recall the patient telling you of feeling pain in that hip for a few weeks prior to the fall; you suddenly stop and reconsider:
  - Could this be a pathological fracture?
  - Anything in previous medical history to suggest that?
  - Do we need to investigate further prior to surgery?

Hence, analytical decision making may override intuitive thinking, and allow change of course.

It may also be possible for one to allow intuitive decision making override the analytical process; one may not be able to hold back their "gut feeling" despite the fact that thorough analysis of the facts points to a different direction [6].

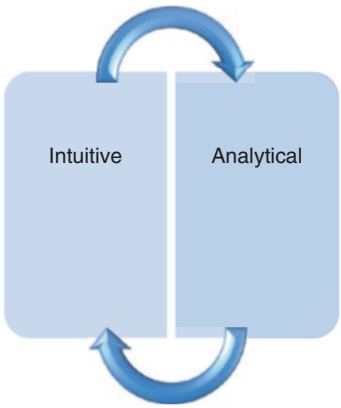

Fig. 7.2 Analytical and intuitive decision making may override each other

7.5 Biases in Decision Making

Decision making is an art only until the person understands the science.

Pearl Zhu [1]

In a similar way to how we evaluate our technical skills, one can evaluate their decisions and the process of reaching those decisions. Such evaluation includes appreciating that our decision making may not always be rational but on occasions may be subjected to biases. Such biases may be more likely to occur when we are in the intuitive mode, when decisions are made in the absence of detailed analysis.

Heuristics are mental shortcuts, or rules of thumbs, which allow fast decision making and avoid the need of deep, analytical, time consuming consideration when a problem is encountered. Heuristics are useful because they allow us to manage complex problems quickly, without devoting much time and "brain energy". However, heuristics may be more prone to biases and error [7–16]. Several decision making biases have been described [7–16] and you may recognise some of the following in surgical practise:

Status quo bias—choosing options that maintain the status quo:

- "Why convert to using oral anti-coagulants in thrombo-prophylaxis when deltaparin works pretty well?"

Aggregate bias—considering that information gathered from a group of patients may not apply to an individual. Surgeons may find reasons to justify that a specific patient is "atypical" hence it is appropriate to deviate from recognised guidelines:

- "It is a nasty open tibial fracture; better give antibiotics for a week rather than the recommended three doses".
- "The patient is mobilising outside her house independently, but is quite elderly. Let's perform a hemi-arthroplasty for her hip fracture rather than the total hip replacement that national guidelines would advice".

Commission bias—choosing action over inaction:

- "We can't leave it. We have to fix the fracture. How can we possibly leave it alone?"

Omission bias—choosing inaction over action to avoid taking responsibility for an adverse outcome.

- "Better see them back again in clinic in 3 months to make sure all is ok. Give them another follow up rather than discharging".

Ego bias—a tendency to overestimate the outcomes of own patients:

- "Not sure what they are talking about. My results are so much better".

Anchoring—the tendency to stick to specific features encountered early in the presentation of an illness, committing to a diagnosis, and resisting subsequent adjustment:

- "Long history of similar back pain, gone worse last few days…unlikely the scan will show up much".

Alternatively, a label may have been attached to a patient by another healthcare worker, by the General Practitioner or the triage nurse at the Accident and Emergency department, and this label continues to stay with that patient without much consideration or challenge. One may find it difficult to consider alternatives, to consider that the assigned label could be wrong:

- "Another referral of PR bleeding from haemorrhoids. Not sure why they keep referring them through".
- "Another case of hand numbness due to carpal tunnel syndrome, let's see if keen to have surgery".

Confirmation bias—findings or observations that appear to confirm a working hypothesis are given more weight, with less attention paid to evidence that could challenge these beliefs;

- "The knee aspirate is heavily blood stained…it looks like haematoma rather than infection…the raised CRP could be due to other causes…let's hold off antibiotics".

Search satisfying—one stops searching for any further abnormalities having been satisfied from finding the first; an orthopaedic surgeon having identified a cervical spine fracture may fail to look for and find any fractures in the rest of the spine or other associated injuries.

Availability bias—the prevalence of a disease is over estimated if it comes easily to mind. If one has recently encountered a disorder, read about it, been to a relevant lecture or course, then that disorder may be the first to be considered in the differential diagnosis next time a patient presenting with similar symptoms and signs is encountered, even though the diagnosis in question is unusual or rare;

- "Acute abdominal pain in a 30 year old; could be another hypercalcaemia and pituitary adenoma".

The opposite may also apply whereby one fails to consider a diagnosis simply because they have not come across it for a long time; one may consider that the 80 year old with back pain is another presentation of acute mechanical pain or cauda equina, but fail to consider the possibility of a ruptured aneurysm, as they have not encountered one before.

Hindsight bias—one looks back at an event and overestimates what was known at the time, thus falsely concluding that the event could have been predicted and appropriately managed. However, this may not be the case, as the context and others factors that could have influenced decision making or performance are not fully taken into account. This could lead to false reassurance that if a similar situation was encountered in the future, it would be appropriately managed. Thus one may fail to truly self-reflect and learn from a past failure.

- "How could we have delayed the diagnosis of appendicitis? It was obvious… there was iliac fossa tenderness and temperature".

But when considering decision making, with the benefit of hindsight, one must take into account the context in which such decisions were made. This may involve considering additional, conflicting information which was available, other cases dealt with at the same time, limitation of resources, the physical or mental exhaustion of any healthcare practitioners involved. This may allow a better evaluation of decision making and hence help development and improvement.

Outcome bias—tendency to judge the quality of a decision based on its outcome:

- "Maybe we should have left the fracture alone...it would have been acceptable to do so, and it would have avoided the infection".

Framing bias—when faced with decisions involving risks, one may consider potential gains and losses. However, in considering losses there may be a tendency to prefer a loss which has a lower chance of occurring but when it occurs it is more damaging, rather than a loss which will definitely happen but its effects are not as devastating;

- "The patient is diabetic, if we reduce and fix the ankle fracture it could get infected and in severe infections one could even lose the leg, but if we leave it alone it will heal in that bad position and cause long term pain and limping".

Recognising the existence of biases in decision making may help construct de-biasing defences, to help minimise their adverse effects.

7.6 Factors Influencing Surgical Decision Making

Ethical decisions ensure that everyone's best interests are protected. When in doubt, don't.
Harvey Mackay [2]

In surgical decision making, one would aim to make rational decisions, that above all aim to benefit the patient concerned. But even when it comes to conscious decisions, a surgeon may be faced with multiple, sometimes conflicting factors, that may guide their decision making process. Leung et al. [17] refer to three types of factors that may influence a surgeon's decision making:

1. Avowed factors—what is in the patient's best interests.
2. Un-avowed factors—that would benefit the healthcare system in general but not essentially the particular patient. These may be necessary to allow surgeons to address multiple priorities and commitments such as teaching, research, relations with colleagues. These may be include decisions such as:
   (a) when to allow a trainee to operate (despite knowing the operation will take longer).
   (b) when to invite a patient to participate in a surgical trial (despite having a strong preference for a particular treatment option).
   (c) when to rush through an operation to avoid cancelling the next case.
   (d) when to change a colleague's surgical management plan (knowing that could question their authority and impair relationships).
3. Dis-avowed factors—that would benefit the surgeon but not the patient such as monetary incentives or the need to maintain personal reputation. These may include deciding to perform surgical procedures which have limited clinical effectiveness because they pay well or because other surgeons do.

Recognising and accepting the decision making conflicts one may encounter, could aid self-reflection and help us appropriately adjust our decision making.

7.7 Decision Making in Offering Surgery

> *In any moment of decision, the best thing you can do is the right thing, the next best thing is the wrong thing, and the worst thing you can do is nothing.*
>
> Theodore Roosevelt [2]

The decision as to whether or not to recommend surgery is one that a surgeon regularly has to make. A challenge faced by surgeons is how to make reliable decisions in the absence of robust supporting evidence. In particular, how do you decide to offer surgery when it is not certain whether it will help, how do you decide between different treatment options?

Hageman et al. [18] surveyed 337 surgeons to determine how they make decisions when evidence is inconclusive. Firstly, they looked at decision making when there is no conclusive evidence as to whether treatment is better than allowing the disease to take its natural course. The most popular responses of surgeons were:

- "Works in my hands"
- "Familiarity with the treatment"
- "What my mentor taught me"

Secondly, they asked surgeons as to how they decide between two surgical treatments, when the evidence shows no difference between the two, and the most important factors reported were:

- "Fewer complications"
- "Quicker recovery"
- "Burns fewer bridges"
- "Works in my hands"
- "Familiarity with the procedure"

Some of the other factors reported by some respondents were "what others are doing", "patients are requesting the procedure", "highest reimbursement", "shorter procedure", and "cheapest/most resourceful".

Teunis et al. [19], presented 15 upper limb injuries (which could be treated surgically or non-surgically) to 223 surgeons and asked them whether they would recommend surgery. Participating surgeons also completed a test, designed to assess personality traits. The authors found that a higher score on the personality test (suggestive of innovation, creativity, and acceptance of higher risk levels) was related to higher rates of preference for surgery.

Janssen et al. [20] asked 254 orthopaedic, plastic and trauma surgeons whether they would recommend surgical or non-surgical treatment in each of 21 fictional cases presenting with upper limb disorders. Half of the surgeons were randomised to choose a treatment for themselves had they had the disorder in question, and half were randomised to choose a treatment for a patient of their age and gender presenting with that disorder. Surgeons were more likely to recommend surgery for patients rather than choosing surgery for themselves, but were more confident in deciding for own-selves than for their patients.

Recent events may also influence our decision making, a concept known as the recency effect. What happened recently to one patient may alter our decision process, guide us to one line of action, even when rational thinking points us in a different direction. Simianu et al. [21] evaluated the recency effect amongst colorectal surgeons. They evaluated the use of preventative leak testing in bowel anastomosis, prior to and after encountering operations with anastomotic leaks. They found that 36% of 25 surgeons showed a recency effect, increasing their leak testing, after encountering leaks where the anastomosis had not been tested.

Along similar lines Dale et al. [22] examined whether the decision making of vascular surgeons could be influenced by a negative previous experience. Surgeons were exposed either to an expanding balloon that eventually burst (considered as a bad outcome) or to a demonstration of an expanding balloon that didn't go on to burst (considered a good outcome). They were then evaluated on a simulator as to when they would opt out from an expanding abdominal aortic aneurysm situation and decide to operate. Despite evidence based guidelines as to when such aneurysms should be operated upon, the group that had been subjected to the bursting balloon were more likely to opt out and decide to intervene early. In accord with this Dale et al. [23] evaluated on a simulator, the decision of surgeons to operate on an abdominal aortic aneurysm. They showed that surgeons tended to proceed with surgery much earlier than evidence based guidelines would recommend, but in addition they demonstrated that previous exposure to a death during watchful waiting led to surgeons operating significantly sooner on a subsequent patient.

Szatmary et al. [24] investigated the factors affecting the decision of surgeons to operate in emergency surgery situations, through semi-structured interviews and consideration of clinical vignettes. Surgeons' decisions to operate were mainly influenced by perceived likely outcomes, deciding to operate when they perceived the outcome with surgery was better than without. Interestingly, surgeons with less than 5 years of experience were less certain of potential outcomes and were also more likely to decide to operate than more experienced surgeons.

In line with this finding (that suggests limited clinical confidence may lead to a greater tendency to operate) are the results of a national survey of American surgeons carried out by Wilson et al. [25].These authors evaluated the factors associated with surgeons' decision to operate in clinical scenarios where there was no strong indication for surgical or non-surgical treatment, and decision was upon the surgeon's discretion. They found that surgeons were less likely than their colleagues to recommend surgery for conditions that fell within their subspecialisation area, suggesting they were more confident in managing non-surgically conditions they had more experience with. Older surgeons were also less likely to offer surgery compared to younger ones.

Along similar lines Sacks et al. [26] presented to a national sample of 767 surgeons four clinical vignettes of cases of appendicitis, bowel obstruction, mesenteric ischaemia and gastro-interstinal bleed and asked them to judge the risks and benefits of surgery versus non-surgery and also state as to whether they would operate. They reported a huge variation in risk/benefit assessments of surgeons as well as in their decision to operate. Surgeons were more likely to operate as their perceptions of the benefits of surgery increased, and the risks of non-surgical treatment increased. However, differences in risk/benefit perceptions amongst surgeons accounted for only 39% of the variations reported in the decisions to operate. It is also of interest that in an associated study [27] the authors demonstrated that exposure of surgeons to a risk calculator improved the assessment of risks but did not influence the likelihood of recommending surgery.

Rutkow et al. [28] evaluated the reliability of surgical decision making in offering surgery for seven elective procedures (breast surgery, varicose vein, cholecystectomy, hysterectomy, tonsillectomy and adenoidectomy, cataract extraction, prostatectomy). They presented clinical scenarios of patients seeking consultation and determined the agreement in offering surgery, amongst surgeons in Maryland and Columbia in the USA. They reported a wide variation amongst surgeons in their decision to operate, with 12 of the 19 test cases examined showing less than 80% agreement. In a follow up study [29] surgeons were again asked (2 years later) as to whether they would offer surgery in those scenarios, and their responses were compared to those given initially. A large intra-observer variation was noted suggesting that even a surgeon's own judgement may differ with time.

As surgeons we seem to make important treatment decisions based on personal preferences, previous experiences, surgical knowledge and training, and may also be influenced by our personality characteristics. Appreciating the factors that may guide your decision making could help recognise the uncertainty that often exists in what you do, and the limitations of the decisions you make. Hence, you can be more forgiving to those who make different decisions to yours, and more forgiving to own-self when faced with the consequences of the decisions you once made.

7.8 Emotions and Decision Making

> *The essential difference between emotion and reason is that emotion leads to action while reason leads to conclusions.*
>
> Donald Calne [30]

Decision making and clinical judgement may be susceptible to emotional influences. Several factors may influence a doctor's emotional state such as patient characteristics, environmental conditions, physical and psychological fitness of the doctor themselves [11].

Doctors may develop emotional biases towards their patients, which may guide their treatment approach. Such biases include:

- Countertransference—the situation where past feelings of a doctor define the present relationship with a patient. Certain characteristics of a patient such as appearance or behaviour may remind the doctor of similar patients encountered in the past, creating a biased response and consequently biased decision making [11]. James Groves, of the Psychiatry Service in the Massachusetts General Hospital, wrote in the 1970s of patient characteristics that produced negative emotions to the treating doctor—the "dependent clingers, entitled demanders, manipulative help-rejecters and self-destructive deniers" [31].
- Fundamental attribution bias—the situation where an event is blamed on the personal qualities of a patient, rather than on the context in which the event occurs. This may lead to patients being judged negatively and disliked, minimising or overlooking their complaints leading to wrong decisions and management errors [11]:
  - An intravenous drug abuser may present with a nasty groin abscess and some abdominal pain, but one may consider it to be another superficial abscess due to groin injection with dirty needles rather than considering the possibility of a more complex iliopsoas collection tracking from above.

Our decision making may also be influenced by the potential emotions we may later experience due to those decisions (Fig. 7.3).

Anticipated regret—the situation whereby in making decisions we take into consideration our own emotional reactions that may occur in the future as a result of those decisions. This may lead to deciding to go with the option which may lead to the least anticipated unpleasant emotion or regret [32].

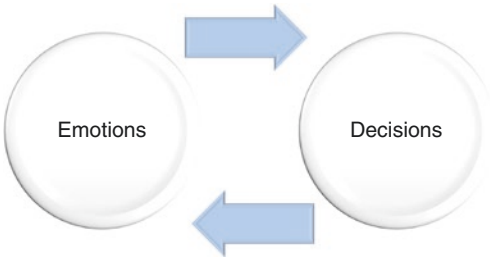

Fig. 7.3 Bi-directional relationship between emotions and decision making

Sorum et al. [32] asked primary care physicians in France and the USA how much regret they would experience if they found advanced prostate cancer in patients for whom they had refused to order Prostate Specific Antigen(PSA) tests several years earlier. The authors showed a positive correlation between the expressed levels of regret and the likelihood of ordering a PSA in a subsequent group of hypothetical patients presenting for routine physical examination.

Furthermore, being upset or preoccupied with other matters may influence our decision making process. The workplace, with its pressures and stressors, may affect your emotions, and hence potentially your decision making. Others, who interact with you, may not be aware of the impact of their actions on your emotional state, or may be aware but decide to ignore it:

- The rota master may keep asking you to cover the on call shift at short notice, ignoring that you have just finished three days on call in a row and not being aware that you already have social plans in place.
- The department manager may be asking you to go at short notice to do ward cover without considering that it would mean missing another day from theatre, another lost training opportunity.
- Your senior may suddenly decide to question why you have applied to go to a course, without considering that has been long agreed as part of your appraisal process.
- Your executive may inform you that "change is inevitable" making you wondering and anxious as to what that change may entail.

It is believed that stress can affect decision making but its exact influences are unclear [33–35]. Both improved performance and performance degradation have been associated with increased stress, and may be influenced by the stress levels. The effect of stress may be influenced by how the individual perceives stress, hence stress, and potentially its effects on decision making, may be minimised in emergency situations through simulation and preparation.

It is important to develop the skill of appreciating the effects that emotions and emotion related biases can have on decision making and develop strategies to deal with these. Not all of us are affected by events in the same way. Some may be able to shrug off troubles and move on, some may be less able to do so. You are likely to know better than others how it affects you, what to ignore or what to avoid. You may consider:

- Avoid any factor that can impair your emotional state prior to critical decision making (but then that may not be always possible). If you know that reading your work emails is likely to make you upset, create constant thoughts or worries, should you be reading these in the morning just before the commencement of a busy day clinic or a day of challenging operating?
- Acknowledge such emotions and aim for decision making that is objective and rational. It does not mean trying to suppress your feelings, but acknowledging those feelings. The advice is not to block your emotional reactions (which could lead to anxiety or even clinical burnout) but to recognise these reactions and take them into account in your decision making [11]. It's almost like being on an interview panel, interviewing a candidate that you know well and like as a colleague. One may acknowledge the affection, but still make an objective and impartial decision.
- If you feel that emotions are impairing you decisions, consider taking time off, seek help and support.

7.9 Improving Decision Making

An executive is a man who can make quick decisions and is sometimes right.
Elbert Hubbard [36]

In improving decision making you may consider:

- Meta-cognition refers to the ability to reflect on the decision process and adjust appropriately [37–42]. Develop the ability to recognise situations where your decision process may be impaired or biased, and plan strategies to deal with those:
  - You may be aware of your tendency to just concentrate on the fractured tibia and end up missing any other injuries—you may deliberately do initially a full system evaluation and leave the tibia last.
  - You may recognise that when faced with patients reporting symptoms out of proportion, you tend to question the validity of such symptoms, and hence endangering dismissing those symptoms—you may deliberately "give the benefit of doubt" to ensure that your usual investigation pathway is followed.
- Aim to continuously self-reflect on your decisions, like you do for technical skills. Keep enquiring whether the correct decision has been taken, and, if not, how could the decision making process be improved next time?
- Lack of insight, poor self –assessment, over confidence, distractions, competing interests, "surgical image" pressures, may impair the decision making process, hence examine own-self for these and deal with them if found.
- Develop the ability to slow down, focus concentration at critical times, at particularly difficult steps in a surgical procedure, when encountering unexpected complication [43].
- Identify attitudes that may adversely influence your decision making and address those. Kadzielski et al. [44] examined the rates of hazardous attitudes (including macho, anti-authority, impulsivity, resignation, self-confidence) amongst orthopaedic surgeons at the Massachusetts General Hospital. They reported that 30% of those surveyed had at least one elevated hazardous attitude level. In addition, a macho attitude correlated with an increased number of re-admissions and re-operations.
- Develop the ability to reflect in action. Reflection in action enables a surgeon to continuously monitor the progress of a task (such as a surgical procedure) [45]. This dynamic decision making model consists of:
  - Assessing the situation
  - Taking the appropriate action
  - Re-evaluating the results of your decision
- Ensure you have the necessary knowledge to facilitate your decision making. Clarke [46] evaluated the role of decision making skills and medical knowledge in clinical judgement of surgical residents. They presented surgical management problems to surgical residents, the solution of which required textbook knowledge as well as logical decision making. They reported that correct decisions correlated positively with more accurate knowledge of textbook information. Hence, the authors suggested that decision analysis can supplement but not replace gathering of scientific knowledge.

7.10 Surgeons Are Allowed to Change Their Mind

Reconsider, v. To seek a justification for a decision already made.

Ambrose Bierce [47]

Surgeons are often perceived as decisive, confident practitioners who cannot tolerate uncertainty. As surgeons we may be taught to make quick, definite decisions, justify our case, stick to our guns. We may be given the perception that re-thinking or re-evaluating are signs of weakness, hesitancy, dithering, vacillating. We may feel that revision or reversal of decisions could impair our ability to lead or could diminish the trust and confidence others put upon us.

But as a surgeon you may often practise in complex, dynamic situations, with constant change of information, emergence of new facts. As in other settings, out of surgical life, you may give an immediate intuitive decision, but then momentarily stop and re-think, consider a bit more the facts, be more analytical, and come to a different conclusion.

If you feel that your revised decision is the correct one, be prepared to change your mind. Is it more important to save face, match a surgeon's image, meet the perceived expectations of others, or is it more important to take, communicate and act upon a better decision?

If you have reconsidered and changed your mind let others know:

- "I am changing my mind..."
- "I am sorry, following further consideration…."
- "You are right, it would be better to do that…."
- "What I have just said is not right…."
- "Forget what I have just said, lets…"
- "No lets do this instead…."

If chancellors make dramatic public U-turns shortly after announcing the annual budget [48], if prime-ministers [49], presidents [50] and even footballers [51] change their mind, is it so difficult for a surgeon to reconsider?

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Chapter 8
Leadership in Surgery

Surgeons are often called upon to lead or manage amongst others processes, activities, people, teams, departments or institutions, through formal or informal roles. Successful leading requires a clear understanding of the task at hand, a clear vision of what one aims to achieve, but also the ability to establish and maintain effective inter-personal relations with followers and the wider team.

This chapter examines the similarities and differences between leading and managing, describes various leadership styles, and discusses the importance of leadership along with the challenges a surgeon leader may face. Both desirable and undesirable leadership behaviours are then presented, whilst finally emphasising the distinction between leading and holding leadership titles or posts.

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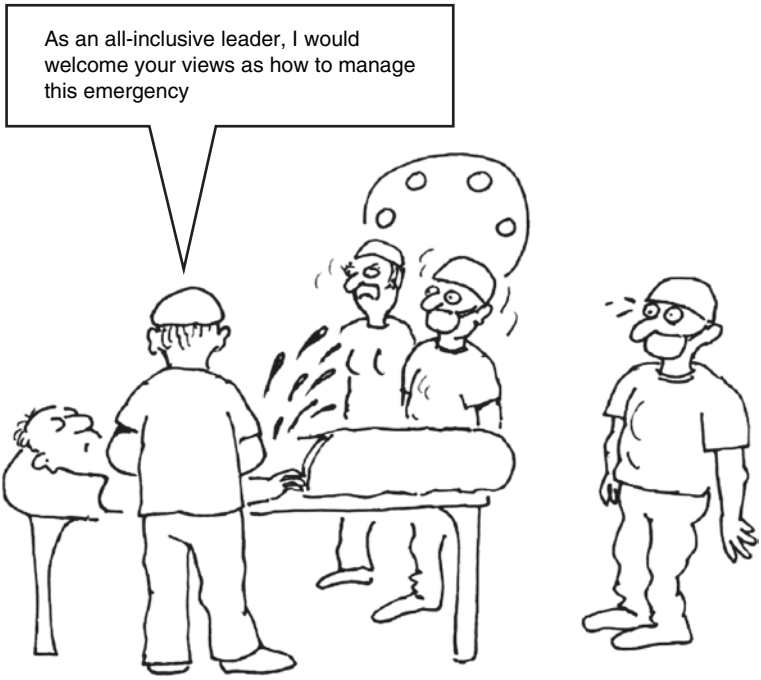
As an all-inclusive leader, I would welcome your views as how to manage this emergency

8.1 Leader Versus Manager

Management is efficiency in climbing the ladder of success; leadership determines whether the ladder is leaning against the right wall.

Stephen Covey [1]

A surgeon may have to lead and manage their team and service, their department, institution or organisation. The terms "leader" and "manager" are often used loosely and interchangeably. Leadership and managerial roles do overlap and one does not preclude the other. Both may share common values, and the need of certain skills to achieve their objectives.

Nevertheless, despite being close, the two roles may differ in their inner core. A leader may be considered as the one who sets the vision, the manager the one who makes the vision reality. A leader identifies the priorities, eliminates the unnecessary and highlights the essential. A leader sets the direction, questions the current path and convinces others of the need to change course. A leader sets the way, a manager ensures the way is followed and the goal is reached. The leader sets the target, the manager hits the target. A manager ensures the wheel keeps rolling whilst a leader questions the need for a wheel.

A leader is the driver who chooses the destination, or the one that alters a destination that has already been pre-set. A manager is a co-driver who organises the journey, reads the map, sets the exact route, allocates the re-fuel stops, and ensures the engine and tyres are up to scratch to get to the end.

The leader is like a pilot, the manager the autopilot. The autopilot will manage most of the flight, make the turns, adjust the speed, control the thrust and throttle to counteract turbulence, to keep cruising smoothly. But no matter how efficient the autopilot is, the pilot is needed to dial in the destination, lead the taking off, and often fine tune the final descent to landing. When trouble hits hard, when in the middle of a storm, the pitot tubes get ice blocked, and the autopilot fails, the pilot once again needs to step in, take control, work out what's wrong and stir the plane back on course.

In the era of target driven healthcare, a leader may question the preference of waiting time targets over quality based assessments. A leader may recognise that waiting time targets are often counterproductive, not necessarily achieving what they mean to, collect supporting evidence, and argue to the stakeholders the need for course change. A manager faced with such targets may strive to make those system adjustments to ensure that target waiting times are not exceeded. A leader questions the task, a manager considers how to cope with the assigned task.

8.2 Types of Leadership

When the best leader's work is done the people say, 'We did it ourselves.'

Lao Tzu [2]

Several types of leadership have been described [3, 4] but three well known ones are:

1. Authoritative—dictates as what to be done.
2. Democratic—consults on decisions, aims to reach consensus, majorities decide but minorities are supported and respected.
3. Laisse-faire—delegates the tasks to followers who are given the freedom and flexibility in how to bring them about.

Leadership styles may also be described as transactional or transformational [5–7];

1. Transactional leader—focused on performing the task at hand, through assignments of roles, actions and responsibilities. Engages in transaction with follower to reward success or penalise failure.
2. Transformational leader—does not only focus on carrying out a task but also on the well-being, and development of the followers and the whole team. Focuses on the team rather than simply on own-self, and is driven by a sense of collective mission. Values and supports individuals, and encourages their personal and professional development and advancement beyond what is the minimum required for carrying out a task. Readily shares information with the rest of the team.

Different leadership styles have their pros and cons, and the one to choose may be influenced by your position, personality, your followers, the task at hand. Leadership styles however do not have to be all or none, and one may move from one to another, according to the circumstances faced. One may be able to move between enabling and more forceful leadership styles but without overdoing either [8]:

- Reaching a decision about long term departmental staffing may require a different leader's approach to that required in the allocation of tasks amongst a resuscitation team awaiting the trauma ambulance.
- Leading the team in deciding the order of an elective theatre list may require a different approach to resuscitating a crashed patient with an acutely ruptured aortic aneurysm.

You may aim for an all-inclusive, empowering, leadership style, where diverse views are heard and respected, where team skills are cultivated and talents are nourished. But there may be occasions where you have to be assertive, direct as to what has to happen, as the urgency of the moment dictates.

8.3 Leadership Matters

You manage things; you lead people.

Rear Admiral Grace Murray Hopper [9]

Leadership is vital at multiple levels, as it can affect [9]:

- The individual follower—promote commitment, encourage loyalty, enhance performance, inspire one to go that extra mile.
- The team—promote communication, organisation, coordination, conflict resolution, goal setting, role allocation, sharing of aspirations and values.
- The institution—set strategy, define direction.

Effective leadership may improve the wellbeing of individuals, and by doing so improve the performance and efficiency of the whole team. Spinelli [10] looked at the effectiveness of transformational, transactional, and laissez-faire leadership amongst hospital managers, and reported that a transformational style was associated with individuals being more satisfied with their leaders, and more willing to exert extra effort in achieving their goals.

Poor leadership may demoralise followers, creating anxiety and misery, with some organisational surveys reporting that for up to 75% of workers the most stressful aspect of their job is their immediate boss [11, 12]. Rasch et al. [13], in their description of ineffective leadership, reported the "failure to consider human needs" as having the worst impact on staff morale.

In assessing effectiveness of leadership at a team, departmental, or institutional level, one may consider its effects on productivity, control of finances, service quality but also the effects of leadership on staff retention and turnover, sickness levels, staff morale, staff engagement and on the sense of belonging and being valued.

In surgery, an effective leadership may not only get things done, improve efficiency and performance, but also facilitate safe care. Hu et al. [14] evaluated the effects of surgeon's intra-operative leadership style on the behaviour of the operating theatre team. They video-recorded five surgeons performing complex operations, who were then scored on their leadership style. All surgeons scored similarly on transactional leadership but varied widely on their transformational style. A transformational leadership was characterised by more supportive and less poor behaviours towards the team. Such a leadership style encouraged cooperation and information-sharing within the team and empowered team members to speak up constructively, to suggest improvements or warn of unsafe situations.

Decreased information sharing during surgery has been shown to be related to increased risk of complications or death. Leach et al. [15, 16] evaluated the factors and conditions that influence performance in the operating theatre, through observations of surgical procedures and interviews of members of the operating theatre team. They concluded that a surgeon's leadership can help "set the tone" in the

surgical theatre, with good leaders proposing an environment where all individuals truly cooperate rather than simply carrying out their bit of the task, an environment where team members can work together and respond to any deficiencies of the system.

Kissane-Lee et al. [17] surveyed 40 surgical residents and interns on leadership styles in the surgical theatre. They described four styles:

- Authoritative—decides and informs firmly.
- Explanatory—decides and explains decisions.
- Consultive—consults in making decisions.
- Delegative—makes decisions by majority.

Residents and interns preferred mainly explanatory and consultive leadership styles but they mainly encountered authoritative leadership styles amongst attending surgeons.

You may find yourself in an operating theatre where everyone has to stand attention in front of the "master", follow clear instructions, where no dissent can be tolerated. Alternatively, you may happen to be in a theatre where tasks are delegated, roles are established, tasks are effectively performed, but at the same time hierarchies are put aside, where all team members are comfortable in speaking out on an equal level, speaking up or questioning what may not be right. A good leader may encourage such an atmosphere. Where would you choose to be?

8.4 Challenges of a Surgeon Leader

The function of leadership is to produce more leaders, not more followers.

Ralph Nader [1]

Leading or managing a surgical team can be a challenging task, due to the dynamics of the working environment, the demands of the tasks to be performed, but also due to your own or your followers' attributes. Appreciating these may help you examine own-self and see others in a different light, may enable you to be ambitious but also pragmatic and realistic.

When it comes to your own attributes you may consider:

- As a surgeon you may be used to giving instructions and orders, in dealing with complex emergency clinical cases, where fast, often immediate decisions must be made. Consultation, negotiation, constructive listening, reaching out for midway solutions may not apply to such circumstances, and hence may not easily come to mind in other leadership tasks.
- You may be used to the certainty of the impact of your actions; if you stitch a vessel the bleeding will stop, if you twist the screwdriver the screw will go in, but your words may not have the same predictable effect on people. You may be used to an action having a positive reaction but in dealing with human beings the reactions may be unpredictable.
- Your expectations may be high, demanding attention to detail, but in doing so you may end up setting too high standards. You may be highly gifted, very knowledgeable, technically skilful, a high striver, you may be looking others to match you, but others may not be able, or really wishing, to achieve that.

You may be leading a group of surgeons, who them-selves can have challenging qualities:

- They may be highly gifted, highly qualified, high striving, ambitious individuals, even more than you are.
- They may be highly opinionated and be prepared to express their opinions even when not asked for one.
- They may be resistant to change, not because they want to sabotage your plans, but because of the inherent belief that "if something works in my hands why change it?" an approach encountered in surgical technical decisions.
- They may be perfectionists who expect the same standards in their leaders or managers, and may be able to identify and pick on any signs of uncertainty or sloppiness you may have.
- They may not be forgetting or forgiving as they don't do in technical surgery. They may notice that you keep changing your mind, making up plans on the back of an envelope, making promises that you don't keep, engage only in what interests you and not in what interests the team, implementing changes without fully thinking things through.
- They may be expecting more from you, after all you are one of them, you went through similar hardships, you should know better.

However, despite their challenges, your followers may well be like you, likely to share the same goals and core values, share the aim to provide some of the best care to patients. Try and utilise their strengths, rather than feel threatened by them.

8.5 Desirable Leadership Behaviours

Before you try to revolutionise my business, I'd like to know that you actually know my business.

George Clooney as Ryan in the Up in the Air [18]

Desirable behaviours of successful leaders have been extensively described by several authors and these share some common characteristics.

The Domain Model of Performance organises personal competencies into four categories [19]:

1. Intra-personal skills—being self-aware.
2. Inter-personal skills—social skills, relationships.
3. Work skills—plan, organise, resource use.
4. Leadership skills—build and lead a team.

According to this model, skills in each category build on those developed in the previous one, so that maintaining positive relationships depends on appropriate self-control, and effective use of resources depends on interpersonal skills with other co-workers. In this model, the ability to lead depends upon effective intrapersonal, interpersonal and work skills.

Dr. Thomas Gordon, a well-known Psychologist and a recognised figure in the teaching of communication and conflict resolution, described that an effective leader must be both a productivity specialist (meeting organisation needs) but also a human relations specialist (who is people centred, meeting their followers' needs) [20]. A leader must aim to achieve productivity and meet the goals of the organisation but also achieve followers' satisfaction and engagement.

Lombardo et al. [21] reported that successful leaders perform well in eight areas:

- Directing and motivating followers
- Handling complexity
- Honour
- Drive for excellence
- Organisational knowledge
- Composure
- Sensitivity
- Staffing

Several studies reported as to what constitutes successful leadership behaviours in surgery. The Surgical Leadership Inventory is a description of surgeons' intraoperative leadership behaviours that are expected to improve patient safety and team performance. It was derived from the literature on surgical leadership, from observations of surgeons at work, and interviews of theatre teams [22]. It has eight components:

1. Effective communication
2. Coping with pressure
3. Maintaining standards
4. Decision making
5. Managing resources

6. Directing
7. Training
8. Supporting others

Hjortdahl et al. [23] interviewed members of trauma teams in Norway with regards their views of the necessary qualities of a team surgical leader. The responses suggested that the ideal leader should be:

- Trustworthy
- Able to transmit confidence and calmness
- Clear communicator
- Decisive
- Technically competent, good in what they do

Patel et al. [24] reviewed published literature to determine the essential qualities for surgical leaders. They suggested that a surgical leader should be:

- Professional
- Technically competent—competent surgeons
- Motivated
- Innovative
- Team builder
- Communicator
- Decision maker
- Emotionally competent
- Resilient
- Teacher
- Business aware

In a study of new technology adoption Edmondson [25] found that effective surgical leaders supported change, encouraged speaking up, and acted to reduce any power differentials between surgeons and other team members.

In addition to the above desirable behaviours previously described for successful leaders, several other characteristics may also be considered and these are described next.

8.5.1 See the Big Picture

You have to get a picture not a photograph.

Doreen Spooner [26]

An important aspect of leadership and management is not to lose sight of the big picture, not to get absorbed too much in the fine details, in the small components of systems. It is like a Monet's painting, you have to stand away to appreciate it. If you stand too close, all you see are coarse detached brushings, random blobs of paint. And the larger the painting the further back you may have to stand.

It is not however uncommon to fall for the "don't sacrifice the forest for the tree". It's a fine balance between not losing sight of the big picture, the big project, the big

change, and ignoring the small but important components, the processes, the individual staff.

See the big picture but bear in mind that the forest is made of individual trees. And unless each of those is looked after and taken care of the forest may not exist.

Don't sacrifice the trees for the forest. A system may consist of people, equipment, rules, or procedures. Each component has its role, and may not be able to fully replace the other. A team is made of individual members, with their individual skills and talents. Don't sacrifice the loyalty, the enthusiasm, the morality, the contribution that each individual brings, in pursuit of an imaginary concept, novel or not.

Instead aim to make the most of each individual, to achieve the main goal. Respect each individual, look after them, as they may help you keep the task on track. Success often relies on cooperation and engagement of people across the system, and people often going that extra mile that cannot be easily quantified or measured. Don't give up on processes, regulations, checks and structures simply because they stand in the way of a big achievement. Aim to work within such frameworks, but the same time improve these to make them more efficient or streamlined.

8.5.2 Stick to the Core Values, Share Your Followers' Values

It's strange how over time what is crazy gets normalised.

Obama [1]

As a leader you may be under pressure, but don't belittle the core values of the profession to justify processes, resource cutting, or change.

- Should you be telling your followers that research or audit activities they undertake are of no benefit to the organisation, when such activities promote an academic environment and encourage high quality practise?
- Should you be telling your followers that the ward rounds they do, or the time they spend doing administration work are not essential and should cut down, simply in an attempt to justify a reduction in working hours?
- Should you be doubting their requests for urgent investigations, or listing patients for urgent surgery, without properly evaluating their clinical reasoning and judgement, simply because such requests are interfering with you meeting imposed time to surgery targets?

8.5.3 Lead by Example

Not the cry, but the flight of a wild duck, leads the flock to fly and follow.

Chinese Proverb [27]

Demand from others what you are prepared to give, motivate by inspiration. Let your vision be shown by your actions not your words. Inspire through actions rather than big words. Set up standards but lead by example:

- Should you be telling others that they are not hard working when you are the last to arrive and first to leave from clinics?
- Should you be stressing the importance of surgical infections but keep walking in the surgical theatre without a mask, sneezing in front of open surgical trays?
- Should you be championing checklists, but keep scrubbing in the side room whilst the time out checklist is taking place?

Respect cannot be enforced, but simply gained, through actions and not promises. Be straight, honest, aiming for consensus, having a clear vision, learn of the problems first hand, rather than relying on messengers who may twist the facts to suit their own agenda.

8.5.4 Lead Change Wisely

> *I kept the same suit for six years and the same dialogue. They just changed the title of the picture and the leading lady.*
>
> Robert Mitchum [1]

As a leader you may have to bring about change. Changing the on all rota, the team structure, the role allocation, the operating schedules. Encourage change, yet control the flow of change.

Surgical training sometimes teaches radical approaches, definitive treatments, complete resections, a single rather than multiple operations. But bringing about real life change may be a bit more challenging than that.

There may be times when the current practise is so rotten, when the status quo can simply not go on, when there is a need to start afresh, but that is likely to be the exception rather than the rule. Erasing the past and starting all over again may not be necessary in many cases, and may not be well received if attempted. Instead small changes, fine tunings, minor adjustments may achieve the wishful outcome, the same result. Small changes may not sound as big achievements of a great leader, but then one ought to look at the outcome rather than the difficulty of getting there. Legend has it that Babylon was not build in a day; small changes can have a huge impact, potentially greater than hitting the reset button which may not achieve much other than setting many into disarray.

We sometimes associate leaders with difficult, painstaking decisions. But change does not have to mean confrontation or conflict, as in many areas a middle solution may be found, a win-win situation for all may be reached.

We sometimes associate change with an emotional turmoil. The reaction of individuals to major change has been likened to the five stages of the grieving process of terminally ill patients learning their diagnosis, described by Elizabeth Kubler-Ross, an American psychiatrist in the 1960s. These five stages are shock and denial, anger, bargaining, depression, and eventually acceptance [28]. But one doesn't have to be made to grieve, before they can come to terms with the encountered change. Change can be welcomed, can be sought for, can be fulfilling. Many of

your followers may thirst for change, but it may simply be that their concept of change, or their route to change are different from yours.

Sometimes one sees great plans for change not taking off or collapsing half way through. Share the vision with your followers and let them work it out, or join them in working it out. What you may not see because you spend all day in theatre, your juniors in the ward may have already mapped it out.

Engaging, listening, and appropriately acting, may help to maintain trust, build bridges, enable the desirable outcome. The audience that needs to be targeted may be wide and not just be limited to one professional group, not just surgeons but theatre or nursing staff too.

Part of change may be the introduction of a protocol, a new procedure, another paper form you are asking others to fill in; introduction of venous thromboembolism assessments for hospitalised patients, and surgical theatre safety checklists, are two some of the processes that surgical leaders have been asked to implement in UK hospitals in recent years. How does one go about achieving this? Healy et al. [29] evaluated the implementation strategies used by hospital leaders in Australian public hospitals in achieving compliance with a "safe surgery" checklist. Their strategies fell into "support" or "sanction" measures depicted by two corresponding pyramids (Figs. 8.1 and 8.2).

Recognise that one implementation approach may not suffice. We often refer to stick or carrot but then there may be so many carrots to go round. But if one could get away with carrot why revert to the stick? Avoid rushing into imposing sanctions, which may achieve a short term effect but not necessarily a long lasting improved

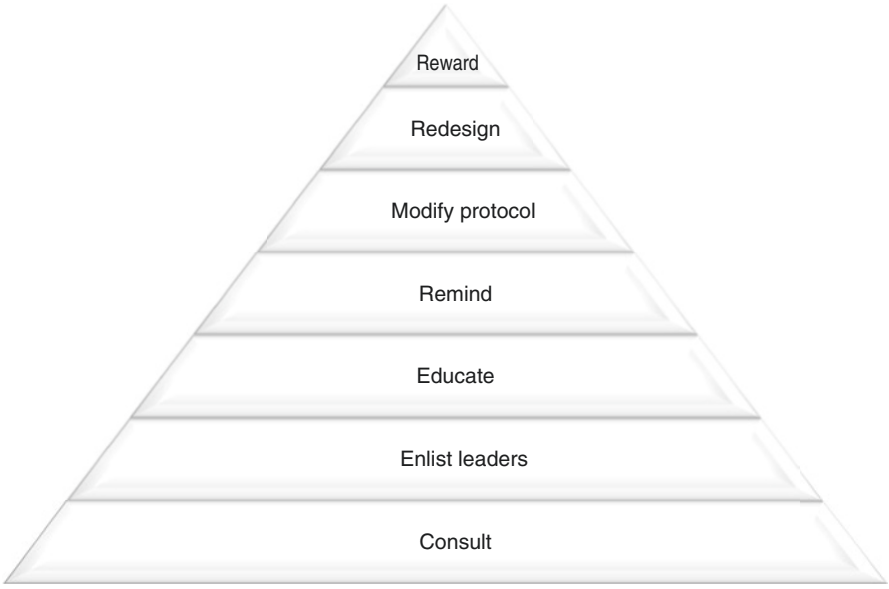

Fig. 8.1 Support pyramid in implementing change; modified from Healy et al. [29]

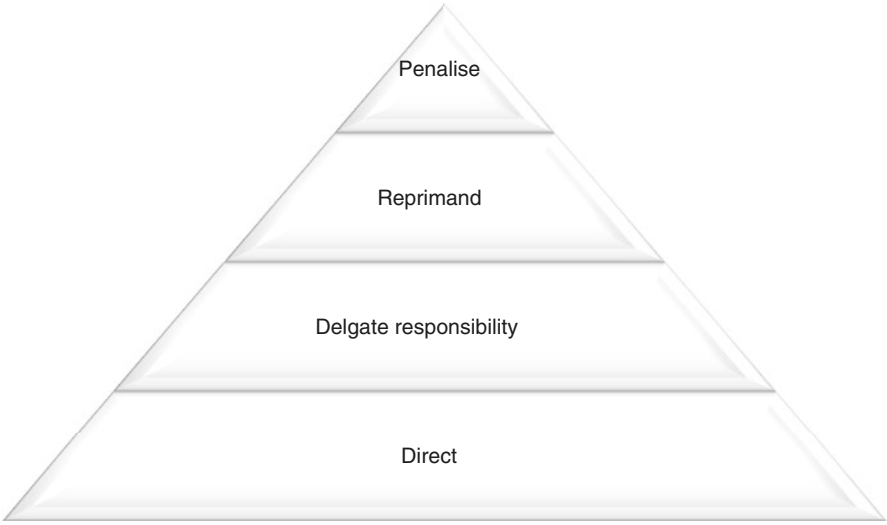

Fig. 8.2 Sanction pyramid in implementing change; modified from Healy et al. [29]

performance. Work with those at the frontline of change, as they have to be engaged and buy into it. Listen, and consider modifying your plans according to what they say. In introducing a new protocol or checklist you may examine how that can fit in, how can it be the least disruptive to the current routine, how could an increase in workload be minimised? Establish an understanding of the need for change, an acceptance for the need for change rather than rushing to instruct or direct.

Bergs et al. [30] carried out a systematic review of studies evaluating barriers and facilitators to safety check-list implementation. They reported that the introduction of such lists required not only changes in the workflow of healthcare workers but also changes in the overall perception of these workers of safety, and changes in their perceptions of the specific checklist to be introduced (such as perceptions of importance, evidence base, time consumption, legal implications).

And if things are not working, if there is no compliance with the introduced change, avoid simply blaming the whole team and disengaging all, but instead aim for personal feedback along with support. Lau et al. [31] demonstrated that individualised performance feedback to surgical residents, along with coaching, significantly increased the rate of appropriate venous thromboembolism prophylaxis prescription for hospital admitted patients.

In bringing about change you may consider the following:

1. Explain why there is a need for change.
2. Identify the task, what change aims to achieve.
3. Define the new order, once change comes about.
4. Define how change will be achieved.
5. Break the task of change into individual components.
6. Define the time frame for changing.

7. Involve the various stakeholders, consult wisely.
8. Plan for alternatives.
9. Perform a risk assessment of things not working out.
10. Be flexible and adaptable along the way.
11. Collect data to assess progress.
12. Communicate progress along the way.

8.5.5 Welcome Alternative Voices

If everyone is thinking alike then somebody isn't thinking.

George S Patton [1]

You may face opposition to your well thought plans, to the upcoming reorganisation that you propose, to your ways that are bound to make things so much better.

Accept dissent, accept being questioned, being challenged. There may be many ways to solve a problem. And for those that may be in constant dissent, who may question all you do, listen to those too, they may be on occasion right.

In the movie "World of the Wars" [32] a Mossad agent explains the "tenth man rule". According to that, any major challenge Israel faces is put in front of a ten man council. If nine agree then the tenth has to, as a rule, oppose it and investigate the possibility of all others not getting it right.

Fact or fiction, reality or legend, the "tenth man rule" reminds of the need to welcome alternative voices. They may be on occasion right.

8.5.6 Follow the Rules

In a courtroom it is not the loudest voice that prevails, it's the Constitution.

B Ferguson [33]

Follow the rules. Just because you are the leader it doesn't mean you ignore policies already in place or that you set up new ones without consultation or due process.

- You may feel that employees should be working in theatre until the list finishes, even though they are contracted only nine to five.
- You may feel that trainees must attend the wards every day, even though they are allowed a day off for regional teaching.
- You may have noticed that trainees do not turn up to teaching. Should you be contemplating using a fingerprint recognition system? Where will the fingerprints be stored? What about those refusing?

What may be acceptable to you may not be acceptable to others. Follow the rules and regulations, rather than jumping to impulsive decisions. If not sure what the rules are, then find out, seek clarification from the experts in the area – such as the human resources department for employment issues, the post-graduate department for training issues, the legal department for controversial medico-legal problems. Resist the temptation of making up rules on the spot, making up regulations that suit the moment.

8.5.7 Consider How You Start

My grandmother always told me how you start is how you finish.

Bernie Mac [1]

Sometimes newly appointed leaders share their vision, concentrating on what they will crack down, how they will stamp their mark. But is this the road to success, or will this just stir trouble? "Attack is the best defence" may have its role in battlefields, but is this really the best approach in civilised working environments?

Alex Ferguson, the world famous manager of Manchester United, summarised the tendency of newly started leaders to mark their presence [34]:

> "I know that there is a widely held belief that the leader only has a chance to make his presence felt during his first one hundred days, but it is not something to which I subscribe. It is all well and good, as a new arrival, to feel the impulse to issue your own version of the ten commandments, but actions speak so much louder than words. When a former player, who is new to management, asks me for advice, I usually tell him not to seek confrontation. Whenever you show up in a new role, it will not be long before you have to face trouble in a clash over something. There is nothing to be gained by stirring it up yourself. Trouble will find you quick enough."

Such an approach may just alienate your followers, and once trust is lost it is difficult to regain. Work towards maintaining trust rather than trying to regain it after you lose it.

8.5.8 Consider How You End

I was the future once.

David Cameron [35]

Being a leader may be a long, sometimes lonely journey. But like most parts of life it may have a start and a finish. Not just the start, the route, but also the end may be challenging.

Sometimes we may have to give up a leadership role or post, even when we are not ready yet, when we dont wish to stop, when we feel we have so much more to offer, when we prefer to keep going on. You may have come to the end of a predetermined term and want to run for another tenure. You may be in the middle of your term but circumstances may have changed, your followers or superiors may feel unsure as to whether you can pull it through, you may be deprived of the resources to achieve what you set out to do.

Leading or managing is not a self-fulfilling purpose, many of us acknowledge that, but it is on occasions hard to just let go. Know when the time has come to move on, and consider letting go.

Moving away from a post which is not working is not a sign of failure but strength, it doesn't mean that you failed as a leader, it could mean that the circumstances or the structures may not be the ones to enable you to show the best of your potential. And even if you realise that you were not cut for that role, well not all of us are, at least you tried and got to find out.

You may feel bitter, disappointed, after all the hard work and achievements you accomplished, and that's understandable and acceptable. But leaders are not only judged by their crowing and reign, but also by their ability to step down at the right time. A leader is not the captain who will not abandon the sinking ship, but someone willing to step aside to let a new pair of hands try and stir the ship away from the rocks, sail to calmer waters.

And if your reputation or pride make it difficult to let go, just recall Hugh Grant's "today's newspapers will be lining tomorrow's waste paper bins" in the Notting Hill's blockbuster [36].

If prime ministers resign [35], presidents step down [37], kings abdicate [38] and even Popes step aside [39] should it not be much easier for a surgeon to let go of a leadership post?

8.6 Undesirable Leadership Behaviours

> *I have heard your views. They do not harmonize with mine. The decision is taken unanimously.*
>
> Charles de Gaulle [1]

We often concentrate on what one should do to be an effective leader, what positive actions to take, but it may be equally important to consider what one should avoid. Several authors have written on leadership and managerial failure in many aspects of life, with their writings showing common themes in the behaviours one ought to avoid.

Bentz [40] examined managerial performance at Sears Roebuck & Company and related the following attributes to failure:

- Lack of business skills
- Inability to deal with complexity
- Being reactive and tactical
- Inability to delegate
- Inability to build a team
- Inability to maintain relationships
- Allowing emotions cloud judgement
- Being slow to learn

Eichinger and Lombardo [41] evaluated more than 1000 managers by relating 360° evaluations to subsequent changes in employment status and associated the following characteristics with failure:

- Problems with interpersonal relationships
- Inadequate administrative skills
- Difficulty in building a team
- Lack of following through
- Poor political skills
- Inability to handle conflict
- Poor integrity
- Low insight

Sydney Finkelstein in his book "Why smart executives fail" [42] described seven habits of unsuccessful leaders:

1. View own-selves as dominating
2. Act as if they own the organisation
3. Have all the answers
4. Eliminate dissent
5. Devote most efforts in managing image
6. Underestimate
7. Relying on outdated practises

Similarly David Dotlich and Peter Cairo in their book "Why CEOs fail" [43] described the following 11 behaviours as leading to failure of top executives:

1. Arrogance
2. Melodrama
3. Volatility
4. Excessive caution
5. Habitual distrust
6. Aloofness
7. Mischievousness
8. Eccentricity
9. Passive resistance
10. Perfectionism
11. Eagerness to please

8.7 Personality and Leadership

My personality is up and down, sassy and cheeky.

Katy Perry [1]

It is thought that personality has an important influence on leadership characteristics being able to shape both effective and ineffective leadership.

Personality has been described as having a bright side and a dark side. The "Big Five" is a description of the bright side traits, attributes of individuals when they are at their best, at the bright side of personality [44]:

1. Openness to experiences (exploratory)
2. Conscientiousness (reliable)
3. Extraversion (outgoing)
4. Agreeableness (cooperative)
5. Neuroticism (emotionally stable)

Judge and Bono [45] examined the relationship between personality traits and transformational leadership, in leaders from over 200 organisations. They reported extraversion and agreeableness as positively predicting transformational leadership.

In contrast, dark side traits are flawed inter-personal behaviours that may prevent leaders from succeeding by impairing their ability to build and run effective teams. Robert Hogan, a personality theorist in the USA, systematically studied failed leadership in various contexts (such as the civil service, business, military) and concluded that leaders fail on one or more of certain inter-personal behaviours. Along with his wife Joyce he went on to relate these behaviours to personality traits to which they referred to as the "the dark side of personality" [46–50], and designed the Hogan development survey to assess them. Hogan describes several attributes that can be disruptive to the surgeon leader, and these were incorporated in Leadership guidance provided by the Royal College of Surgeons of England [51]:

1. Excitable—unpredictable
2. Sceptical—distrustful
3. Cautious—indecisive
4. Reserved—detached, introverted
5. Leisurely—resistant to calls for improvement
6. Bold—arrogant, unrealistic
7. Mischievous—manipulative
8. Colourful—attention seeking
9. Imaginative—eccentric
10. Diligent—over-controlling, micro-managing
11. Dutiful—unable to stand up to others

One may evaluate own-self and own personality to try and avoid harmful behaviours or improve on what may hold them back from reaching their full leadership potential.

8.8 Leadership Posts and Titles

It is not titles that honor men, but men that honor titles.

Niccolo Machiavelli [1]

Much is said about leadership in surgery, with not just chapters but whole books devoted to the subject; surgeons acting as leaders of departments or institutions, leaders of research, leaders of audit, leaders of innovation, the list is endless. Such focus on leadership may put unintentional pressure on one to strive for leadership posts and could even be considered a deficiency if this is not achieved.

But leadership may not be all about taking a leadership post, or even leading others. Having leadership skills does not equate being in a leadership position. Some of us don't have the motivation, interest or resilience to take on such major challenges. It's not a failure if you cannot see yourself wearing the helm.

Many of us may be leaders whatever our position in society or organisation. Most of us lead one way or another, our families our friends our own-selves. One may gain pride in being able to lead own-self into further development, further learning and improvement to allow them to do even better for their patients. One may lead own-self into being a constructive follower who will applaud the achievements of those running the system, and speak up where improvements are necessary.

One may lead themselves into being someone that can be looked up to for their principles and actions, rather than for their titles and posts. You may be aware of politicians having left an inspirational legacy without ever making it to the front bench team. And some may be remembered because despite tasting power and posts, when the times and their principles demanded, they followed their values, returning from the frontline to the backbench.

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Chapter 9
Surgical Research

Research is defined by the Cambridge dictionary as the "detailed study of a subject, especially in order to discover (new) information or reach a (new) understanding" [1]. Hence, surgical research may be considered as the process which investigates and aims to discover new information on the development, presentation, diagnosis and treatment of surgical conditions.

The Surgeon has a pivotal role in identifying where surgical research is needed, and in the design, delivery and dissemination of surgical research. Through research participation a surgeon appreciates the limitations of research, and the limitations of our knowledge; one begins to understand that the didactic teaching encountered in books is often an over simplification of the current state of knowledge. Participating in research may also enable surgeons to question the validity of methodologies, as well as scrutinise the interpretation of results and accuracy of conclusions presented in research studies.

Surgical research may be basic science, clinical or literature based. Clinical studies may be of multiple designs including retrospective or prospective, controlled, or randomised. Clinical studies evaluating the role of surgical interventions pose particular challenges and these are described in this chapter. The value of feasibility and pilot studies, the role of patient and public involvement, and the importance of surgeon engagement in enhancing the successful completion of surgical clinical studies are also discussed. Ways of facilitating the translation of research findings to clinical practise are also described, and guidance is presented on how to contribute to the assessment of research as part of a Journal Club.

C. Panayiotou Charalambous, *Career Skills for Surgeons*,
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CENTRE
OF
SHAM
SURGERY
We had to change our clinic name following the latest RCT in The Journal

9.1 Accepting the Need for Surgical Research

Medicine is a science of uncertainty and an art of probability.

William Osler [2]

The first step in constructing a clinical research study is to acknowledge that there is a gap in current knowledge, accept that there may be uncertainty as to best practice, that there may be alternatives to what is perceived as acceptable or mainstream.

Clinical equipoise refers to the presence of real uncertainty amongst the medical community as to whether a treatment is efficacious or beneficial [3]. In comparing two treatments, clinical equipoise refers to the presence of real doubt as to whether one treatment is better than the other. The presence of clinical equipoise may justify research to determine if a treatment works, if an intervention is better. But is not the mere presence of equipoise, but also its acceptance by the clinical community, that is vital in setting up and successfully running a research study.

However, such acceptance of uncertainty, may be more difficult amongst the surgical profession. As surgeons we are often trained using the apprentice model, learning through observation and experience, taught by seniors or experts. We may thus develop specific, almost regimented ways of doing things, of approaching and treating surgical conditions.

As surgeons we may be having intuitive rather than analytical evidence based preference for one treatment over another, our ways may have worked well in the hands of our trainers, may be working well in our hands, hence the reluctance for these to be challenged. If we have strong, almost dogmatic views as to the value of one intervention and the ineffectiveness of another, how can we easily accept the need to formally compare the two?

Some interventions may be substantially different—operate versus wait and see, pills versus the scalpel. How can we justify comparing the two if we think we already know the answer?

We may not be comfortable to accept that there is uncertainty in what we do as we like to give our patients definite information and leave little doubt. We may feel that if we introduce uncertainty, our authority or competence may be questioned. Patients may turn to more definite and more confident surgeons. There may be worries of being more prone to medico-legal challenge if our plans went wrong, if adverse events were to happen. And when considering a randomised trial, how can we accept that randomisation or simple chance, can choose the intervention applied? After all how would we feel if when getting on a plane, the pilot proposed throwing a dice to decide between going round or through the upcoming storm?

Hence the first step in surgical research is to question if what we do in our current practise is evidence based, based on good quality, scientifically robust data. If not, should we be re-examining our practise? Should we be trying to come up with the evidence?

And if as researchers we accept that there is clinical equipoise, is that view shared by the wider surgical community? Are there enough surgeons who share these views who can then participate in the proposed research study?

9.2 Defining the Aim

If you aim at nothing, you'll hit it every time.

Zig Ziglar [2]

In setting up a clinical study one must clearly define its aim. This is its main objective, the question the study attempts to answer.

One may consider the Ladder of Interventions described earlier in this book. The least invasive intervention lies at the bottom of the ladder and the most invasive at the top. In ascending the ladder one goes from observation (allowing natural history to follow its course), to non-medical interventions, medical pharmaceutical interventions, minimally invasive non-surgical procedures (such as injections), minimally invasive surgery (arthroscopic, laparoscopic) to extensive open surgery.

One may concentrate at a particular step of this ladder or look at multiple steps, to evaluate one or more interventions. Comparisons of interventions may be between separate steps or between various treatment options within the same step.

Comparisons between management options on different steps may help determine whether there is any benefit of following a step by step treatment approach or whether it is more beneficial to jump up steps. In contrast, comparison between various treatment options within the same step may help determine which one is the preferable option in patients whose lower step treatments have been exhausted.

Hence, the specific aim of the study will determine the groups to be examined, and the "general populations" from which the study groups can be obtained.

Consider a group of patients with osteoarthritis of the knee:

- Within step comparison: Patients may be taken through the non-invasive treatment options and only those who have not responded to these options are considered for knee replacement. Hence, cases who do not respond to non-surgical treatments and who end up needing knee replacement may then be studied to determine the benefits of various types of knee replacement implants.
- Comparison of separate steps: It may be of interest to evaluate whether it is beneficial to exhaust non-invasive options prior to proceeding with knee replacement or whether early knee replacement is better. It may be that if early knee replacement is performed then time wasted trying less invasive options may be avoided, with patients improving faster with regards to pain and function. Potential disadvantages of this however is that patients who could have avoided surgery end up having major surgery.

In comparison studies it is also necessary to specify what you aim to determine [4, 5]:

- Superiority study: is one group superior to the other?
- Non-inferiority study: is one group not inferior to the other?
- Equivalence study: are the two groups equivalent?

To understand the above, you may consider research aiming at evaluating a new surgical implant. In introducing a new implant it may be important to determine whether this new prosthesis is better (superior) with regards to pain and function as compared to other established implants. However, even if not superior, it would be important to establish that the new implant is not any worse (inferior) with regards to these outcomes. If it is not worse but it is less costly it could still be preferable. It may also be of use to know that the new implant is neither any worse nor any better (equivalent), hence allowing a more fair play in implant selection [4, 5].

9.3 Defining the Study Groups

Groups are grammatical fictions; only individuals exist, and each individual is different.
Robert Anton Wilson [2]

The next step is to determine which patients are eligible for participation in the study. To do this certain inclusion/exclusion criteria are applied. Cases that meet these inclusion/exclusion criteria can participate in the study. Such criteria may refer to:

- Characteristics of the patient (demographics).
- Characteristics of the condition in consideration (symptomatology, pathological stage).
- Characteristics of the intervention to be examined (type of surgical procedure).
- Presence of previous failed interventions.
- Other relevant parameters (ability to consent, anaesthetic fitness, centre of treatment, treating surgeon).

A physician evaluating the effect of a new antihypertensive tablet may have to define the study group in terms of type and level of hypertension so that only those with primary severe hypertension can participate. Along similar lines, an orthopaedic surgeon examining the effect of plating on wrist fractures may want to look at two part displaced fractures rather than any wrist fractures (which could vary from un-displaced to very multi-fragmented completely displaced fractures). A vascular surgeon may wish to examine the effect of prophylactic aneurysm surgery on medium sized rather than any size aortic aneurysm.

If the inclusion/exclusion criteria are too strict, it may be difficult to identify the necessary number of patients for participation. In addition, any observations made in such a selected group may not be easily applicable to the wider population having the investigated disorder. In contrast, if too loose inclusion criteria are applied, then you may end up with a very heterogeneous group, like a "bowl of apples and oranges"; this could potentially distort the results that might have been obtained if "bowl" subsets were examined in isolation.

An additional challenge, which may be of particular relevance to surgery, is whether definition of the study groups should be disease or intervention driven. The former approach allows you to specify a disorder, identify a homogeneous group with this disorder, and then examine the effect of an intervention on this group (e.g. the outcomes of knee replacement in a group of patients with primary tri-compartmental knee osteoarthritis).

Surgical studies however often fall in the second category, whereby the study group is defined based on whether they had the intervention (e.g. outcomes of a group of patients who had knee arthroplasty). This may be because the focus is on getting to know how well a procedure is doing, how well a new implant is performing, what are the outcomes of an intervention in the hands of an individual surgeon.

However, if an intervention driven approach is utilised, attention must be paid to avoid ending up with a very distorted heterogeneous treated group; such as evaluating a knee replacement implant in a group of cases in whom the underlying diagnosis includes any cause of arthritis (primary, post-traumatic, inflammatory, metabolic), and any stage of arthritis (uni-/bi-compartmental, tri-compartmental).

9.4 Defining the Study Population

Designers simply can't afford to make dresses in 10 sizes for a sample.

Nigel Barker [2]

Once the intervention group is specified the next challenge is to identify the "general population" from which this group can be drawn. This will help plan as how to approach or screen this population to identify potential study participants.

You may consider the following examples:

- In examining the outcomes of knee replacements that have been performed by an individual surgeon, the general population may be patients who had any type of surgery under that particular surgeon. Hence, screening the listing forms of patients scheduled for any surgery, or screening the theatre logbooks could help identify the group to be examined.
- In comparing the clinical outcomes of different implants of knee replacement (which is yet to be carried out), the general population may be those patients presenting with symptomatic knee arthritis to secondary care and who are scheduled for surgery. Hence, patients may need to be approached for participation in secondary care clinics.
- In comparing physiotherapy versus early knee replacement following an initial presentation with arthritic knee pain, the general population may be those patients presenting with symptomatic knee arthritis to primary care rather than to secondary care. Hence, patients may need to be approached at primary care clinics rather than hospital clinics. If instead of approaching patients in primary care, patients are approached in secondary care clinics, the results of the researched comparison may not be applicable to the wider community of arthritic knees as secondary care patients are a pre-selected group; for some patients treated in primary care might have had resolution of their symptoms, and hence never got referred to secondary care.

9.5 Study Design

I don't start with a design objective, I start with a communication objective. I feel my project is successful if it communicates what it is supposed to communicate.

Mike Davidson [2]

Another challenge in surgical clinical research is which study design to employ. The Research Ladder [6] describes study designs according to how reliable the evidence they present may be considered. At the bottom of the Research Ladder are reports of single or limited number of clinical cases with further steps ascending to retrospective studies, prospective studies, randomised controlled trials and finally systematic reviews and meta-analyses (Fig. 9.1).

Case reports: these describe the events or outcomes of the treatment of one patient or small group of patients. They are limited by their small numbers and lack of comparison groups.

Retrospective studies: these are studies whereby the researcher looks back, in the past, to assess the outcome of an event (in this case a surgical intervention) that has already occurred. They often rely on reviewing medical records or patient recall for data collection, the accuracy and reliability of which may be limited. However, as the intervention in question has already occurred, retrospective studies can be completed more quickly than prospective studies.

Prospective (non-randomised) studies: these are studies whereby the researcher identifies the participants prior to the intervention applied, and follows them into the future to assess as to how they perform following the application of the intervention. They allow more accurate and complete data collection, but could take longer to complete and are resource consuming.

Case control studies: in epidemiological research this design has been mainly used to study risk factors for a disease. These studies compare the rate of one or more risk factors/exposures amongst a sample of individuals with the disease (cases) against the rate of risk factors/exposures amongst a sample of individuals without the disease (controls). Hence, they compare the distribution of risk factors/exposures among diseased and non-diseased groups. Such case control studies could be utilised in the assessment of surgical interventions, such as by considering the intervention as the exposure and a surgical complication as the "disease" (Fig. 9.2).

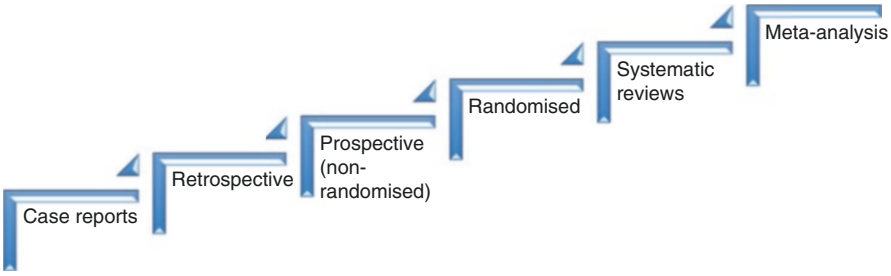

Fig. 9.1 Research ladder. Adapted from Charalambous CP [6]

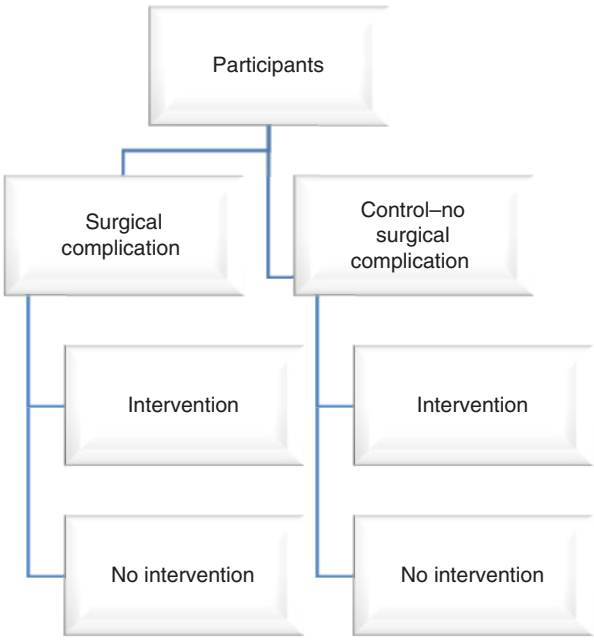

Fig. 9.2 Case control study

In surgery, however, the term "case-control design" has also been used to describe studies whereby patients having an intervention (cases) are compared with those not having the intervention (controls-having no intervention or another intervention), to determine if the intervention in question offers any advantage. Cases and controls are matched with regards to certain parameters that could influence outcomes, to ensure they are as similar as possible, with the main difference between the groups being the application of the examined intervention. However, the decision as to whether an individual is having the intervention is not made randomly, which means that the groups may differ in some other unknown (and hence not matched) influential parameter, which could in turn have accounted for the observed results. Mihailovic et al. [7] examined all self-identified "case–control" studies published between 1995 and 2000 in six surgical journals, and reported that only 35% of these met the epidemiological case-control definition. The rest used the term whilst comparing the clinical outcomes of groups treated with different interventions. This lack of consistency in the terms should be taken into account when reporting or interpreting surgical research.

Cohort studies: these identify a group (cohort) which is then followed up to see how it performs. The cohort may be identified prospectively before it sets off, or by going back in time. It may be that all individuals in the cohort end up having one intervention hence providing no comparison group (similar to a large case series). It is also possible that some individuals have a different intervention or no intervention, allowing comparisons to be made (Fig. 9.3). The decision as to whether an individual is having the intervention is not made randomly, hence the potential limitations this study design confers.

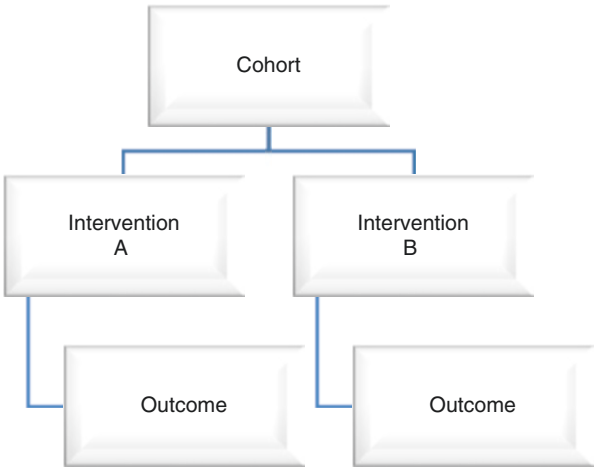

Fig. 9.3 Cohort study

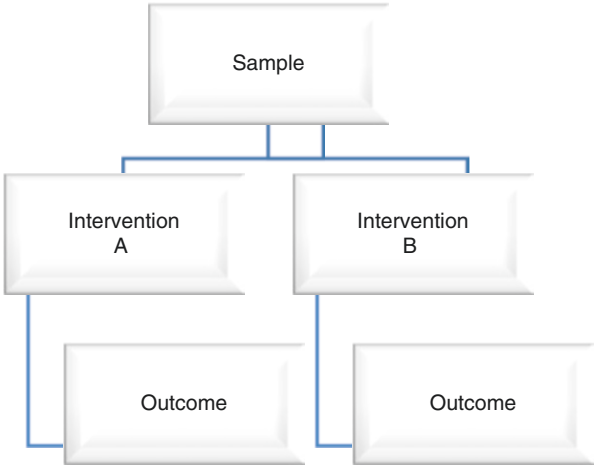

Fig. 9.4 Randomised controlled trial

Randomized controlled clinical trials (RCTs): these introduce an intervention to a group of patients and assess its effects upon that group compared to a group having a different or no intervention. Intervention allocation is random which aims to eliminate any bias in assigning treatment, and to match the comparison groups both with regards to known and unknown potentially influential parameters (Fig. 9.4).

Where possible, patient, investigator and assessor are blinded as to the treatment allocation. Blinding in surgical clinical studies is particularly challenging. It is very difficult, if not impossible to blind a surgeon to the administration of a surgical intervention. The same may apply to the patient when a particular surgical intervention is compared with non- surgical treatment. However, in some cases, for instance where different implants may be compared, attempts can be made for the surgeon or patient to be blinded. Nevertheless, the assessors may be blinded such as by having the patient wearing a T-shirt to hide an abdominal scar, to stop the assessor of knowing whether that particular patient had abdominal aortic surgery, whilst examining their peripheral circulation. The utilisation of members of the treatment team in assessing outcomes is to be avoided to minimise assessor bias (a junior trying to please their senior may sub-consciously guide patients into giving positive responses when assessing outcomes of a surgical procedure done by their senior). Hence, independent assessors are preferred.

Systematic reviews: these identify (through a literature search) studies which examined the intervention in question. These studies are reviewed and their results summarized and presented. The results of the included individual studies are not statistically combined. In contrast, meta-analyses use statistical methods to combine the results of the individual studies, and report such results as if a large study had been performed.

RCTs are considered the gold standard in clinical research but it is often not possible to jump straight to an RCT, and RCTs s may be considered as complementing rather than completely replacing all other types of research [6]. Several stages have been described in which a new intervention is assessed, starting from an initial description in the form of a case report or case series followed by good quality cohort studies, to RCTs, to long term surveillance studies. Hence, all types of research have their role in answering vital surgical questions, rather than just RCTs [8–11].

9.6 Defining the Intervention

We don't define the unlimited.

Toba Beta [12]

Unlike pharmaceutical studies where the intervention may be in the form of a tablet or medicine infusion, surgical interventions may be much more complex in their composition and application. The term "surgical intervention" may not just include the surgical procedure that takes place in the operating theatre, but also the pre-operative, intra-operative and post-operative patient care that could potentially influence clinical outcomes.

In evaluating a particular knee replacement implant, clinical outcomes may be influenced not only by how well the implant behaves in terms of durability and resilience, but also by the way the soft tissues were managed, the accuracy with which the bone cuts were made, the pre-operative care of the patients in terms of optimisation for surgery (haemoglobin control, physiotherapy to strengthen the muscles to allow early post-surgical mobilisation, treating urinary tract infections to reduce infection risk), the intra-operative care (use of spinal anaesthesia, local anaesthetic infiltration, use of tourniquet, timing of antibiotic prophylaxis) and post-operative care (timing, type and intensity of physiotherapy, use of cryotherapy to reduce postoperative swelling). Unlike a medicine the administration and dosage of which may be more easily defined, it may be difficult to standardise a surgical procedure, as two cases are not identical, and surgeons may vary as to how exactly they perform a procedure.

In principle two of the potential ways that can be adopted are [13, 14]:

1. Explanatory approach where the various steps are specified and controlled, hence any findings will be directly applicable to those specific conditions.
2. Pragmatic approach whereby the various management components are left to the surgeon as per their normal practice other than what is considered as the major component of the intervention under examination. This means identifying those parts of the intervention that are considered vital in influencing outcomes and ensuring that these are consistently applied by all participants, whilst leaving the remaining parts of care to the discretion of the treating surgeon.

The challenge is that if very restricted criteria are utilised in defining the intervention, the surgeons may find that the intervention is not similar to how themselves carry out the procedure, and hence consider the results of the study irrelevant to their practice. This could mean they are reluctant to adopt any study findings. In contrast, if the definition of the intervention is too loose, there may be such a variation that the quality and relevance of the results may be questioned. The study design should try and find the right balance, to increase acceptability to the general surgical population.

The early stages of a surgical intervention may be assessed with explanatory studies. Once its efficacy is established under strict conditions, a more pragmatic approach may be utilised to determine what the results are when the intervention is applied to the real world.

In line with this, there is a need to consider whether the study should include cases from an individual surgeon, multiple surgeons, single centre, or multiple centres. In reality, this decision may be influenced by the study aim and available resources. Nevertheless, in the early stages where an intervention is introduced and efficacy is assessed under strict conditions, inclusion of a single surgeon or a small group of surgeons (who were involved in developing the intervention) may be preferable. Once the procedure is established, the inclusion of a number of surgeons, in multiple centres will give results that can be applicable to the wider surgical community. On occasions, the results of a procedure amongst the general surgical community are inferior to those reported by the pioneers of the technique, hence the need to carry this further assessment.

9.7 Quality Assurance of Interventions

Quality is not an act, it is a habit.

Aristotle [2]

A further challenge in surgical clinical research is to put in place check mechanisms, to ensure the intervention was applied at an acceptable level. In a pharmaceutical intervention one may ensure that an infusion is administered over a specific timeframe by an infusion pump. The equivalent in surgery, in a knee replacement study would be to determine that a knee replacement procedure was actually performed to satisfactory standards. Ensuring high quality of any examined interventions in clinical studies such as RCTs, is an important factor for the successful uptake and application of RCT findings [15, 16].

Some design approaches that may be employed in ensuring quality of the applied interventions are:

1. Including only surgeons of certain experience, to minimise any learning curve effects.
2. Utilising a study design that allows surgeons to perform only procedures they are comfortable with, without demanding to perform all types of interventions evaluated.
3. Intra-operative video recording which can be then accessed by an independent assessor.
4. Post-intervention by examination of post- operative radiographs by an independent assessor.

Such measures aim to give the reader the confidence that the intervention was applied at a high quality level and avoid comments such as “I don’t recognise those results because I would perform the procedure in a much better way”.

9.8 Control Groups—Sham Surgery—The Surgical Placebo

What is inefficient is the use of relatively expensive drugs as placebos. It is a pity some enterprising drug company does not produce a wide range of cheap, brightly coloured, non-toxic placebos.

Archibald L Cochrane [17, 18]

With many surgical procedures we are uncertain as to the exact mechanism by which they work and any placebo component that may come into play. Hence, a sham control may help us determine how much of the potential benefit we observe is due to a placebo effect, and how much is truly attributable to the technical aspects of the applied intervention.

In pharmacological studies we often compare an active agent against a placebo agent by administering the latter in a form (such as pill or capsule) which has the same appearance and characteristics as that of the therapeutic agent. However, examining a placebo effect in surgery may be more challenging. Surgical interventions cannot be easily masked, as patients will be aware as to whether they had a cut or not. One way of going round this is to carry out the surgical incision but not the rest of the surgical procedure, but this approach brings the ethical questions of potentially exposing patients to harm without any potential gain to those participants [19, 20].

Such studies have been performed previously. Moseley et al. [21] carried out an RCT to evaluate the role of arthroscopic debridement in knee osteoarthritis, and their results were published in the New England Journal of Medicine in 2002. They compared patients having arthroscopic debridement, with a group having arthroscopic washout, and a group having sham surgery. Several measures were taken to ensure that the sham surgery patients were blinded as to their treatment—they had their knee prepped and draped, and they had three small skin incisions made around the knee, the same that someone having a full debridement would need. The debridement instruments were used in theatre to simulate the noise and motions of surgery and saline was splashed to simulate the sounds of lavage, but the patient's knee was not entered. Sham surgery patients were kept in theatre for as long as those having real debridement, and their post-operative care was the same. In that hallmark study, which changed clinical practise amongst many orthopaedic surgeons, no significant differences in pain or function were observed between the intervention and sham surgery groups.

Along similar lines Freed et al. [22] randomised 40 patients who had severe Parkinson's disease into either receiving a transplant of embryonic dopamine producing nerve tissue into their brain, or sham surgery (that involved sole drilling holes in the skull). They demonstrated some clinical benefit in the transplant group amongst young but not amongst older patients.

Wartolowska et al. [23] carried out a systematic review of RCTs comparing surgical interventions with placebo. In 39 of 53 (74%) trials examined there was improvement in the placebo group, and in 27 trials (51%) the effect of placebo and surgery did not differ. In 26 trials (46%) the effect of surgery was superior to that of placebo but tended to be small.

Another issue to consider when it comes to sham surgery, is the extent to which the results of such comparisons are useful in clinical practice. Even though such comparisons may give an insight as to how surgery exerts its effects, it may not fully guide clinical practise in real life where the sham surgery option is unlikely to be available. In addition, a lack of demonstrable difference between "intervention surgery" and sham surgery may not necessarily imply lack of difference between "intervention surgery" and "application of no intervention".

9.9 Sample Size Calculation

Weather forecast for tonight: dark.

George Carlin [2]

A major challenge in surgical study design is to decide how many patients should be recruited. The greater the number of cases, the more time and resource consuming the study will be. In addition, if more patients were recruited than those required to answer the study question, some patients (through participation in the study) may be exposed to unnecessary interventions, or be denied helpful interventions.

In non-comparative studies we may be limited by the number of cases we have available, such as the number of procedures a surgeon has performed, and accept that even though the numbers are small they are still worthy reporting. In prospective trials we must accurately estimate how many cases we would need to obtain an answer to the research question. This can be achieved by sample size calculation that takes into account [24, 25]:

1. Type I error—concluding that there is a difference between groups when one does not exist. The P value is a measure of the probability of this happening, and is usually set at <0.05.
2. Type II error—concluding that there is no difference when one exists. A study may fail to show a difference between two groups because there is no significant difference or because the study did not have enough patients to allow the demonstration of such difference which exists. The power is the ability of the study to show the difference if one exists, and is often aimed at a level of 80% or greater.
3. Estimated mean and variance of the outcome in the groups.
4. Effect size—level of smallest difference in outcomes that would be considered of clinical importance. Tiny differences between groups may be of statistical significance, but if so tiny may be of no clinical significance.

It is necessary to describe which outcome is used to calculate sample size; usually that would be the primary outcome a study aims to examine. It should be noted that a study may be large enough to evaluate potential differences in the primary outcome but that does not mean it is also large enough to determine differences in other secondary outcomes, unless a sample size calculation was also applied to those. Hence, close scrutiny is necessary of sample size calculation, when studies report that no difference could be demonstrated between study groups in some of the parameters examined.

9.10 Follow Up

Instant gratification takes too long.

Carrie Fisher [2]

Another challenge in clinical surgical studies is the need to follow up participants to assess how well they do after an intervention is applied. The required duration of follow up and how to deal with those lost to follow up need to be considered.

Duration of follow up: In some cases the outcomes evaluated occur early following an intervention, hence patients do not need to be followed up for a long time (outcomes such as early post-operative pain, 30-day infection or mortality rates, surgical wound healing).

Some outcomes, however, need to be assessed several months or years following the applied intervention as the true effects may take time to become apparent. One may take a substantial period of time to recover from the trauma of surgery per se, and any gains from the intervention may not be assessable until after that.

Consider a rugby player that undergoes surgery to stabilise their shoulder to prevent further dislocations. Post-surgery there is a period in which the sutured ligaments heal and during which shoulder movements are limited to protect the repair. This is followed by a period of shoulder mobilisation, strengthening and rehabilitation with gradual return to play. The athlete may be able to return to competitive practise at six to nine months post-surgery. During this time one would expect a further need to fully re-adjust to play, regain confidence and use the arm at the same level as prior to all the shoulder troubles starting. Hence, it may take about two years for the arm to be exposed to activities that may re-dislocate the arm; an assessment of re-dislocation rates may require at least a two year follow up to be meaningful.

Similarly, the effects of surgery may deteriorate with time. Consider the evaluation of an implant used in hip replacement. As time goes by, implants wear, may loosen and hence the rate of revision surgery rises. Early evaluation of the revision rates of an implant may thus be misleading, providing false reassurance.

Lost to follow up: Attrition rate refers to the proportion of patients who do not complete their allocated treatment or assessment and these include lost to follow up. Participants may be lost to follow up and not be assessed for multiple reasons including:

- Relocation—relevant to mobile populations (younger, students) as patients may move away from the area where intervention was applied.
- Change of contact details, not traceable. Obtaining multiple contacts, addresses and phone numbers may help limit this.
- Not available to attend follow ups due to other commitments.
- Failure of intervention—symptoms persistent and sought treatment elsewhere.
- Success of intervention –hence no need to further engage with healthcare and attend any invited appointments.

There are several ways of dealing with those lost to follow up in analysing the results of a study. Lost to follow ups may be excluded, with only those who completed the follow up analysed. Alternatively, those lost to follow up may be considered as “all failures” or as “all successes” in the analysis, which can provide the spectrum of potential outcomes [26].

9.11 Surgical Waiting Lists and Research

I have a new philosophy. I'm only going to dread one day at a time.

Charles M. Schulz [2]

In many healthcare systems there are waiting lists for elective surgery which may vary from days to weeks to months or even longer. This places particular challenges in conducting clinical surgical studies including:

- If a patient is left to wait for long prior to surgical intervention their condition may deteriorate. Hence, an up to date evaluation is needed prior to administering the intervention to record their immediate pre-intervention status.
- Some cases may improve whilst awaiting surgery and no longer needing the intervention, leading to drop outs, which must be accounted for in any subsequent analysis.
- Study participants allocated to one treatment may change their mind and ask for the other treatment in the study. This will have to be accounted for in any subsequent analysis.

9.12 Outcomes

All right everyone, line up alphabetically according to your height.

Casey Stengel [2]

A major challenge of surgical studies is to identify the outcomes by which an intervention is assessed. There are multiple outcomes that may be assessed such as pain, function, mortality, morbidity, complication rates, speed of recovery, psychological impact, patient satisfaction, health economics, the list is endless.

The choice of outcomes will be influenced by the study's aims. Outcomes that are directly relevant to the various stakeholders to which the intervention applies are preferable. Such stakeholders are:

- Patients (patient reported outcomes).
- Surgeons (objective functional scores, infection rates, operative complications).
- Funders (cost-effectiveness).

In choosing outcomes you may consider the need for:

1. Well defined outcomes, which are easy to assess.
2. Outcomes assessed by validated systems.
3. Outcomes that are generic, disease specific, or intervention specific.
4. Outcomes that are commonly used in similar research studies, which can thus allow direct comparison between such studies, and also facilitate the pooling of such studies in subsequent systematic reviews and meta-analyses. Core outcomes may be identified for specific conditions or interventions and be utilised when those are evaluated. The COMET (Core Outcome Measures in Effectiveness Trials) initiative was launched in Liverpool, UK, in 2010, and brings together researchers aiming at achieving standardised sets of outcomes (core outcome sets) for specific conditions; with the aim that these will be the minimum reported in studies evaluating those conditions [27].

9.13 Recruitment

Success is how high you bounce when you hit bottom.

George S. Patton [2]

A major challenge faced by surgical clinical studies, particularly RCTs is the recruitment of patients to the study. Surgical studies, even when well designed, may have difficulties recruiting patients.

Chapman et al., in a 2014 observational study [28], reported early discontinuation of one in five surgical RCTs, with poor recruitment cited as the most common reason, observed in 44% of cases. Similarly, recruitment rates vary widely between orthopaedic trials comparing surgical and non-surgical interventions, ranging from 22 to 86% [29–31].

Poor recruitment may be due to several reasons:

- Patients not meeting inclusion/exclusion criteria.
- Patients not agreeing to participation.
- Surgeons not considering patients for inclusion.

Recruitment rates may be particularly challenging when comparisons are made between substantially different interventions, and when dealing with patients or surgeons who may have strong starting preferences for one line of treatment.

Recruitment may be low if recruiters cannot effectively communicate the clinical uncertainty that exists with regards to differences in effectiveness between treatment options, and hence the need for the research study.

In setting up a research study ways of ensuring recruitment must be considered. Training of surgeons or other recruiters may be needed so they can provide information about the study and interventions assessed in an impartial way. Systems that identify patients who, despite being suitable for recruitment, are not recruited and examination of the reasons behind this, may guide to recruitment improvement strategies.

9.14 Improving Success of Surgical Clinical Research

I'm writing a book. I've got the page numbers done.

Steven Wright [2]

There are several ways of trying to overcome surgical study challenges some of which are:

1. Carrying out a feasibility study prior to the full trial.
2. Carrying out a pilot study prior to the full trial.
3. Patient and public involvement—actively involving patients and the wider public in identifying research priorities, and in the design and delivery of surgical research.
4. Surgeon engagement—engaging surgeons to encourage collaboration and participation in research studies.

Feasibility studies in surgery

Rather than setting off with a definitive trial, with all the resource and time investment that entails, only to find out down the line that the study cannot be completed, one may initially set out to evaluate whether it is possible (feasible) to run such a definitive trial. This may be achieved using a feasibility study [32, 33].

A feasibility study may help [32, 33]:

- Determine recruitment and attrition rates (proportion of eligible patients willing to consent, proportion of patients that surgeons are willing to randomise, withdrawals, lost to follow up) and estimate deviation in outcomes to inform sample size calculation for the definitive trial. This can guide as to the number of centres and length of time necessary for recruiting to a full trial.
- Identify barriers to recruitment and provide information about how the recruitment process could be improved in a subsequent definitive trial. A feasibility study may help identify patient or surgeon concerns about the study that may then be addressed in the future full trial. Along these lines Donovan et al. [34] looked at recruitment barriers such as treatment preferences and perceptions of the recruitment process, in the ProTeCT (Prostate Testing for Cancer and Treatment) study, an RCT comparing surgery versus radiotherapy versus active monitoring for men with localised prostate cancer. The recruitment process was then adjusted based on the feedback received, such as emphasising equivalence of the treatment options, avoiding terms that could be mi-interpreted, and presenting clinical equipoise and randomisation in a more convincing way. This led to a rise in randomisation from 30 to 70% over 12 months. Similarly, Blazeby et al. [35] in a feasibility trial comparing surgical and non-surgical interventions for oesophageal cancer, demonstrated that close investigation of the challenges recruiters faced in articulating proposed treatments, and subsequent relevant training to help manage these challenges, increased recruitment from 0 to 31%.
- Assess ease and rates of completion of outcome measures.
- Assess the feasibility of trial design.

- Assess ability to blind outcome assessors.
- Develop models for health economic analysis.
- Assess acceptability of randomisation amongst surgeons.
- Map variation in patient treatment pathways across participating sites.
- Assess whether measures aiming at safeguarding the high quality of the applied interventions, can be adhered to.

Pilot studies

Pilot studies are a mini-version of the definitive trial which aims to test whether all the components of the study can fall in place, to allow a smooth run [32, 33]. It helps to identify problems that can be resolved prior to setting off with the main trial. Any data collected from the pilot may be used in the definitive study analysis.

Patient and public involvement

It is increasingly recognised that patient and public participation in the conception, design, development and running of research studies has an important role to play [36–38]. Patients are major stakeholders in the outcomes of research. In addition, as patients are the ones experiencing the disease and interventions, they may be able to provide an insight from the participant's perspective, a different angle to what the surgeon or researcher may view.

Patients may participate in the:

- Identification of important outcomes—what is important to the surgeon may not be of equal importance to the patient. A surgeon may consider the degree of angulation of fracture healing as an important outcome, but the patient may value more the ability to return to work early.
- Assessment of the ease of understanding outcomes measures, such as evaluation questionnaires.
- Study design, with an input to various parameters such as the frequency of follow up appointments, length of time needed to consider participation in the research.
- Governance of the study, as members of committees overseeing the study.
- Dissemination of information about the study to facilitate awareness of the study and encourage recruitment.
- Dissemination of the study results, to facilitate translation of any findings into clinical practise.

Surgeon engagement

One of the challenges researchers face is accessibility to potential participants.

In studies involving multiple centres, there is a need for patients to be identified and recruited by each of the participating centres. In each centre a researcher, which in surgical studies is often a surgeon, is allocated the task of overseeing the local running of the study, and is often referred to as the trial's gatekeeper at the site. It is a challenging task to ensure that an adequate number of such gatekeepers are identified to allow participation of the required number of centres, but also to ensure that active participation of such gatekeepers is maintained for the duration of the study [39, 40].

The same may apply in smaller studies, when trying to recruit from multiple surgical teams in a single centre. You may be faced with surgeons who are not interested in participating and make this clear early on, but also with ones who sound very keen in taking part and give lots of promises, but do not actually deliver when recruitment starts.

Several approaches may be employed in surgeon engagement such as:

- Having a strong enthusiastic team, that can effectively communicate and engage with the individual surgeons.
- High quality design, one that promises high quality outputs.
- Getting the support or endorsement of the study by a recognised society or institution, which may again indicate high quality design.
- Simplified design that can be easily incorporated into a surgeon's busy schedule or clinical practise.
- Involving potential collaborators early on in the study design, application of funding, and running of the study. Surgeons may thus feel as stakeholders in the study rather than mere recruiters for someone else's study.
- Recognising their contribution through authorship in any publications that may emerge.

9.15 Putting Evidence into Practise

Dreaming is good but implementation is success.

Paballo Seipei [12]

Another challenge in surgical clinical research is to ensure that any research findings influence or change clinical practice [41–45].

At a surgeon level this involves informing the wider surgical community of the findings, and convincing individual surgeons that study results are reliable and valid, as well as relevant to their own practise. This may be achieved in several ways:

- Study having high external validity (generalizability) –
  - Internal validity refers to the utilisation of safeguards in the design, methodology, and contact of the study, to ensure that the effects tested in the study are truly the result of the intervention applied rather than due to bias or random chance.
  - External validity refers to the extent of which the results of the study can be generalised or applied to a definable group of patients in a particular clinical setting [46, 47].

Study characteristics such as the healthcare context of the trial, the demographics of participants, differences between the trial protocol and real clinical practice, and the outcome measures examined are some of the parameters which may limit the external validity of a study [47]:

  - The results of a study carried out in a specialised hip centre, comparing hemiarthroplasty versus total hip replacement in young active patients with hip fracture in terms of ability to return to high demand jobs and sports, may have limited generalisability when applied to low demand elderly hip fracture patients operated in district hospitals and in whom pain control and early mobilisation are the main surgical goals.

- Presenting the findings at local, national, or international meetings attended by stakeholders asked to implement change.
- Publicising the results through journal publications in high quality journals, that are accessible and read by the target population.
- Follow up initial publications with review articles or editorials.
- Developing clinical guidelines based on the study findings. Such guidelines may be at local or national level. These may be achieved through local institution policies, or through the development of guidance by surgical societies or national bodies evaluating the effectiveness of healthcare interventions.
- Having healthcare systems and institutional processes that are flexible to allow early incorporation of new research findings into clinical practise.
- Commissioners directing funding and remuneration for healthcare interventions in line with best evidence.
- Publicising the findings to the general public and patient groups, so that they can ask for what is available.

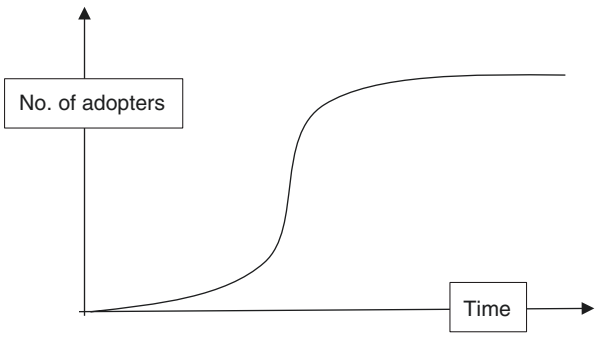

Fig. 9.5 Spread of an innovation over time. Adapted from Rogers E [48]

The challenge of putting research into practise may be explained by the theory of Diffusion of Innovations [48]. Everett Rogers, a professor of communication studies, described the Diffusion of Innovations theory, to describe how new ideas and technologies spread and come into wide use [48]. Spread of an innovation requires sufficient practitioners to take it on, who are described as early adopters, or as early majority, late majority and laggards according to the timing of their acceptance of new ideas. Spread of an innovation tends to follow an S curve when plotted against time (Fig. 9.5) [48].

Rogers [48] proposed that the main factors that influence the spread of a new finding are:

1. The innovation itself—simplicity, advantages, fitting in rather than disrupting established routines.
2. Communication—spread the word, increase awareness.
3. Time.
4. Social system—practitioners, organisations, leadership.

Hence, communication, patience and perseverance are often needed to turn the tide.

Thornley et al. [49] carried out an international survey of orthopaedic surgeons, to assess what factors of research studies are likely to influence a change in orthopaedic practise. They found that RCTs, systematic reviews and meta-analyses are the study designs mostly valued amongst orthopaedic surgeons. Publication of research in reputable journals and research performed by highly skilled subspecialist surgeons, and sample sizes of 101—500 cases were amongst the other factors encouraging adoption of research findings.

Despite the challenges faced with, surgical research can change practise. Costa et al. [50] evaluated the impact of the DRAFFT (Distal Radius Acute Fracture Fixation Trial) study on clinical practise in the UK. The DRAFFT compared volar locking plating (a more invasive and costly procedure) with percutaneous wire fixation (a less invasive and less costly procedure) for distal radial fractures, and showed no difference in functional outcomes between the two [51]. Prior the DRAFFT, 75% of distal radial fractures were plated and only 12% wired. Following publication of the trial, the rate of distal radial fractures wired rose to 42% and the rate of plating fell to 48%.

9.16 Running a Journal Club

Get your facts first, then you can distort them as you please.

Mark Twain [2]

Educating surgeons is an essential activity in breaching the gap between research and clinical practise. Journal Clubs are educational meetings where individuals meet to discuss and critically appraise newly published journal research articles [52, 53].

A Journal Club aims to assess the full article in a systematic way. It is not so much about getting informed of the question the study examined and the answer obtained, but more about evaluating the way in which a particular answer was reached.

As part of your training or teaching commitments you may have to present an article in a Journal Club, to your peers, colleagues, juniors or seniors. The aim is to present a summary of the article, followed by an assessment of each of its components, giving the positives as well as negatives. In presenting a Journal Club article you may consider:

Article distribution

Inform the meeting participants well in advance of the article to be presented, asking them to read it prior to the meeting. This may achieve a discussion rather than a one way presentation.

Article presentation

- Background: State the background of the problem as stated by the authors.
- Aim: State the aim of the article as stated by the authors.
- Methodology: Describe the method that was used, the design, the inclusion, exclusion criteria, the target population, outcomes.
- Results: State the most important results. You may use tables or graphs taken from the actual article.
- Discussion: Describe what the authors discussed and give their final conclusion in their own words.

Article evaluation

Evaluate each step of the article in turn:

- Background: Did the authors give a clear, concise but adequate description of the background that forms the basis of the research article? Did they justify the need of their study?
- Aims: Did the authors give a specific, clearly understood aim?
- Methods: Was the choice of method design appropriate? Were the inclusion/exclusion criteria correct and rigid? Was the target population appropriate? Were the statistical methods relevant to the results and aims? Was there a sample calculation or power analysis?
- Results: Were the results clearly presented through text, graphs, tables or figures? Were the results complete or are some missing? Do the numbers add up?

- Discussion: Was there a balanced discussion given the findings? Did the authors relate their findings to those of other relevant studies?
- Conclusions: Are the authors' conclusions justified, given their aims and results?

At the end of your presentation you need to ask whether the research study is relevant to your practise, or the practise of your audience. If it is relevant to your practise, will the study make you change your practice based on its findings?

– You may decide to incorporate the results of the study in your clinical practise.
– Alternatively, you may decide to stick to what you do; you may not be seeing the patient population examined by the study, you may not agree with the conclusions given the actual study results, you may be doing already what the study authors propose and support.

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Chapter 10
Surgical Audit

Audit is defined by the Oxford dictionary as "a systematic review or assessment" [1]. In surgery, it may be considered as the process through which we can systematically review our practise, identify those areas where we excel and those where we could do better.

Hence, audit can guide us as to which successful processes to maintain and which deficient areas to improve, to help develop and get better. Understanding the importance of audit in surgical practise, and recognising the strengths and limitations of processes through which surgical audit can be achieved are important skills to develop.

This chapter describes the surgical audit cycle, along with the various types of surgical audit. It also discusses the role of the surgical logbook, mortality and morbidity meetings, and national databases in evaluating surgical outcomes.

C. Panayiotou Charalambous, *Career Skills for Surgeons*,
DOI 10.1007/978-3-319-57490-5_10


Based on my experience I would highly recommend this extremely successful procedure
SUCCESS
100% (n=1)

10.1 Surgical Audit Cycle

Without reflection, we go blindly on our way.

Margaret J. Wheatley [2].

The surgical audit cycle refers to the process whereby we set standards for an "ideal" practise and then compare our current practise against that "ideal". This helps identify areas whereby our current practise falls short of being "ideal". Based on those, we then introduce changes in our practise to allow us to move towards or meet the predefined "ideal". This is the first part of the audit cycle.

After a settling in period (allowing our practise to get used to the changes we introduced and for any initial enthusiasm or despair to reach a steady state) we re-examine our practise to see if we are now closer to the "ideal". This is the second part of the audit or the closing of the audit cycle (Fig. 10.1).

Surgical audit may be described according to what it examines:

- Audit of process—pathways, protocols, procedures
- Audit of resources—human, technological, space, time
- Audit of outcomes—clinical, cost effectiveness

Audit may examine the practice of an individual surgeon, a group of surgeons, a department, an institution, region, the surgical practice across a nation or in multiple countries.

Standards of "ideal" practise may be set (amongst others) by:

- International surgical associations
- National bodies that evaluate any available clinical evidence for the effectiveness of healthcare processes and provide guidance as to their use (such as the National Institute of Clinical Excellence in the UK, or the Agency for Healthcare Research and Quality in the USA)
- Government healthcare bodies or regulators
- Surgical Training Organisations
- Institutions—hospitals, clinics, practises
- Surgical departments, groups or individual surgeons

Audits may be prospective (commence before the practise in question has occurred) or retrospective (looking back at events which have already taken place). Audit should be viewed as an improvement process through which deficiencies can be identified and addressed, as well as through which high quality practices can be appreciated and popularised. Audit is not an exercise utilised simply to improve one's qualifications or aid one's career advancement, or allow an institution to obtain accreditation and government funding.

Audit may be considered as being dynamic rather than static, with the audit cycle viewed like a wind driven turbine rather than a single twist; an audit demonstrating a low infection rate may be reassuring but should be regularly repeated to ensure that the conditions have not changed.

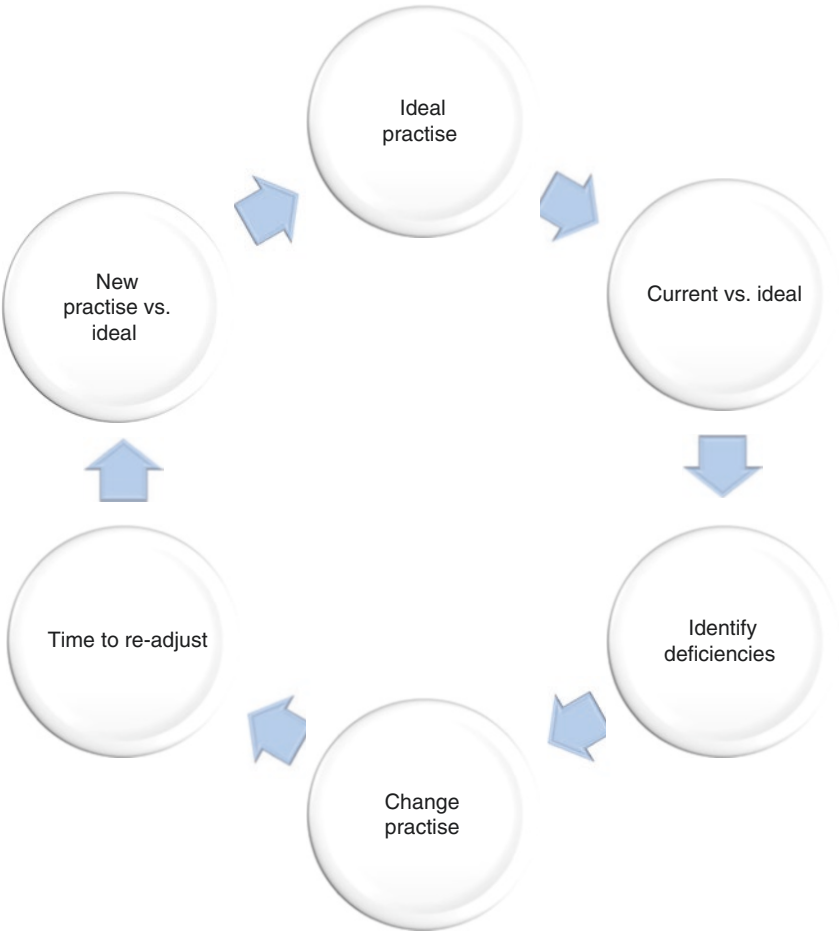

Fig. 10.1 Surgical audit cycle

10.2 Surgical Audit Ladder

Surgical audit may be performed at various levels, which may be described as the ladder of surgical audit (Fig. 10.2). Surgical audit may be performed by keeping a surgical logbook, or through departmental morbidity and mortality (M&M) meetings, systematic local data collection, and regional/national/international registries.

As one ascends the ladder of surgical audit the required resources for audit completion escalate, but any findings may have more widespread influence on healthcare systems.

10.2.1 Surgical Logbook

An individual surgeon may routinely keep (and is advisable to keep) a logbook of surgical cases performed under his/her care. This may be written or electronic. Various formats may be used but information recorded may include:

- Identifiers of the case—without compromising confidentiality and data protection rules
- Date of procedure
- Type of procedure
- Details of procedure
- Level of surgeon's participation in procedure
- Intra-operative and post-operative complications

Complications may be recorded as they are encountered (in theatre, ward, clinic). Such a record may allow surgeons to glance through their records and see how their cases are doing. Surgical logbook is not resource demanding, and may be considered a part of continuous assessment of own results, self-evaluation, self-reflection and professional development. However, surgical logbooks are limited by how much information can be recorded. In addition, recording of complications is often opportunistic rather than systematic as complications are recorded if and when

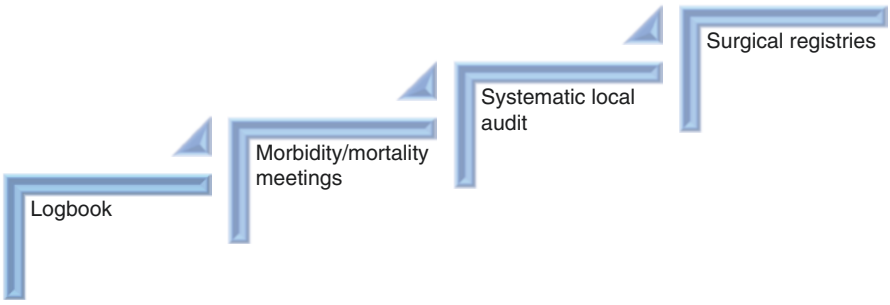

Fig. 10.2 Surgical audit ladder

encountered; this may miss cases who develop complications but are treated by other healthcare providers, hence not captured by a surgeon's logbook. Conclusions reached from surgical logbooks may thus be limited.

One may try to resist looking at own log book results using the 3 Ds approach which could refer to:

- Did it once
- Didn't go well
- Disaster procedure

Alternatively it could refer to

- Did it once
- Did very well
- Discovery

10.2.2 Mortality and Morbidity Meetings

These are meetings taking place on a regular basis, which aim to examine complications (morbidity) and deaths (mortality) encountered in the period since the last meeting. In hospitals, these often take place at a departmental level. Cases who developed such unwanted outcomes are examined in detail to help determine:

- What went well in care
- Deficiencies in care
- Factors leading to the unwanted outcome
- Whether the unwanted outcome could have been prevented
- Lessons learnt

Findings of such meetings may provide reassurance that complications and deaths occurred despite all preventable measures taken. Alternatively, such examination may identify care deficiencies, allowing lessons to be learnt and changes in practise to be introduced to minimise the risk of such unwanted events recurring.

M&M meetings should:

- Be considered quality improvement exercises rather than simply educational events.
- Take place in the presence of representation from all groups of staff that contributed to the patients' care (surgeons, nurses, physicians, anaesthetists). With increasing subspecialisation it may be more appropriate for the physician that dealt with the post-infarct fast atrial fibrillation to input as to that part of medical care, rather than the orthopaedic surgeon who fixed the patient's fractured hip.
- Take place in the presence of members of the surgical team that had direct responsibility for the patient's care (and may thus give better insight to what occurred rather than simply having to rely on recorded information).
- Conducted in a "no-blame" spirit where all are supported and helped to develop and learn. Such meetings should not be viewed as opportunities to "blame", to "name and shame" to "get at" longstanding foes. Pinto et al. [3] interviewed

vascular and general surgeons in two National Health Service(NHS) Trusts in London, UK to assess the impact of surgical complications on surgeons. About half of their participants described M&M meetings as being dominated by blame, not being supportive and exacerbating the burden of complications. The words of one registrar in general surgery in that study are striking:

> *"…morbidity and mortality meetings are supposed to be a forum where you can have an open discussion but if anyone believes that they're only kidding themselves; everybody in that room is very defensive and aggressively pursues an angle that puts them in the best possible light and professional rivalries exist…".*

- Deal with a manageable volume of cases for the time devoted, to avoid rushing through.
- Should be performed regularly so that cases are discussed close to their time of occurrence.
- Have mechanisms of adequately identifying cases (theatres, wards, out-patients) to avoid bias in case selection.

A recent survey [4] of 15 general surgical units in Scotland, reported that M&M meetings happened with variable frequency (three-weekly, one-fortnightly, ten-monthly, one-three monthly) and in only one unit the meeting was attended by nursing staff. In only three cases, morbidities identified during follow up appointments in the outpatient clinics were included.

If assigned with the task of presenting such cases in M&M meetings, you may consider the following in your presentation:

- Describe the patient's journey as a sequence of events.
- Be succinct but thorough.
- Obtain up to date information (such as post-mortem report).
- Verify the accuracy of the information you gathered with the team looking after the patient. Simply reviewing the medical records may not give you the whole picture.
- Give an assessment as to:
  - What went well
  - What could have gone better
  - Lessons to be learnt

10.2.3 Systematic Audit at Local Level

Such audits aim to examine practise at local level (one surgeon, group of surgeons, one department or institution). They aim to gather data in a more systematic, thorough and detailed way, particularly with regards to case identification and outcomes examined.

Systematic audits are closely related to research studies with regards to design and data collection. However, unlike research which aims to discover what the "ideal" practise is, in audit one knows what the "ideal" practise is and tries to discover if current practise meets that "ideal".

10.2.4 Audit Databases

Surgical registries may be kept at local/national or international level. They usually aim to record the outcomes of patients or procedures carried out by a large number of surgeons across various institutions.

There are several national audits taking place in the UK [5] evaluating outcomes and processes in various aspects of surgery and these include:

- Hip Fracture Database
- National Joint Replacement Registry(NJR)
- National Vascular Registry
- National Emergency Laparotomy Audit
- Congenital Heart Disease Audit
- Neurosurgical National Audit
- Ophthalmology Cataract Audit

Similar databases exist in the USA and include:

- Society of Thoracic Surgeons Adult Cardiac Surgery Database [6]
- Bariatric Surgery Quality Improvement Program [7]
- American College of Surgeons National Quality Improvement [8]
- Trauma Data Bank [9]
- Vascular Quality Initiative [10]

There are also examples of international databases:

- European registry for abdominal wall hernias [11]

National/international databases offer important advantages such as:

1. Large number of cases (patients, procedures, implants).
2. Large number of surgeons; hence any findings can be more representative of the real world picture and provide a pragmatic presentation of potential outcomes, rather than if evaluation is limited to few specialist centres.
3. Can provide a temporal rather than static assessment as cases are continuously added to the database. This may allow one to examine not only current performance but also assess trends in performance. Trends in practice may also be determined (such as patient selection, preference for particular procedures or implants, outcomes). In orthopaedic surgery national registers have been able to identify early problems with some implants such as metal on metal hip arthroplasties, or patella-femoral knee arthroplasties.

However, when referring to surgical registries certain design challenges may be considered:

Accuracy of data: Data collected and used for analysis must be accurate, as inaccurate data can lead to erroneous results and wrong conclusions. In some situations data may be collected retrospectively from medical records, often by non-medically trained staff, which could limit the accuracy of collected data. Accuracy of data may

also be influenced by whether they are collected by someone independent to the provision of treatment; in theory if the person performing the operation is completing the data recording form, the complexity of the procedure and the pre-surgery condition of the patient may be exaggerated consciously or subconsciously. It has been demonstrated that the accuracy of data recorded for the orthopaedic national registries in the UK may be lower than expected [12, 13]. Similarly, Seagrave et al. [14] examined the accuracy of data recorded from two hospitals in the Arthroplasty Clinical Outcomes Registry in Australia. They reported that in one hospital only 28 out of 49 (57%) variables collected met a 95% benchmark for data accuracy, whereas in the other hospital 38 of 51 (75%) variables did so. Inaccuracies involved mainly co-morbid conditions and complications.

Completeness of data: When assessing the results of a surgical registry one must examine whether data collection in the target population is complete, as incomplete data may lead to inaccuracies. Missing data may be due to random factors, in which case such loss may not substantially affect the overall results (if these results are presented as rates rather than absolute numbers). However, missing data may also be due to systematic factors (bias), which could lead to over- or under- representation of certain groups of patients in the population examined, and hence influence the overall results. Such bias may be conscious or subconscious. It may be that if an operation goes less well than expected, the data collection form is deliberately not completed (conscious bias). Alternatively, it may be that the records of cases who developed an infection following surgery are kept in the microbiology department for a long time as part of infection surveillance, or records of cases who died are filed in a different location and hence not made available to the person collecting the data (and who may not be aware of such arrangements). This could lead to the systematic (unconscious bias) under-representation of infected and dead cases in the population under examination and hence under-estimation of such complications.

The NJR in the UK records primary and revision joint replacements. In this way the survival rates of primary hip and knee replacements can be determined and outlier implants and surgeons identified. However, accurate calculation of such survival rates requires recording of all revision procedures and linking them to the initial primary procedure. Sabah et al. [15] compared data recorded by the London Implant Retrieval Centre (LIRC) and the NJR in the UK for hip replacement revision procedures performed between 2003 and 2013. They reported that 213 revision procedures on the LIRC (23% of those examined) could not be found on the NJR. Only 349 (38%) of revision procedures on the LIRC were found to be linked to their primary procedure on the NJR and hence contributed to the survival rate calculations.

Choice of outcomes: Appropriate outcomes must be utilised. Hard outcomes are preferable, ones that cannot be easily disputed—such as mortality rates in assessing emergency laparotomies, revision rates in assessing joint arthroplasty surgery, amputation rates in assessing vascular surgery reconstruction. Outcomes such as infection may be considered “softer” as their occurrence may be subjected to dispute due to the various definitions of “infection” available, and subjectivity that may be encountered in applying such definitions to real clinical practise.

Outcomes should also be able to capture "failure" that is not identified by hard outcome measures. If one looks only at occurrence of revision surgery in assessing failure of hip joint replacements then several cases who are doing badly (such as repeated dislocators, cases with persistent chronic pain) but do not undergo revision (for various factors including being medically unfit, not wishing further surgery, surgeon's view that revision surgery will provide no benefit) will not be considered, giving false reassurance. Inclusion of other outcomes such as patient reported pain or function may be preferable to help capture failures.

Similarly, if one looks at re-dislocation rates following shoulder arthroscopic stabilisation surgery, it would be helpful to describe re-dislocation according to whether it was related to a new injury or happened with minimal or no trauma. If the outcome of surgery is not good enough to enable an athlete to rehabilitate and return to professional rugby, then that athlete may be at less risk of further injury and hence at lower risk of further dislocations. In contrast, if the outcome of surgery is so good to enable an athlete to return back to rugby, then the athlete may sustain further rugby related injuries and hence further dislocations. Hence, if one simply looks at overall re-dislocation rates erroneous conclusions may be reached.

Case adjustments: Failures may be related to multiple factors other than the technical quality of performing the surgical procedure or the type of implant utilised. Such patient related factors may include:

- Patient characteristics—medical fitness, biology of healing
- Patient compliance with post-surgery instructions and rehabilitation [16, 17]
- Secondary gains such as worker's compensation and disability allowances [18, 19]
- Presence of other associated injuries

This raises the need to make adjustments for the case-mix under consideration, for factors that could influence outcomes. Several risk prediction models have been described which may help to predict outcomes such as the:

- EuroSCORE—to predict mortality post cardiac surgery [20]
- POSSUM—to predict morbidity and mortality post general surgical procedures [21]
- Nottingham Hip fracture score—to predict mortality in hip fracture patients [22]

Such prediction models may be used to calculate predicted mortality in specific patients which can aid decision making and counselling of patients about surgery. Prediction models can also be used to calculate the expected mortality in a group of patients and then compare the observed mortality to the expected, allowing evaluation of the quality of care provided by individual surgeons or units. Stratified outcomes are thus preferable to crude outcomes.

Case selection: As patient characteristics and procedure complexity may influence outcomes, it may be that if only straightforward cases are offered surgery (with more complex ones avoided) outcomes are better [23]. Such "gaming" [24] could theoretically happen at any level from an individual surgeon, to departments, insti-

tutions, commissioners or wider healthcare systems. There has been a recent trend in the UK and USA for the public reporting of surgeon specific or unit specific results [25, 26]. Such public reporting of outcomes can help identify areas of excellent practice which can then be mimicked or areas of deficient practice which can be improved. In addition, such reporting may encourage transparency and accountability, and can reassure the public for the existence of quality control in delivered care. Nevertheless, unit or surgeon reporting may (in theory) encourage case selection, with risk aversion behaviour, and potentially deny surgery to those cases that need it most.

10.2.4.1 Impact of Surgical Registries

There are several examples of surgical registries having a positive impact in various parameters, some of which are described below.

1. Improving quality of care: By encouraging and monitoring adherence to quality measures, registries may improve the overall quality of care.

The National Hip Fracture Database (NHFD) was introduced in 2007 in England, Wales and Ireland, with the aim of improving the care of patients admitted with a hip fracture. It involved setting standards for care, collection of performance and outcome data and feedback to participating units [27]. Neuburger et al. [28] looked at almost half a million cases of hip fractures in patients older than 60, treated in the NHS in England and compared those treated during 2003–2007 (prior to the introduction of the NHFD) to those treated during 2007–2011. The rate of early surgery increased from 55 to 71% during 2007–2011, whereas it had been stable in the previous years. In relation to this, 30-day mortality decreased from 10.9 to 8.5% during 2007–2011 but only from 11.5 to 10.9% during 2003–2007 (Fig. 10.3). These findings suggest that the NHFD improved hospital care with resultant improvement in survival.

In the USA, the Vascular Quality Initiative collects data on vascular procedures (risk factors, peri-operative management, outcomes) and gives feedback to participating centres allowing them to compare their performance with their peers. Participation in the Vascular Quality initiative was shown to lead to improvements in utilisation of antiplatelet and statin therapy in patients having vascular surgery from 55 to 68%, with centres participating in the initiative for more than three years being 30% more likely to have patients on these medications. Discharge on these medications was associated with an improvement in five year survival, compared with discharge on no such medication (82% vs. 67%) [29].

2. Reducing healthcare costs: Surgical registries may lead to substantial healthcare cost reductions by improving care quality and reducing complication rates. Larsson et al. [30] evaluated the role of the Swedish Hip Arthroplasty Register in reducing hip replacement revision rates and the cost savings of such reduction. By comparing the revision rates seen in Sweden with those encountered in the USA they estimated a cost saving of about $14 million per year.

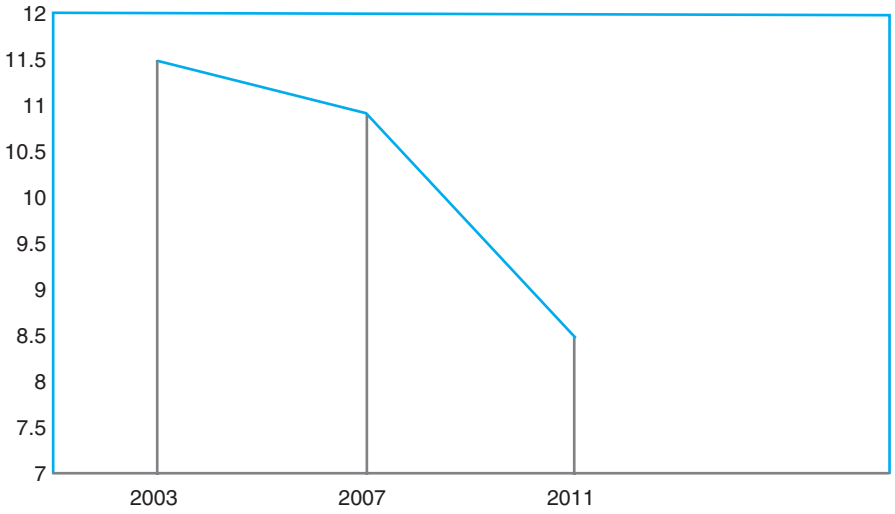

Fig. 10.3 Reduction in 90 day mortality following the introduction of the National Hip Fracture Database (NHFD) in 2007. Adapted from Neuburger et al. [28]

Guillamondegui et al. [31] evaluated the role of participation of Tennessee hospitals in the Tennessee Surgical Quality Collaborative in reducing complication rates in general and vascular procedures. They estimated that through the reduction in complication rates $2.2 million per 10,000 surgical cases were saved each year.

3. Limiting harm: Registries (when thorough and accurate) may aid to identify at an early stage implants, procedures, units or surgeons underperforming and hence by addressing these minimise further harm.
4. Reassuring stakeholders: Through the inclusion of huge numbers of cases, registries can provide meaningful rates on rare complications.

Hunt et al. evaluated about 409,000 total hip replacements [32] and 468,000 total knee replacements [33] carried out for osteoarthritis in the NJR in the UK. They reported that the mortality rates in total hip replacements fell from 0.56 to 0.29% and for total knee replacements from 0.37 to 0.2% between 2003 and 2011. Along similar lines Zaidi et al. [34] reviewed 1522 primary ankle replacements on the NJR in the UK and reported a 0.13% 90-day mortality. The 90-day incidence rate of pulmonary embolism was 0.51% but no deaths occurred as a result of this complication.

Publication of surgeon specific outcomes or unit specific outcomes (even though they may have several limitations) may improve transparency and confidence of the public on the surgical profession.

10.3 Hawthorne Effect

In audit one may consider the possibility of the Hawthorne effect, whereby improvements in performance may be due to the awareness of being observed [35, 36].

This effect was described in the 1950s when analysing the results of studies done at the Hawthorne Works, a factory of the Western Electric Company in Illinois. Those studies assessed ways of improving workers' productivity, but found that productivity increased whatever the intervention applied (changes in levels of light, or even a reversal to the original working conditions). Hence, it was concluded that it was not the intervention per se, but the attention that the participants received (knowing that they were being watched) that improved productivity [35, 36].

The Hawthorne effect may be considered when auditing snap shots of clinical practise. If participants know that during the audit period their performance is monitored (such as their compliance with completing venous thromboembolism assessment forms, hand washing during wards rounds), they may be more likely to behave as they should, leading to a false reassurance of appropriate practise. One may have to go undercover or come up with other novel ways of monitoring performance to counteract this effect [37–40].

In national registries, which provide continuous feedback, a Hawthorne effect may be welcomed.

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Chapter 11
Safety in Surgery

The Institute of Medicine defines patient safety as "the prevention of harm to patients", that is "avoiding injuries to patients from the care that is intended to help them" [1].

Patients seek surgical care to improve and get better. Surgeons provide care to help patients recover and pull through. The surgeon's motto remains that above all "do no harm" [2].

Yet, in the process of delivering surgical care patients may be harmed. Understanding potential causes of such harm, the factors that may lead to errors, and recognising processes as well as individual behaviours that may help promote safety, are important skills to develop and are discussed in this chapter.

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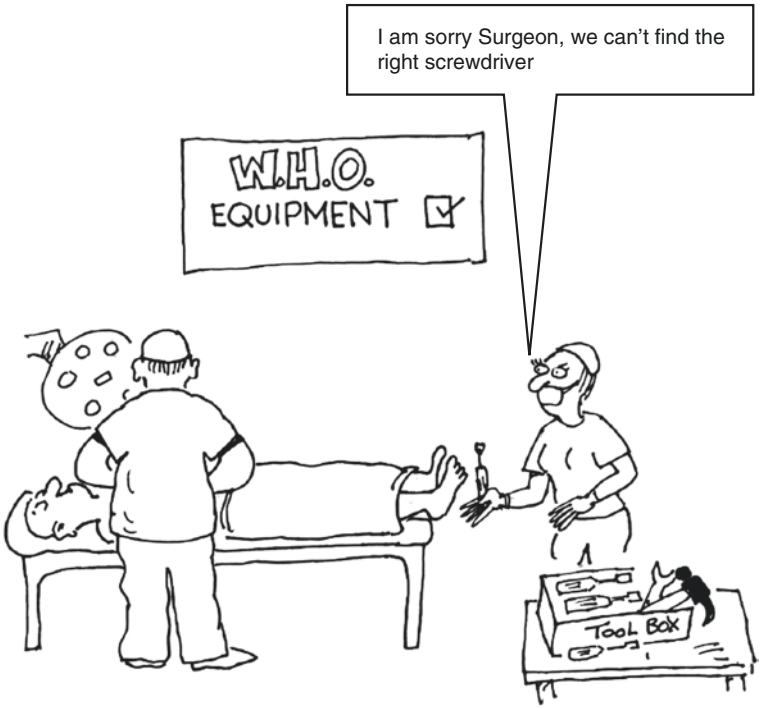
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W.H.O.
EQUIPMENT
TOOL BOX

11.1 The Safety Problem

Make a habit of two things: to help; or at least to do no harm.

Hippocrates [3]

It is estimated that about 10% of patients in hospitals in the developed world may suffer an injury related to medical management with 50% of these possibly being preventable [4]. A study in Portugal, reported that 10.8% of hospital patients died and 5.4% suffered permanent disability due to an adverse event [5]. In the USA, lapses in patient safety may cause more than 200,000 deaths each year [6].

Patient harm may occur at any step of care delivery, from diagnosis to treatment. The surgical theatre is prone to harmful events as they are dynamic environments with interaction of multiple players, multiple teams (surgical, nursing, anesthetic), and reliance on technology.

Harmful events may vary in their severity, the resultant damage they confer, or the likelihood of taking place. At one extreme of severity are "Never Events" a term introduced in by the National Quality Forum (NQF) in the USA. The term "Never Event" was used to describe healthcare errors that should never be encountered [7, 8].

The National Health Service (NHS) in the United Kingdom (UK) defines "Never Events" as "serious, largely preventable, patient safety incidents that should not occur if the available preventative measures have been implemented by healthcare providers" [9]. The NQF identifies 29 [10] and the NHS describes 25 [11] such events.

In relation to surgical or invasive procedures, "Never Events" include [10, 11]:

- Wrong site surgery.
- Wrong patient surgery.
- Wrong surgery.
- Implantation of a wrong implant.
- Retention of a foreign object in a patient after surgery.

Such events attract massive attention within healthcare organisations but also amongst the wider public, with press reports referring to wrong kidney removed [12], wrong eye lens implanted [13, 14], swabs or needles left behind [15].

Amongst 9744 paid malpractice settlements and judgements for surgical never events occurring in the USA between 1990 and 2010 Mehtsun et al. [16] reported mortality occurring in 6.6% of patients, permanent injury in 32.9% and temporary injury in 59.2%. Kwaan et al. [17] reviewed wrong site surgery cases reported to a large mal-practise insurer in the USA between 1985 and 2004, and reported an incidence of one in 112,994 operations. Retention of foreign bodies after surgery was in the order of one in 8801 to one in 18,760 operations.

Never events are unacceptable but also rare, and should not distract attention from other more common but equally harmful encounters such as medication errors which in the USA alone may kill up to 7000 patients per year [18, 19].

Hence, healthcare safety is a real issue, a major problem that a surgeon needs to have at the forefront of their mind. Surgery may not help a patient due to treatment resistance or progression of the underlying disorder, but patients should not be further harmed by failures of the treatment process.

11.2 Contributors to Healthcare Safety

Our goal is to make the best devices in the world, not to be the biggest.

Steve Jobs [3]

Safe surgical care is not the responsibility of one individual but of all those involved in healthcare. Various parts of the healthcare system could contribute to safety as below:

- Education—Medical Schools, universities and postgraduate professional development bodies that aim to promote safe care rather than simply transfer knowledge.
- Governments and politicians who develop safe healthcare policies, prioritize safety, take safety into account in describing quality care, incorporating safety measures in tariffs and remuneration of surgeons or institutions.
- Professional bodies who give guidance about safe care and support safe practice.
- National bodies for reporting and investigating unsafe acts.
- Regulatory bodies which inspect institutions to ensure standards are met, which respond effectively and promptly when such standards deteriorate, which investigate and act when things go wrong, which ensure lessons are truly learnt and minimise the possibility of harmful events recurring.
- Leadership that makes safety a priority alongside productivity and cost efficiency.
- Healthcare Industry with manufactures having safety as a main consideration in technology design.
- Processes, pathways, policies aiming at improving safety.
- Culture of safety at individual, departmental, or organizational level. This takes into account the priority given to safety relative to other goals of the organization (such as productivity, financial gains). Such a culture encourages front line workers to speak up, avoids assigning blame as the reflex response to adverse events.
- The individual at the frontline of surgical care—the surgeon, anesthetist, nursing staff, theatre scrub staff.

11.3 Causes of Harm

One of these days, I'm going to stop learning through my errors.

Burgess Owens [3]

Failures in healthcare may lead to no harm, minor harm or major harm. On occasions minor harm if left unchecked may progress to more severe harm (Fig. 11.1).

Surgical care harm may be due to several types of failures:

1. Recognised complications of care: occurring despite all reasonable precautions.
2. Errors: James Reason, Professor of Psychology at the University of Manchester, UK, and author of the book, "Human Error" [20] described error as "the failure of planned actions to achieve their desired goal" [21]. Reason classified errors into slips/lapses and mistakes. Slips and lapses refer to situations where the intended plan is appropriate, but there is failure to execute that plan. Mistakes refer to situations whereby the actions are executed as planned, but the plan is wrong [21].
3. Violations: These were described by Reason [21] as intended "deviations from safe operating practises, procedures, standards, or rules". Violations may refer to cutting corners simply because the opportunity is there, to get the job done, or to get personal gratitude such as to get a kick in a boring situation.
4. Technological breakdowns: A systematic review reported that almost one in four adverse events in the surgical theatre involved medical devices [22]. Doyle et al. [23] reported that, between 2005 and 2012, medical device errors cost the Johns Hopkins Hospital $75.3 million in legal fees and settlement pay-outs.

The outcomes of the above may not differ. A patient may be harmed as a result of any of the above. You may consider the example of a patient suffering an infection of a surgical wound. Infection can have devastating consequences on the individual concerned. Several precautions are taken, pre- intra- and post-operatively to minimize the risk of infection. Despite taking all necessary precautions, infections may still occur, and infection is a recognized complication of surgery, one

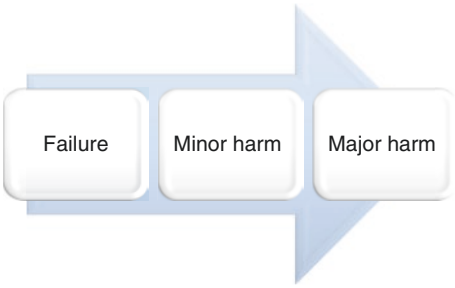

Fig. 11.1 Relationship between healthcare failures and harm

for which patients are appropriately counseled. However, infections may also occur due to care errors: a lapse may lead to omission of administering the correctly prescribed prophylactic antibiotic. Alternatively, the prescribed antibiotic may be administered but there was a mistake in that the wrong antibiotic was chosen in the first place. Infections may also be the result of good practise violation, such as deliberately overlooking the need for frequent ward cleansing, in an attempt to get more patients processed for surgery. Infections may also arise due to technology failures such as breakdown of the sterilization autoclave (that sterilises surgical instruments), which may not become immediately apparent, despite regular checks.

Safety failures may be described as:

1. Active—errors or violations performed by those at the frontline of surgical care. Once these happen they have an immediate effect, and become easily apparent [21, 24].
2. Latent—due to decisions, omissions, actions or inactions by those behind the frontline staff, those higher up in an organisation or general healthcare system, failures in any of the contributors to healthcare safety [21, 24]. The effects of such acts do not become immediately apparent, but may remain dormant and silent for a long time. Such failures may set the context predisposing the frontline staff to err, or may set the context whereby the frontline staff are not prevented from erring.

Active failures are those of the individual, and are the ones that often catch the focus when things go wrong. However, the importance and contribution of latent failures to harm are increasingly recognised [21, 24, 25].

Latent failures are those of the "system" and the "system" can be at any level, such as national, regional, individual hospital, practise, department, ward, operating theatre suite. Latent conditions may exist due to inadequate decisions made by government, healthcare authorities, institution authorities, lack of thorough oversee regulatory bodies, wrong assumptions or dogmatism installed in medical education curricula, design faults of medical devices, deficiencies in policies and procedures.

11.4 Latent Failures in Aviation

Talk sense to a fool and he calls you foolish.

Euripides [3]

The role of latent conditions may be more apparent in the aviation industry where they have been extensively studied with examples of latent failures occurring at various levels:

Education: American Airlines Flight 587, an Airbus A300, crashed in 2001, shortly after taking off from New York's JFK airport, due to break off of one the plane's fins, the vertical stabiliser. One of the factors contributing to the vertical stabiliser's failure was the use by the pilot of excessive rudder inputs, in trying to deal with turbulence caused by another plane flying in front. This pilot's action in using the rudder was considered unusual but it became apparent that education issues could have explained such a response; American Airlines had incorporated into their "Advanced Aircraft Manoeuvring Program" the guidance that rudder could be used in recovering from upsets and unusual attitudes (such as encountered in wake turbulence), but without giving any advice as to the effects of such rapid rudder reversals [26].

Processes: In 1996 a mid-air collision occurred between two planes travelling at similar altitude in opposite directions; a Saudi-Arabian Airlines Boeing 747 leaving from Delhi and a Kazahstan Airlines II-76 plane on the way to Delhi, over the village of Charkhi Dadri. Several factors are thought to have contributed to this world's deadliest mid-air collision, but these included the lack of separate air corridors for departing and arriving planes in the civilian airspace around Delhi, with inbound and outbound flights separated only by differences in flight altitude. Hence, this arrangement, led to two planes colliding when they (by mistake) ended up flying at the same altitude [27].

Regulation: Alaskan Airlines Flight 261, a McDonnell Douglas MD-83 plane, crashed into the Pacific Ocean near California due to loss of pitch control, in 2000. Loss of pitch control was considered secondary to failure of the plane's horizontal stabiliser occurring due to inadequate maintenance (inadequate lubrication of the jackscrew assembly causing screw thread wear). The Federal Aviation Administration, a national authority in the USA that regulates civil aviation, was found to have granted extension in the required intervals of plane maintenance, despite inadequate technical data to support the safety of such extensions. The investigation into the crash concluding that "FAA surveillance of Alaska Airlines had been deficient for at least several years" [28].

Technology designs—British Airways flight 38, a Boeing 777, crashed in 2008 just short of Heathrow runway. During its long journey from Beijing, whilst passing over Siberia and other frozen territories, at extremely low temperatures, ice crystals

formed in the fuel lines. As the plane approached to landing, this ice was released obstructing the fuel feed system to the engines. The possibility of ice clogging was not recognised at the time of engine design and initial certification, and eventually led to a redesign of the engine components to allow for the possibility of such an occurrence [29, 30].

Technology interface designs—Helios Airways flight 522, a Boeing 737, crashed in Greece, in 2005. The plane took off with its pressurisation system set to "manual" rather than "auto", which led to failure of the cabin to pressurise, and the crew becoming incapacitated due to oxygen lack. The plane flew for several hours, eventually running out of fuel and crashing. Amongst the potential contributors to the crash was a misidentification of a warning sound. This could have been partly due to a complexity of the pilot–cockpit interface, as the same warning sound was used to inform the crew of two different types of dysfunction—when airborne, the warning sound acted as an altitude warning, prompting the crew to stop ascending, but when on ground the same warning acted as a take-off configuration advising pilots that the plane is not ready for take-off [31]. To improve the pilot–cockpit interface the FAA subsequently released a directive requiring all similar Boeings to install two separate warning lights, one for take-off configuration problems and one for cabin altitude warnings [32].

11.5 Latent Failures in Healthcare

The way to gain a good reputation is to endeavor to be what you desire to appear.
Socrates [3]

But even in healthcare there are examples of latent failures leading to unsafe situations and patient harm and three of these are described below:

1. Thomas Hugh, past Chairman of the Australian Cases Committee of the Medical Defence Union, looked at the factors behind bile duct injury during laparoscopic cholecystectomy [33]. Laparoscopic cholecystectomy is a commonly performed procedure for symptoms of gall bladder stones. In this procedure, the gallbladder is identified, and the cystic duct is dissected, ligated, and divided. However, the hepatic or common bile ducts may be mistaken for the cystic duct and wrongly divided. Bile duct injury is a feared complication due to its associated morbidity and mortality. It is estimated that 1500–2500 patients have bile duct injury in the United States every year [34].

Hugh [33] examined in detail the circumstances of bile duct injury during laparoscopic cholecystectomy in a series of cases. He reported that mis-identification of the biliary anatomy was the major cause of such injury. In 27 of 34 cases examined, mis-identification of the biliary anatomy occurred, usually mistaking the common bile duct for the cystic duct. It was noted that the injury was unrecognised by the operating surgeon in three out of four cases. This suggested spatial disorientation on the part of the surgeon. Hugh [33] questioned the common assertion that bile duct injury is simply the result of inadequate dissection and poor visualisation of anatomic structures and looked for more latent systemic deficits that could contribute to such injuries. Latent errors were identified that contributed to bile duct damage even in the hands of well trained, skilled and experienced surgeons. These included:

- Latent deficiencies in training whereby traditional advice and landmarks for safe dissection were considered as inadequate.
- Latent deficiencies in equipment such as defective laparoscopes, inadequate light illumination, inadequate cameras or defective telescopes that led to poor view, and reluctance of hospital authorities to invest in new equipment.
- Latent deficiencies in the provision of inexperienced assistants who unsettled instead of facilitating the surgeon.

Dekker and Hugh [35] also stressed the importance of under-estimating the risk of potential bile duct injury and visual misperception leading to bile duct misidentification as contributory causes to such harmful events.

Hugh [33] proposed changes in what had been previously taught as how to perform gall bladder dissections. He proposed that principles used in maritime and aviation industries to minimise navigation errors should be employed:

- Starting dissection from a fixed point.
- Knowing where you are at all times.
- Having a clear bearing.

In addition, surgeons were encouraged to refuse inadequate equipment; in one case surgeons suspended laparoscopic operations until the hospital management provided better equipment. It was also emphasised that targeted training in camera holding could improve the quality of assistance provided. Attention was also paid to teaching juniors to be assertive and be prepared to question the actions of their seniors, if they felt there was mis-identification of anatomical structures. In a prospective study of 2000 laparoscopic cholecystectomies, where the above principles were applied, there were no bile duct injuries [33].

2. In the UK, The Bristol Inquiry, chaired by Professor Ian Kennedy, examined the factors that led to unacceptably high death rates in children undergoing heart surgery at the Bristol Royal Infirmary and the Bristol Royal Hospital for Sick Children [36]. It was reported that between 1988 and 1994 the death rate at Bristol hospitals was about double that seen in other centres in 5 out of 7 years, with an estimated 30–35 excess deaths observed in children under one undergoing heart surgery in Bristol between 1991 and 1995. The enquiry found that about one in three children who had open-heart surgery received less than adequate care due to a number of latent failures occurring at multiple levels. These failures included [36]:

   - Processes: "*a service offering paediatric open-heart surgery which was split between two sites*" "*with cardiologists in one hospital and surgeons in another*", "*no dedicated paediatric intensive care beds, no full-time paediatric cardiac surgeon and too few paediatrically trained nurses*" [36].
   - Leadership: "*There was a 'club culture'; an imbalance of power, with too much control in the hands of a few individuals". "There was power but no leadership. The environment was one in which problems were neither adequately identified nor addressed"* [36].
   - Management: "*Senior managers were invited to take control, but little or no system existed to monitor what they did in the exercise of that control*" [36].
   - Regulation: *"At a national level there was confusion as to who was responsible for monitoring quality of care". "There was no agreed means of assessing the quality of care. There were no standards for evaluating performance". "The clinicians in Bristol had no one to satisfy but themselves that the service which they provided was of appropriate quality. There was no systematic mechanism for monitoring the clinical performance of healthcare professionals or of hospitals". "Audit was represented as an educational tool, not a mechanism for accountability to the profession, the employer (the NHS) or to the public". "When concerns were raised, it took years for them to be taken seriously"* [36].
   - Education: *"There was no requirement on hospital consultants at that time"…. "to keep their skills and knowledge up to date"* [36].

3. Wrong side surgery can have devastating consequences for the patient and healthcare staff involved. Pre-operative verification of the side with the involvement of the patient, appropriate marking of the side to be operated, and taking time out to check that we are dealing with the correct side, are recognised requirements for minimising the possibility of side errors.

Underlying latent failures may contribute to wrong side surgery, rather than the surgeon simply putting the knife on the wrong body part. Mulloy and Hughes [37] describe some of the latent system failures that may exist and predispose to such an event occurring:

- Lack of institutional check mechanisms to verify side.
- Reliance only on surgeon for confirming side.
- Lack of continuity of surgical care -multiple surgeons or teams.
- Inadequate communication channels between team members.
- Time pressures to reduce pre-operative preparation time.
- Inadequate staffing levels.

11.6 Isolated Versus Sequence of Events Leading to Harm

Habit is the nursery of errors.

Victor Hugo [3]

Failure of safety leading to patient harm may be due to an isolated event, but in many cases it is due to a sequence or combination of events.

Reason [38] proposed the concept of the Swiss Cheese model of safety barriers. According to this, normally there are several barriers protecting against harm, each of which may have potential holes or weaknesses. Failure in one barrier may be prevented from causing harm by the next barrier. However, if the weaknesses of consecutive barriers coincide, then harm may occur. Consider the following two hypothetical scenarios:

1. A patient may be having surgery on the index finger for tendon triggering:
   - The patient may be correctly consented, marked, pass all the verification checks, prepped and draped.
   - But the surgeon instead of making the incision on the index finger, opens up the ring finger instead.

In this situation harm occurs due to a single error occurring at the terminal step of care delivery, when no more safety barriers are left.

2. In contrast, wrong side surgery may be due to failures at multiple barriers. A patient with established dementia may be admitted with a left hip fracture, needing a hip hemi-arthroplasty:
   - The junior doctor admitting the patient in the Emergency Department, has just clerked three other hip fracture cases and by mistake recalls the wrong radiograph when it comes to marking the leg, marking the "right" instead of the "left". The patient cannot self-consent, screaming with pain on moving either leg.
   - The attending surgeon the next morning simply checks the side mark on the leg, and countersigns the consent form; the attending surgeon cannot recall the actual radiograph as in the admission meeting several cases of hip fractures were reviewed, and it is hard to recall "who is who".
   - The trauma coordinator (in line with the junior doctor's handover sheet) lists the patient for "right hip" surgery.
   - The checks in the ward confirm that the leg mark, consent and listing agree.
   - The checks on arrival at the surgical theatres' suite confirm that the leg mark, consent and listing agree. The patient is not questioned as they cannot give a reliable answer and there is no family or carer around.
   - The team pre-op briefing, confirms the listing and the type of procedure to be performed.
   - The final verification, prior to "knife to skin", confirms the presence of the correct patient and that the marking, listing and consent agree. The surgical theatre monitors are down and a final examination of the radiograph cannot occur.
   - The surgeon opens up the wrong leg.

In this situation harm occurs due to an initial marking error, early on in care delivery, but also failures of multiple subsequent barriers where the error could have been identified and prevented from causing harm.

11.7 Strategies for Improving Safety

Don't spend time beating on a wall, hoping to transform it into a door.

Coco Chanel [39]

In improving safety, we aim to prevent failures from occurring and also aim to recover from such failures if they were to occur (Fig. 11.2).

Recovering from failures may mean having mechanisms in place for identifying such failures early, and stopping them from propagating and causing harm or causing worse harm than what may have already occurred. Such mechanisms may include multiple verifications, or checklists; if a medicine has been prescribed wrongly on the drug chart, a routine check by the pharmacist may identify the error, hence stopping the administration of the wrong medicine and potentially preventing harm from occurring. Alternatively, even if a dose has been given, identification of the error may stop further administrations hence minimising harm.

Recovery, may also mean having plans to counteract the effect of failures to stop or minimise the harm they may cause. Early identification of a hip replacement wound infection may lead to appropriate antibiotic treatment, stopping it from becoming deep, involving the prosthetic implant and leading to revision surgery.

In considering how to improve safety one may look at addressing the "system" and the behaviours or actions of the individual.

Howell et al. [40] carried out a systematic review of studies evaluating interventions used to reduce adverse events in surgery. They reported that of the interventions examined the following were shown to have a beneficial effect in decreasing morbidity and mortality:

1. Use of safety check lists.
2. Improving nurse to patient ratios.
3. Intensive care unit physician involvement in post- operative care.
4. Sub-specialisation in surgery.
5. Submission of outcome data to national audit.
6. Adherence to care pathways.
7. Certain safe technologies and team training.

As an individual surgeon, you may not be able to radically alter the system you find yourself practising in. Nevertheless, individuals and front line staff have a central role to play in minimising the possibility of harm. Mehtsun et al. [16] in their review of the federal repository of medical malpractice claims, estimated that about 4000 surgical never event claims occur every year in the USA. Of interest, 12.4% of physicians named in a surgical never event claim were also named in at least one further surgical never event claim.

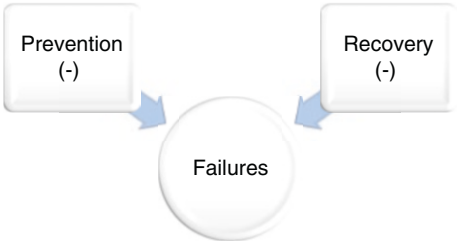

Fig. 11.2 Minimising the effect of healthcare failures

11.8 The Iceberg of Error

What we think, we become.

Buddha [3]

One may think of "system" errors as the iceberg which lurks round the corner, and the skipper the individual which may have a last chance to spot it, to redirect and save the ship (Fig. 11.3). Sometimes, no matter how alert, able and skillful the skipper is, there may be fog, a rough sea, the iceberg tip maybe hardly visible and can't avoid. But on situations the skipper may not be alert, may be tired or sleepy, may be distracted, may be entertaining rather than looking. There may also be times when the skipper is aware of the iceberg and still decides to risk it, take chances, and sail close to the wind. And then, there may be times when the skipper can't see but one of the stewards calls the iceberg out and saves the ship.

And even if the unlikely were to happen and the ship hits an iceberg, the skipper may help avert disaster by shutting the compartment barriers to isolate the flooding, or by coordinating a safe transfer of all to the life vessels.

Appreciate your vital position as the last layer of protection, the last line of defence.

Clarke et al. [41] looked at near misses of wrong side surgery in Pennsylvania, USA. They reported that surgeon involvement in the verification process in the pre-operative holding bay helped prevent wrong side surgery in 19%. Nurses carrying out verification in the pre-operative holding area were also effective in catching errors as did some of the scrub nurses in the surgical theatre.

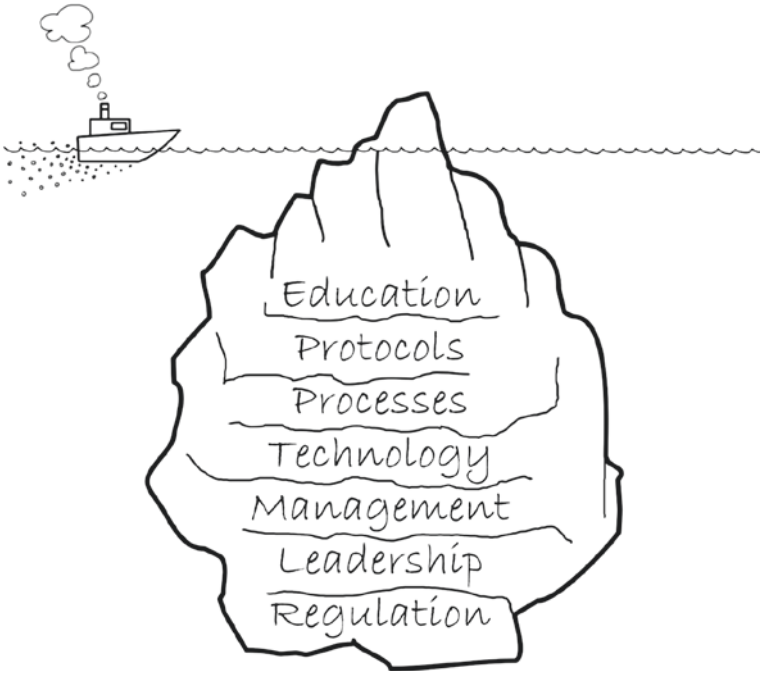

Fig. 11.3 The iceberg of error

11.9 Individual's Actions to Improve Safety

Just as courage is the danger of life, so is fear its safeguard.

Leonardo da Vinci [3]

Hugh [33] described certain attitudes thought to characterise a surgeon at low risk for error as someone who:

- Anticipates the order of events.
- Accepts feedback and input from other staff.
- Considers and modifies the working hypothesis as the need for information arises.
- Recognises the limitations of own-self such as self-fatigue, time pressures.

In addition to these attributes there may be other behaviours and actions that an individual surgeon could exhibit to help promote safety, and these are described next.

11.9.1 Be Risk Aware

One is not exposed to danger who, even when in safety is always on their guard.

Publilius Syrus [3]

One of the initial steps in encouraging a safe practise may be to consider risks and the harmful effects they could have:

- "What could go wrong? What if it doesn't work out?"
- "What if the "unlikely" happens?"
- "What would be the consequences?"

Considering the possibility of things going wrong, may be the first step in looking for what could go wrong, and for planning preventive measures or ways out.

- One may need to consider the risk of being run over if walking down the street in the middle of the night dressed in pitch black, in order to consider putting a shiny vest on.
- If you stay in a hotel for the first time, considering the possibility of fire breaking out, no matter how rare that may be, may let you look for a fire exit in case you have to run out.
- One may need to consider the risk of being struck by lightning if seeking shelter under a tree in the mid of a thunderstorm, to think about searching for another cover from rain.

Dekker and Hugh [35] reported that a chronic pre-operative underestimation of risk amongst experienced surgeons may contribute to bile duct injury during laparoscopic surgery. They postulate that such underestimation may be based on experienced surgeons failing to accept that it could happen to them. They also suggest that risk underestimation may be based on previous success in avoiding the error and

stress that such past success cannot guarantee future safety. They propose that surgeons should deliberately heighten their awareness for potential risks, and keep reminding themselves "this could be the one".

Adverse events will happen no matter how skilled, careful, dedicated or thoughtful we are, but sometimes what determines their outcome is how we respond to those, how we recover from error, how we intervene to rectify and prevent further harm.

Being risk aware may enable you to prepare back-up plans and ensure the resources are available if those plans had to materialise:

- If your initial plan of fixing the fracture does not work out, do you have the equipment for replacing the broken hip, or would it mean having to stitch up the wound and return to theatre another day?
- If you hit the popliteal artery whilst drilling in the back of the knee do you have a vascular surgeon on standby? How long away will they be if you were to need them?

11.9.2 Avoid Taking Unnecessary Risks

I can resist everything except temptation.

Oscar Wilde [3]

Avoid taking unnecessary risks, cutting corners, ignoring well established processes. Stick to safe practises all the time. Once safe practises, rules and procedures are established, keep to those in a consistent manner. Avoid cutting corners even when you could easily do.

The equipment you asked for may not be ready, the company representative that you needed to guide you with using the new instruments may not be able to stay, there may not be backup equipment in case you drop that pelvic retractor on the floor. Should you be taking risks and proceeding, hoping it will all be good, hoping that you can get the job done just with the equipment on the shelf, that the scrub staff will manage to work out the new equipment, that you will be careful and won't drop the retractor?

The pressures may be high, not wanting to cancel a patient who has made plans and has been fasted from the night before; pressures from management who are worried about the patient breaching and theatre time under-utilised, or from yourself who may be reimbursed by case and a cancellation may mean loss of valuable income for that week or month. You may feel as being "on a mission" of getting the job done. You may be thinking it's a "bravery act", with you "the hero" saving the day.

It is a balance of risks and every case needs to be considered on its merits, but keep safety as one of the main factors in your thoughtful consideration.

11.9.3 Identify Error Prone Situations

Once we know our weaknesses they cease to do us any harm.

George C Lichtenberg [3]

Develop the ability to recognise situations with a high probability of things going wrong, of errors occurring. Reason [38] proposed the three bucket model for recognising situations that have a high potential for error and harm. Bad stuff in each bucket should make alarm bells ring, concentrate attention and focus minds:

- Bucket 1—the current state of yourself.
- Bucket 2—the context in which the task occurs.
- Bucket 3—the error potential of the task per se.

One may consider a task like driving and the potential for accidents and errors. What if you just finished a long shift and you hit the road with your eyes half closed? What if you are short sighted but you forgot your glasses at home? What if the car is due for service and the brakes or tyres are worn out? What if you are used to a manual gearbox and you have been given an automatic? How reliable is your co-driver, can you trust the directions they are giving? Has the co-driver been round London many times before as they claim to have done? What if it is raining, foggy or snowing, do you have to take that into account? And what if you are used to driving on an empty stretch of road in the Atacama Desert, and then you find yourself in the middle of the M25 motorway going round London?

Similar considerations may be applied in surgery. Recognise your own weaknesses that may predispose to error. You may be tired at the end of a full day theatre list, you may be recovering from bad flu, you may be upset that your last case will be cancelled due to lack of ward beds, dismayed for the lack of essential equipment. Appreciate that such factors may alter your behaviour, impair your performance and predispose to error.

Recognise the context in which you are expected to perform. The theatre environment is often dynamic with theatre staff changing, new faces you never came across before, junior staff not familiar with the tasks you are about to carry out. It may be that your assistant is very junior, just started in surgery and needs guidance to ensure that sterility is maintained. It may be that your assistant has surgical experience but has not in this type of operation and needs guidance about retracting. It may be that the scrub nurse is not familiar with the equipment being used and needs guidance as what instrument to give you next. It may be the radiographer has never screened for this type of fracture and needs guidance as how to position the image intensifier, where to position the viewing screen, how to move the intensifier in and out without getting in your way. It may be the anaesthetist has little experience managing patients in a sitting position, maintaining low blood pressure to reduce bleeding, and needs guidance as to what you are looking for. You may have a heavy list and may be pressed for time. It may be that two cases on your list share the same name, or there may be a mixture of left and right knees to be operated upon.

Recognise the complexity of the task. It may be that you are carrying out a challenging lengthy operation, in a challenging case, a medically unfit patient, a patient with difficult access or exposure.

Recognise error prone situations and adjust your behaviour and actions appropriately. Anticipate the storm and plan appropriately.

11.9.4 Check and Check Again

There is no harm in repeating a good thing.

Plato [3]

Carry out multiple checks to ensure the information you rely on is accurate. If needed check your self rather than simply relying on the word of others. Don't rely on a single port of information as it may be wrong, use multiple sources, cross check the information for accuracy. Even patients themselves on occasions may not be a reliable source of information. Clarke et al. [41] looked at near misses of wrong site surgery in Pennsylvania, USA and reported that the patient or their family provided incorrect information in 11 wrong site procedures. You may consider:

- In admitting patients for surgery, ensure that you have available and see all relevant documentation from the patient's journey, the clinic letters, investigation results, the listing form for surgery.
- You may practise in an environment where there is no continuity in administrative support, where your waiting list administrator changes every couple of weeks, where separate administrators put together your Monday and Saturday lists. Lists may be put together just before surgery, patients may be rushed onto the list to replace short notice cancellations, cases may even be rung in the morning to see if they could come in. The typing of clinic letters may lack behind, not all cases may have been listed by you in person.

Avoid cutting corners and proceeding without the necessary information. Simply relying on the information you gather from the patient on the day may not be adequate. You may have previously identified in clinic consultations important issues, such as the previous history of deep venous thrombosis, the strong metal allergy, the previous reaction to local anaesthetic, and you may not be able to elicit this information again on the surgery day, in the rushed environment of the theatre suite.

Clarke et al. [41] in their study looking at near misses or initiation of wrong site surgery, reported that failures in documentation, review or verification of patient information (such as in diagnostic tests, clinic records, consent forms, patient records, theatre listing forms) contributed to a substantial proportion of the cases examined. Non-availability of clinic records to allow verification on the day of surgery contributed to four wrong site procedures in their report. Errors in scheduling were frequently mentioned but implicated in seven never events involving patient contact.

11.9.5 Use Checklists Appropriately

> *I watch a lot of astronaut movies....Mostly Star Wars. And even Han and Chewie use a checklist.*
>
> Jon Stewart [42]

Checklists refer to a list of items to be checked or tasks to be done. They help to avoid reliance on memory, and to provide consistency and completeness in performing vital tasks. Checklists are well known in aviation industry, but their potential value is increasingly recognised in healthcare [43]. The ability of intensive care units in Michigan to reduce the incidence of catheter related blood stream infections from 2.7 per 1000 catheter days to zero by using an evidence base five point check list is well recognised [44].

There are several aims of checklists such as:

- Facilitate communication.
- Ensure all steps are completed.
- Ensure all items are available.

Facilitate communication: to ensure that all information is communicated to all team members, at briefs, debriefs, handovers. If you leave it to memory you may forget to let the anaesthetist know that your patient has a history of deep venous thrombosis and that thrombo-prophylaxis is warranted.

To ensure all steps are done: to ensure that antibiotics have been administered, venous thrombo-prophylaxis has been initiated, correct preparation of a patient for theatre has been performed, all outstanding jobs are completed in the surgical ward round.

Crisis check lists for rare events: to ensure all steps are executed and in the correct order, when emergencies or rare events are encountered. Flight 1549 took off from the La Guardia airport in New York, on a nice bright day in January of 2009, but two minutes into the flight both engines were burnt out by a geese strike. The heroic pilots who successfully landed the plane on Hudson River took out the emergency checklist, trying to follow step by step what they were to do in such an eventuality [45]. In theatre you may face a rare event. A patient starts bleeding, you fractured the patella whilst doing a knee replacement, you dropped the graft on the floor during a tendon reconstruction, you perforated the aorta during an oesophagectomy. These will be stressful times, when everyone is on the edge, when all may be looking to the surgeon for a solution. Rather than relying on memory for a bail-out plan, a checklist may ensure a consistent approach. It may also give you the confidence that you are following the correct steps.

To ensure all items are available—such as checking that all equipment, instruments, and implants are available, sterilised and ready, rather than realising in the middle of an operation that some are missing, and having to send to the nearby hospital for them.

Weiser et al. [46] evaluated the impact of the World Health Organisation (WHO) Surgical Safety Checklist in reducing complications and mortality in urgent surgical

cases in eight hospitals round the globe. They reported a reduction in complication rate from 18.4% to 11.7% and a reduction in death rate from 3.7% to 1.4% following introduction of the checklist. Borchard et al. [47] carried out a systematic review assessing the effectiveness and compliance of the use of safety checklists in surgery. They reported that surgical checklists reduced both mortality (relative risk 0.57) and complications (relative risk 0.63). However the mean compliance rate of surgical checklists was low at 75% (range 12–100%).

Checklists should be appropriate and relevant to the individual practise in which they are employed, and can be adjusted or modified to achieve that. Checklists should also be considered as complimentary rather than a complete substitute of all other practises, a substitute of common sense; pre-surgery briefing of the team using checklists does not totally substitute informal communication between team members to discuss patients or other issues.

Accept the importance of checklists and use checklists appropriately. They ought to be viewed not as a ritual or a box ticking exercise, but an opportunity to improve safety, to allow the team to stop, think, slow down, to concentrate minds. Checklists are as good as their operators. Do not simply go through the list for the sake of the process. If you identify a discrepancy during your checks, stop and evaluate it fully. Keep thinking of the consequences to patient and others if any adverse event were to occur, and the potential of checklists to help avoid those.

Appreciate the value of checklists. If one does not rely on memory for the weekly shopping but takes a shopping list along to the grocer's, should we be relying on memory for vital safety surgical tasks?

11.9.6 Recognise Critical Steps

The aim of the wise is not to secure pleasure, but to avoid pain.

Aristotle [3]

There may be critical situations, steps at which minds must be focussed, when all resources must be available, steps which if do not go as planned can have a huge impact, steps whose failure may not be easily salvageable. The ability to recognise such critical steps is an important skill to develop.

During surgery you may be supervising a junior surgeon, they may have done the procedure before, may be confident in what they are doing. Yet, there may be steps when you want to be physically present, when you need to double check that they are doing the right thing, difficult steps when your input will be of real value.

- A junior may be doing a Dynamic Hip Screw fixation for a hip fracture. Is the fracture adequately reduced? Is the initial guide wire central?
- You may be supervising a junior surgeon in doing a bowel resection in a case with multiple previous abdominal surgeries, with lots of intra-abdominal adhesions. They may have opened and closed the abdomen multiple times before, you

may have watched them opening the abdomen several times previously, but you may well need to scrub up from the beginning in this one.

- You are about to open an implant. Are we opening the correct one? Correct type, size, side? Is it still within date? Routine checklists at the beginning of surgery are unlikely to stop the use of the wrong implant. Double checking means neither simply assuming that the person who has checked it is correct, nor simply accepting what they are saying, but checking your-self and confirming that your readings match.

11.9.7 Aim for Effective Error Reduction Measures

The best car safety device is a rear-view mirror with a cop in it.

Dudley Moore [3]

Measures taken to improve safety may differ in their effectiveness in achieving their aim of preventing errors and hence harm. One may consider the Ladder of Effectiveness of Safety Interventions, with protocols, processes, education and warnings at the lower part of the ladder with technology imposing safe behaviour higher up (Fig. 11.4). The specific ladder order may vary according to what you are trying to achieve but this emphasises a concept that should be considered in safety planning.

If we look at the use of car seat belts, one may set processes whereby drivers and passengers are informed that seat belts have to be worn. Drivers may be educated, be made aware of the benefits and risks, to make them buy in the process, change their behaviour. The process could be enforced with heavy penalties and fines, but one cannot be looking all the time. Technology may be employed to warn the driver, such as the constant beeping when we set off without a seat belt on, but the driver can still ignore it. Alternatively, technology can be introduced which prevents the car from setting off without the driver's seat belt on [48].

Redesigning equipment to force safe behaviour can have a profound effect on safety. In contrast, re-educating staff, changing a policy or adding a warning label or sign may have a more limited effectiveness in promoting safety.

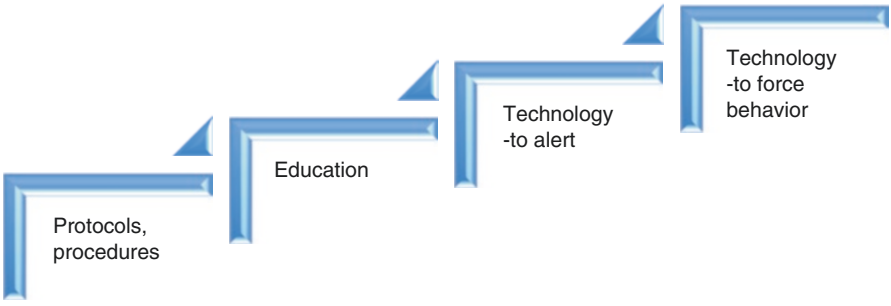

Fig. 11.4 Ladder of effectiveness of safety interventions

Consider the possibility of a wrong implantation of a right sided knee implant on to a left knee.

- A policy may be put together of having to check the side writing on the implant box before opening and handing over the implant to the surgeon.
- Staff may be informed of this policy and educated of the possibility of inserting the wrong side implant and of the need to pause and double check prior to opening the component and prior to implantation.
- A warning sign may be put on the implant box reminding the operator to check the implant side.
- The behaviour of staff may be monitored to ensure that they carry out the checks, with disciplinary action taken for those deviating from good practise.
- In contrast, the implant could be designed such as to make it physically impossible to insert a right sided implant into a left knee and vice versa.

Which of the above is likely to be more reliable?

11.9.8 Aim for Standardisation

There's no harm being a copycat. If someone else is doing a good job, copy. It's free.

Uday Kotak [3]

Standardisation of procedures, policies or protocols may help improve safety. Standardisation of certain actions may help avoid ambiguity and confusion, may ensure that actions are performed rather than avoided, and may minimise the possibility of error.

Consider a department where each attending surgeon has a different protocol for VTE, or a different protocol for peri-operative antibiotic prophylaxis, versus a department where there is one protocol for all. If there is a high turn-over of junior staff who are asked to assess and prescribe for VTE prophylaxis or antibiotic prophylaxis which setting is likely to produce more reproducible results?

Consider a department where each surgeon prefers to use a different knee arthroplasty prosthesis, versus one where there is agreement for the use of one or a small number of prostheses. In which of the two settings are the scrub nursing staff more likely to be up to scratch?

A standardised approach may improve safety, but then of course only if it is the right approach. Standardising an ill-thought policy, may simply help standardise the achievement of sub-optimal results.

11.9.9 Aim for Consistency

If we can play like that every week we'll get some level of consistency.

Alex Ferguson [3]

Safety measures should be consistently applied rather than a la carte. Avoid cutting corners just because you can. Safety measures should be fully applied at all times, to help encourage a culture where safety is the norm. Develop the mental strength to resist the temptation of cutting corners even if you have got away with it before. If you start cutting corners where will you stop? How effective is team briefing if utilised by all surgeons apart from the odd one? Or if you religiously apply team briefing first thing in the morning, but not after the lunchtime break when you are in a rush?

When are the red traffic lights be more likely to be effective? When they are respected by all drivers who stop at all times, or when they are simply considered as guidance, and ignored when one cannot see another car coming?

11.9.10 Recognise the Impact of Minor Failures

We are all of us failures - at least, the best of us are.

James M. Barrie [3]

We often pay attention to big failures, huge errors. Yet minor failures may accumulate and impair outcomes.

de Leval et al. [49] evaluated the role of human factors on surgical outcomes in 243 cases of major cardiac surgery. Major and minor human failures during surgical procedures were recorded. Major failures were considered as potentially life threatening events whereas minor failures were events that in isolation were not expected to have serious consequences on patient care. Major events were related to death. Similarly the total number of minor events per case was closely related to death and/or near misses. Some of the minor events recorded were positioning errors by surgical assistants, instrument handing errors by scrub nurses, distracters, inappropriate task delegation to inexperienced assistants, problems with theatre equipment, problems with communicating information between team members, absence of a senior team member in theatre at critical safety times, surgical fixation to one particular aspect of the procedure at the expense of monitoring, human resource problems such as no assistant available.

Catchpole et al. [50] observed 24 paediatric cardiac and 18 orthopaedic operations, to identify negative intraoperative events. They found that for every three minor problems (defined as "negative events that were seemingly innocuous") encountered above what was expected for the operation, intra-operative performance decreased by 1% and the duration of surgery increased by 10 min. Hence, reducing such minor events could lead to safer and faster operations.

Recognising the impact of minor failures may help concentrate minds, pay attention to detail, aim for a smooth ride.

11.9.11 Learn from Near Misses

The crashes people remember, but drivers remember the near misses.

Mario Andretti [44]

Learn from near misses, give them the attention they deserve, investigate what exactly happened, learn and improve. Don't simply feel relieved for real harm was avoided, but also feel relieved that you have been made aware of what could go wrong and given the opportunity to put barriers in place to help prevent real harm in the future. Investigating near misses and learning from them may help to identify latent systemic flaws which if addressed could prevent the occurrence of an actual adverse event occurring.

You may find yourself driving on the outer lane in a busy motorway, and whilst suddenly switching to the middle lane inadvertently cutting the way of the car behind you. You may have forgotten putting the indicator on, properly looking at your mirror, relying too much on your mirror and not turning your head to ensure a car is not too close for the rear or side mirrors to detect. The driver behind, even though upset, could simply slow down, shake their head in despair and just keep driving, without you ever becoming aware of how close to an accident you may have just come. Alternatively, the driver behind you may sound the horn, not to punish you, but to alert you of what has just happened. You may then drive away simply relieved that it was a near miss, or use the event as a wake-up call, a reminder of how careful one ought to be when changing lanes.

11.9.12 Use Incident Reporting Systems Appropriately

In giving advice seek to help, not to please, your friend.

Solon [3]

Incident reporting systems are commonly utilised in institutions, to record unwanted events where harm was done, or near misses where there was a lapse of performance but without actual harm occurring. Any filed reports are then looked into, examined, and where necessary actions are taken to learn from the event, and bring about changes that minimise the risk of similar events recurring. For any incident reporting system to effectively work it must be used as it is intended by those reporting and those investigating such incidents. You may consider:

- Don't use incident reporting systems for threatening others, that "if you don't send for the patient I will file an incident form" or use them just for getting at foes. And if you are on such a receiving end, with others using the incident filing system to put pressure on you, that "If you don't do the discharge summary I will do an incident form", then try to educate them that that's not what incident reports are about.
- If you find yourself unfairly named or accused in such a report, engage with the system, provide the correct facts and help to resolve the situation. It may be dismayed at

the ease with which others can file a report, but is it not better to have a culture where individuals feel free to report (even if on occasions get it wrong) rather than a culture where they don't dare to speak up and unsafe circumstances are not brought to light? It may just be that someone with good intentions misunderstood the situation, at least you know that a system of feedback and improvement is in place and working.

- If you find yourself in a situation where you examine any such incident reports ensure they are not simply put aside, closed without thorough investigation and action. What message would that send? Would it inspire confidence to its users, would it encourage them to report, would it help to alter behaviours and practise?

11.9.13 Lead in Safety by Example

Put safety high up on your agenda. Raise and act upon concerns. Prepare to stand up and be counted when it comes to safety matters. Have the courage to take big decisions and, where needed, to halt, rethink and reconsider. Be the first to do what you expect from others. How can you expect all to wear their face mask in theatre, if you are not wearing yours?

11.9.14 Encourage Flat Hierarchy

There's no sort of hierarchy at 'Corrie.' The crew get on.

Katherine Kelly [3]

Aim for an easy going environment which may empower all to speak up, to raise concerns, to warn of risks and unsafe acts, where they will be praised for noticing your mishaps rather than made to feel they should stay quiet. Do not underestimate the "power of hierarchy", the power of "authority gradients" [51] in inhibiting free communication and predisposing to error.

There are multiple examples in the aviation industry of airplane crashes where the first officers are thought to have correctly read the situation and could have averted disaster by challenging their captains; yet their perception of authority and hierarchy stopped them from doing so [52, 53].

Would you not like your junior to be able to inform you that you just put your subcutaneous suture through the skin and you need to take it out and start again, remind you that you are planning to fix the medial part of the clavicle hence the incision you are about to make is too lateral and must be reconsidered, advice you that your bone cut for knee arthroplasty is not fully smooth and you need to run the saw again, warn you that the tourniquet time is getting too lengthy?

Kobayashi et al. [51] surveyed USA and Japanese residents to identify barriers to questioning or challenging their superiors. They reported that the decision not to challenge a superior (in a given general surgery scenario in the surgical theatre

setting) was mostly influenced by the relationship with their superior and their superior's personality. Friedman et al. [54] randomised 34 trainee anaesthetists into facing a consultant anaesthetist in a strict/exclusive or open/inclusive communication dynamic. They showed a better performance in their ability to challenge clearly wrong decisions of their superior in dealing with a difficult intubation, in the flattened hierarchy as compared to the steep hierarchy group (although statistical significance was not reached).

If all feel that they have a say, then frontline staff may look out, identify risks, and come up with solutions and actions to address them.

"STOP me if about to err" may encourage your juniors to speak up and avert harm.

11.9.15 Aim for a No-Blame Culture

To err is human, to forgive, divine.

Alexander Pope [3]

Aim for a no-blame culture, to empower others to admit to, report and address minor lapses, that if ignored could accumulate and lead to major harm. Don't blame the junior for touching your back and desterilising, but praise them for letting you know and for taking time out to re-scrub.

A no-blame culture doesn't mean lack of accountability; repeated active violations, or repeated disregard of processes and rules need to be looked at and addressed. Nevertheless, it is a fine balance and a challenging task between rushing for the stick when things go wrong and trying to explore the real cause.

A driver may accept a parking ticket when parked on a double yellow line, but may not be so understanding or forgiving of the traffic wardens hiding round the corner to catch them out.

11.9.16 Communicate for Safety

Words empty as the wind are best left unsaid.

Homer [3]

Appreciate the role of communication in maintaining safety.

The Joint Commission for Hospital Accreditation in the USA, reported that failures in communication contributed to more than 60% of 7194 never events [55]. Hu et al. [56] evaluated 22 hours of operating in six complex surgical procedures, and observed communication failures in all, occurring at a rate of one in eight minutes. The most common failures were due to communication exchanges occurring in the absence of key individuals, and due to exchanges not leading to resolution of the issues raised.

Several aspects of communication may help improve safety, and these are described below.

Use similar language

This refers to using structured systems in communication, which all participants can comprehend and follow. These include the ALS (Advanced Life Support) [57] and ATLS (Advanced Trauma Life Support) [58] systems used in the resuscitation of a collapsed or trauma patient.

Use understandable language

Avoid technical terms or abbreviations that may not be understood or may be misunderstood by others.

Use closed loop communication

Ask the receiver to repeat the message you have just given them, to confirm they have understood what you said and that they are on board. Warn that you will ask them to repeat your message prior to giving them the information.

Expect a response to a question or a request. Respond yourself to a question or a request of others. If you are asking for a surgical instrument in theatre, expect an answer whether that is available or not or someone has gone to get it. If you asked how much more time you need to finish the procedure, give a response than leaving others to guess as to whether you have heard them or whether it is too long to say.

Brief/debrief

Brief and debrief prior to commencing and after completing a task to help ensure that all participants share information, and have a similar picture of what will happen or of what has happened. Briefing allows all to contribute to what will take place, and debriefing allows all to learn from what has taken place.

Such briefs/debriefs may occur at various levels:

- Between all surgical theatre team members.

The WHO Surgical Safety Checklist provides a structured briefing between the various members of the surgical theatre team, prior to commencing surgery and debriefing at the end of surgery [59, 60]. In such briefings:

– Aim to develop a shared plan of what will happen, give specifics as to what will be done.
– Share all considerations you have.
– Share your concerns, don't paint a rosy picture, if anticipating difficulties let all the team know. An action in response to an event may be considered "a plan" if it was expected, but may be considered a "reaction" if it was unexpected; expectation may distinguish between a "forced water landing" on the Hudson and a plane's "river crash" [61].
– Share the problems you have encountered, to learn for the next time, and warn others of similar problems.

- Between surgeons–supervisor and trainee.
  - Discuss the procedure.
  - Potential problems, anticipated difficulties.
  - Distribution of roles –who will do what.
  - In the end what went wrong, what well, what has been learnt.

Communicate over and over again

Avoid under-estimating the need for communication or over-estimating what the communication exchanges have achieved. Communicate the message multiple times in various ways or means. Enquire whether it is all clear for your co-workers or whether there are still any doubts that ought to be resolved. Wauben et al. [62] evaluated the perceptions of communication amongst surgical theatre team members in five hospitals in Netherlands. Surgeons rated the current state of communication (exchange of information, establishing shared understanding, co-ordination) significantly higher than scrub nurses and anaesthetists did. What may look crystal clear to you may still look blurred to others.

Have a system for alerting about unsafe acts

You may need to communicate your immediate concerns when things are not right. The receiver of your concerns may be a senior making such communication more difficult and challenging. Several warning systems have been described, to help the expression of concerns. The CUS (Concerned, Uncertain, Safety) technique puts a structure on how to escalate concerns and attract attention to those [63]. It was developed by the Agency for Healthcare Research and Quality in the USA as illustrated below:

C-oncern – "I am concerned we should not be doing this".
U-nsure – "I am uncertain that we should be doing this".
S-afety – "We shouldn't be doing this, it is unsafe. We should stop".

Use eligible written information

Use clear, eligible writing in constructing a theatre list, a consent form. Use capital letters for key words, avoid abbreviations. Do not let others having to guess as to what you are trying to say.

Ask for information, not confirmation

Avoid asking others to confirm what you are saying. They may reply "yes" or "no" without fully appreciating your question. They may want to please you with an answer, they may be embarrassed to tell you they cannot understand what you say or that they cannot recognise your accent.

- When confirming if you have the right person in front of you, instead of asking "Are you Mr. John Smith?" you may ask "Can you please tell me your name?"
- When checking if the correct procedure is documented for the correct patient instead of stating "I am doing your right knee arthroscopy today" you may initially ask "What am I doing for you today?" "Which knee am I doing?"

Alert others of potential trouble

- At handover of ward cases, of admissions.
- In theatre, of problems you encountered with particular surgical equipment.

Use team inclusion words

Sexton and Helmreich [64] evaluated the relation of language content with performance and error rates, in a flight simulator. They showed that use of the first person plural (WE) and words indicating strive towards a successful outcome (ACHIEVE) were positively related to cockpit performance as well as communication and negatively related to error rates. Use of achievement words by the captain improved subsequent performance and reduced errors by the flight engineer.

Hear the warnings

If someone is questioning your decision, then stop, listen, take on board what they are trying to say and reconsider.

- "Why are they saying that?"
- "What are they worried about?"
- "What are they trying to tell me?"
- "Am I missing something?"

Listen, no matter how junior the challenger is, whether a doctor or not.

11.9.17 Avoid Disruptive Behaviours

I was a disruptive child.

Allyson Felix [3]

Avoid behaviours that put others out of ease, which distract rather than concentrating minds. You may alert others without shouting, swearing, fast walking, jumping up and own, kicking anaesthetic room doors, throwing instruments around. All that such behaviours may achieve is to stress even more those around you, making them less able to help you out.

Cochran and Elder [65, 66] explored the perspectives of 19 individuals, who had diverse occupations in the peri-operative setting, on the effects of disruptive behaviours by surgeons. They described that such behaviours compromised safety by shifting the attention from the patient to the surgeon, and increasing the risk of mistakes during surgical procedures.

After all what would you think if the scrub nurse started shouting every time you asked for a surgical instrument, did not reply to your requests, or kept refusing to look for an instrument you needed in a challenging case? Similarly how would you feel if the anaesthetist started shouting that you should rush to scrub up, or simply stared through you each time you tried to discuss a medical matter. Would such behaviours help you focus or would they make the procedure an unnerving experience?

11.9.18 Plan to Recover from Failures

Any man is liable to err, only a fool persists in error.

Marcus Tullius Cicero [3]

Plan for the possibility of failures, and prepare as to how to deal with them to help avoid or minimise harm. Develop mental strategies, institutional protocols or pathways.

Failures may lead to stressful situations. Startle has been used to describe a "fight or flight" response that occurs in encountering unexpected, highly stressful significant events. It is thought that startle can impair information processing and decision making, leading to poor handling of such occurrences [67].

The startle reaction has been used to explain inappropriate reactions amongst pilots leading to catastrophic failures. Air France Flight 447, an Airbus A330, flying from Rio de Janeiro to Paris in 2009, crashed in the Atlantic Ocean after going into an aerodynamic stall. A subsequent investigation suggested that the first officer continued to pull back rather than push forwards the control stick (equivalent to hitting the brakes rather than accelerating) almost all the way down to the ocean [68].

When faced with an unexpected intra-operative event one may:

- Freeze, unable to decide what to do or take action.
  - You may be manipulating a pelvic fracture to apply your fixation plate when suddenly you see a gush of blood.
  - You may be inserting the laparoscopy camera when you suddenly realise you entered the aorta. Can you respond appropriately or do you freeze?
- Persevere with the original plan of action, rushing to finish the task:
  - You just drilled the femur for inserting a screw and a gush of blood is coming out of the screw hole. Do you simply continue as planned and insert the screw or do you stop and re-valuate the situation, looking for a major vessel injury behind the femur?
- Take wrong action

If faced with an unexpected emergency try to:

- Maintain composure.
- Evaluate what you are facing.
- Take appropriate action.
- Communicate with the team.
- Emphasise urgency.

Expect the unexpected, to minimise the effect of startle when the unexpected occurs. A complication may be "unlikely", but if you are not prepared for the "unlikely" how can you deal with it if and when it arose.

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Chapter 12
When Things Go Wrong

Despite all good intentions, hard work and perseverance, implementation of safety nets and precautions, it is unlikely to achieve absolute surgical safety. On occasions things are likely to go wrong.

Adverse events are likely to happen, that may or may not cause harm, recognised complications or potentially avoidable errors, adverse events that our patients may become aware of or require disclosure, isolated occurrences or clusters of adverse events.

The ability to deal with an adverse event, disclose its occurrence, explore and investigate its underlying causes, alter practise to prevent similar events occurring in the future, and the ability to communicate any lessons learnt to the wider surgical community are important skills to develop, and are discussed in this chapter. Ways of evaluating clusters of uncommon, yet recognised, surgical complications are also described.

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This umbrella was supposed to keep me dry

12.1 Managing Adverse Events

It is better to destroy one's own errors than those of others.

Democritus [1]

As a surgeon you may encounter or be directly involved in an adverse event, where things have gone wrong. The World Health Organisation defines an adverse event as "an injury related to medical management, in contrast to complications of disease", with medical management referring to all aspects of care, including surgical care [2].

When faced with an adverse event in its acute presentation, one has to ensure that harm is minimised, and any harm that has already occurred is dealt with. The events leading to the harmful event are then examined to determine what went wrong, and how its recurrence could be avoided.

An approach used by the author and described using the acronym SAFEST (Stop, Antidote, Find, Explain, Sorry, Transform) [3], may provide guidance in dealing with a harmful event. This involves:

S-top any further harm from occurring
A-ntidote any harm that already took place
F-ind why this happened. Root cause analysis
E-xplain to the patient or relatives- disclose
S-orry Sympathise for what went wrong and apologise for any errors
T-ranform your practise to minimise possibility of recurrence

12.2 Root Cause Analysis of an Adverse Event

When things go right it's hard to figure out why, but when things go wrong it's really easy.
Steven Soderbergh [1]

An adverse event may be the result of a recognised complication of treatment (such as complications of surgical procedures), or occur due to medical error, due to violation of rules and processes, or other factors (such as failure of equipment or technology). On occasions the distinction is obvious, but in some it may be difficult to define.

Once harm is halted, and if possible reversed, it is important to get to the bottom as to what has happened, get to the root of the cause, a process known as root cause analysis.

The examination of the causal factors of an adverse event may be considered as having four components (Fig. 12.1):

1. Defining the adverse event, defining the problem.
2. Defining the patient pathway which one would expect to encounter under normal conditions, and locating the occurrence of the adverse event in that pathway.
3. Cause effect analysis.
4. Introducing changes that will minimise the possibility of the adverse event recurring.

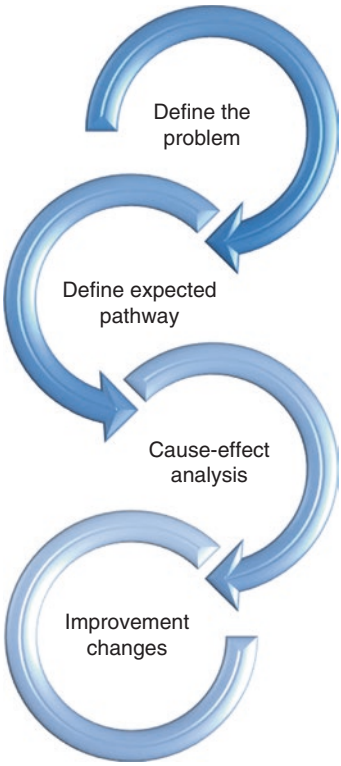

Fig. 12.1 Learning from an adverse event

A cause-effect analysis, is a method that attempts to determine what factors led to an adverse event occurring. This may be a single factor or multiple factors. Cause-effect analysis was initially described by Professor Kaoru Ishikawa at the University of Tokyo [4]. It considers potential factors contributing to the adverse event such as the personnel involved, patient pathways and processes, equipment, management, supervision, surrounding environment, available resources. It then examines each in detail, to determine if there were any deficiencies that could have led to the unwanted event.

A fish bone diagram is a way of demonstrating the cause-effect analysis in graphic form [4]. Horizontal lines point to the adverse event with branches and sub branches arising from this, pointing to potential causes (Fig. 12.2). Such an analysis may be part of a formal investigation into what went wrong, but also employed in a surgeon's individual practise to examine complications, to self-reflect and learn.

A cause effect analysis can only examine what it is asked to look into. Consider a complication that could arise due to pre-operative deficiencies in preparing patients for admission, deficiencies in the ward, or in the recovery suite; a cause effects analysis that examines only the surgical theatre environment may fail to give the true answer. If an adverse event could be due to understaffing, but resources and management pressures are not considered in the cause effect analysis, then one may not get to the bottom of the cause. Hence, in circumstances where the various

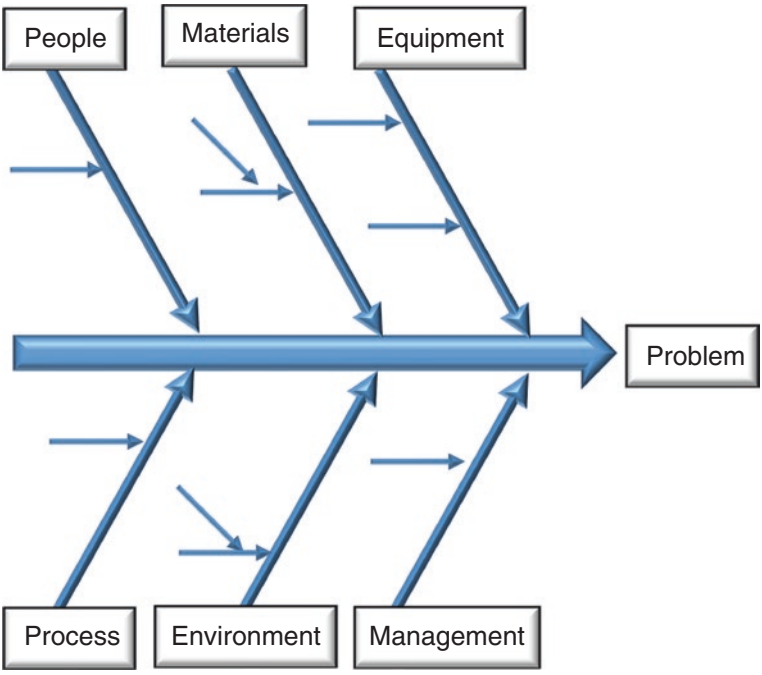

Fig. 12.2 Fish-bone analysis

potential causes may arise from multiple environments (pre-theatre ward, theatre, post-theatre, ward) each of these may have to be analysed in order to identify where the problem lies.

The same problem may arise due to one or more failures of possible many. Clarke et al. [5] looked at reports of wrong side surgery in Pennsylvania, USA. Amongst the causes of such failures were:

- Failures of the time out process.
- Failures of documenting, reviewing, or verifying patients' information.
- Problems with the diagnostic tests leading to surgery.
- Incorrect consents.
- Incorrect information on the medical clinic records.
- Clinic records not available.
- Errors in positioning for surgery, preparing the operative side, applying a tourniquet.
- Failure to mark the site, obliteration of marks, incorrect markings.
- Errors in scheduling the procedure.
- Incorrect information provided by patient or relatives.

Root cause analyses may identify a single factor or multiple factors, or may suggest as to the possible causes rather than fully confirming the actual cause. But then, even painstaking investigations into aviation accidents may not fully confirm the cause, and there may be disputes years later as to whether it was the plane or pilot to blame.

12.3 Dealing with a Cluster of Recognised Complications

Sometimes when you lose your way, you find YOURSELF.

Mandy Hale [6]

In some cases the adverse incident may be well defined, such as wrong side surgery, but in some cases it may be uncertain whether the observed events constitute a system breakdown. There may be a cluster of recognised complications which are seen at a higher than expected rate. This could occur simply by statistical chance, or could be due to dealing with high risk cases. However, such an occurrence may also be related to a breakdown of the normal precautions or barriers in the patient pathway that aim to prevent such complications, or due to sub-optimal performance of the surgeon or healthcare team.

A systematic approach in analysing such a cluster of adverse events may ensure that the root cause is found and appropriate action taken.

Cluster of surgical wound infections

Infection is the invisible enemy of the surgeon, one that becomes apparent only once it is established and settled. Much of what we do aims at minimising the risk of infection occurring. From the moment a patient is listed for surgery to the time they fully recover from their operation, several actions are taken to try and protect against infection. These may be pre-operative, intra-operative or post-operative.

At some point in your career you may face a cluster of surgical infections; multiple patients may develop a surgical wound infection in a short space of time, many more than you would expect to encounter. This may arise simply by chance, a statistical fluke, or may signify something more sinister; hence the need to determine if indeed a problem truly exists:

- What is the rate of infections?
- How does it compare with historical controls?
- How does it compare with other institutions?

If such analysis confirms an unexpected high infection rate, its causes must be examined.

1. Define the problem

   - Identify the cases which developed the infection.
   - Were they patients with an inherent high infection risk?
   - Were the infections superficial or deep?
   - What organisms were involved (strain, antibiotic sensitivities)?
   - What was the timing of presentation in relation to surgery?
   - Did they affect one surgeon's team or multiple teams?
   - One particular theatre or multiple theatres?
   - One or multiple procedures, one or many parts of the body?
   - Are the infections encountered in one or multiple specialties?

2. Define the normal patient's pathway

   - Explore the patients' pathway from presentation, to clinic, to surgery, to the infection presenting.
   - Has anything recently changed in the patient's pathway, especially in the steps taken to reduce the possibility of infection? For each step explore whether there has been any recent change in practise.

3. Carry out a cause effect analysis

Infection may arise due to failure at any of the various steps in the patient's pathway from the pre-operative assessment, to intra- operative events such as equipment and theatre sterilisation processes, post-surgery infection prophylaxis and nursing, to post hospital discharge and management in the community. A cause effect analysis may be drawn for each of these steps. This can be achieved either by grouping all components together or by using a different fishbone diagram for every step in the patient's journey (the pre-op, the intra-op the post op, the community, the ward, the theatre).

Haessler et al. [7] described their experience of an increased level of surgical site infections over nine consecutive months in 2007, and the subsequent "cluster investigation" they performed. This investigation involved review of the medical records, microbiological results, and inspection of the practises in the instrument sterilisation areas, surgical theatres and storage areas. As part of their investigation they determined that various types of bacteria with varying antibiotic sensitivities were responsible for the encountered infections, but the antibiotic prophylaxis choice was appropriate and the antibiotic administration timing was adhered to. There was no clustering of the infections around any particular surgical theatre or any particular personnel (surgeons or other staff). There were no changes in the sterilisation process of equipment or any obvious breaches of sterility. Investigators carried out interviews with the surgeons and other personnel, who expressed concerns about the amount of traffic through the surgical theatre and also the practise of wearing scrubs outside theatres. They also reported confusion of the appropriate use of the agents used in hand antisepsis, which led the investigators to directly observe the hand antisepsis practises. They noted improper use of one of two hand scrub agents used (an alcohol-based antiseptic); they noticed that there was limited soap and water wash before the alcohol was applied, the nail picks were not utilised and the alcohol was insufficiently applied. Removal of that antiseptic agent and reminding all staff of the importance of infection control, led to a reduction in infection rates to historical levels.

Septic arthritis following arthroscopic surgery is rare, in the order of 1/500 to 1/1000 [8–10]. Blevins et al. [11] described their encounter of three cases of septic arthritis following an arthroscopic meniscal repair of the knee, within a four day period at the same institution. These arthroscopies were performed by two surgeons,

in different surgical theatres, with different assistants and other staff involved. All cases were positive for coagulase negative staphylococci. As part of their investigation they carried out molecular typing of the bacteria's DNA which showed that in two of the cases the infecting organisms shared common DNA patterns, which would be consistent with a common inoculation source. They identified that the same set of meniscal repair cannulas was used in all cases. Inspection of these cannulas after they had been cleansed, sterilised, and packaged ready for surgery, identified dried organic material residues in their lumen, and samples taken from these cannulas tested positive for coagulase negative staphylococci. Following a change in the sterilisation process of such cannulas, the authors encountered only one case of septic arthritis in a further 89 meniscal repairs.

Cluster of intra-operative cardio-vascular arrests

One may encounter a cluster of intra operative adverse events such as patients with hip fractures having cardio-vascular collapse or arrests during hemi-arthroplasty surgery. This could be a co-incidence, occurring by chance, but should be investigated thoroughly to ensure there is no other underlying cause.

1. Define the problem

   - What exactly happened?
   - Population affected?
   - Timing of arrest?
   - One surgeon versus multiple teams?
   - One versus multiple anaesthetic teams?
   - One or more theatres involved?
   - What was the patient's condition during those events, how were they managed, what was the eventual outcome?

2. Define the normal patient pathway

   - What is the journey of patients presenting with a hip fracture from presentation, to hospital admission, to ward preparation for surgery, to surgery and the intra operative events? Each of these steps is investigated to look whether there has been a change in practice, as well as plausible causes which could have led to the observed adverse events.

12.4 Stop Whilst You Investigate

Your philosophy determines whether you will go for the disciplines or continue the errors.
Jim Rohn [6]

When faced with serious adverse events, one may have to pause whilst investigating the cause, rather than continuing with their usual practise and potentially expose more patients to harm. At which point one pauses is a challenging decision, and needs to be carefully considered on a situation by situation basis.

Marc de Leval [12] a cardiac surgeon described his experience of encountering a high number of post-operative deaths following complex cardiac surgery (arterial switch operations for arterial transposition) between 1987 and 1993. In his first 52 patients he encountered only one death, but, suddenly, amongst his subsequent 16 cases he encountered seven deaths. When faced with this cluster of post-operative deaths, the surgeon visited a centre of low mortality to see what could be done differently, but following the seventh death he recognised that there could be a performance issue and decided to retrain (and follow to the finest detail the practise of a surgeon with low mortality rates). Following this, only one death was encountered in the subsequent 36 cases. Subsequent formal analysis suggested that the risk factors of the individual cases could not account for the mortality rates observed, and that there was an element of suboptimal performance which was addressed by re-training.

Maguire et al. [13] described their experience of encountering a cluster of six unexplained deaths in a paediatric intensive care unit (PICU) between 1989 and 1990. These deaths were seen in children who had undergone heart surgery for congenital heart conditions. During the investigation into the cause of these deaths the unit was temporarily closed. Despite extensive effort, no cause for the encountered high mortality rate could be established. The PICU was re-opened only when it was established that there was no scientific evidence to justify its continued closure.

Sometimes in such events an absolute cause may not be found, and multiple factors may need to be improved, several controls may need to be tightened to address the problem.

12.5 Near Misses and No Harm Events

Failure is instructive. The person who really thinks learns quite as much from his failures as from his successes.

John Dewey [6]

A near miss may be considered as an unplanned unwanted event that is stopped from completing its course at the last moment, either because its recognised or by chance. A no harm event is an unplanned unwanted event that is not stopped, but does not result in harm, although it could have done so. It may be that real harm was avoided just due to pure luck, or because the medical student watching the surgery tried to speak up.

Herbert William Heinrich, an engineer and pioneer of industrial safety, reported in his 1931 book entitled "Industrial accident prevention, a scientific approach" [14] that for every accident that leads to major injury, there are 29 accidents that cause only minor injuries and 300 that cause no injuries. This 1-29-300 ratio is now known as Heinrcih's Law or Triangle (Fig. 12.3).

Even though the exact figures, and the validity of Heinrcih's reasoning have been questioned [15, 16], several messages may be drawn from this concept:

- Near misses or events that lead to minor harm are much more common than those leading to major harm. Hence much more information may be gathered by investigating these more common events, with greater opportunities for learning.
- If the mechanism of occurrence of near misses or less harmful events is similar to those leading to major failures, then by minimising the former one may eliminate the latter.
- Staff may be more willing to report, and be more open and transparent in dealing with events where no harm was done, facilitating learning from such occurrences.
- Near misses may help identify those barriers that stopped full harm from occurring, and hence identify potential areas that could be strengthened further to avoid real harm occurring in the future.

Reporting and investigating each near miss may lead to unbearable workload. To minimise this, such reports may be assessed in terms of their frequency, and potential risk for real harm, in order to prioritise which ones to fully investigate and act upon.

Fig. 12.3 Heinrcih's triangle. Adapted from Heinrich HW [14]

12.6 Learning from Adverse Events

I never made a mistake in my life; at least, never one that I couldn't explain away afterwards.
Rudyard Kipling [6]

Once the root cause analysis is done, and the causal factors are identified, practical changes may have to be made to minimise the risk of adverse events recurring. Aim for changes that can have a substantial impact, high up on the ladder of safety interventions, rather than simply for changes in policies or protocols which may have minimal effect.

Despite increasing numbers of root cause analyses performed in healthcare, it is estimated that only a small proportion of these lead to implementation of changes that will minimise similar errors recurring. Instead in many cases such changes are weak, with no probability of reducing further risks.

It is increasingly recognised that root cause analyses carried out at individual institutions do not have the impact that they could possibly have [17, 18], hence centralising the analysis of adverse events may have a more substantial effect. Such an approach might ensure that various safety stakeholders are brought together, including manufacturers of medical devices or technology industries that would help produce and provide more robust safety mechanisms.

12.7 Informing the Wider Surgical Community

Nothing is more intolerable than to have admit to yourself your own errors.
Ludwig van Beethoven [6]

As part of the learning process, the outcomes of any investigation into adverse events ought to be shared not just with the participants of the event, but also the wider surgical community. At a local institutional level this may be achieved through:

- Correspondence—newsletters.
- Ground rounds.
- Departmental morbidity and mortality meetings.

In addition, there may be central agencies which need to be informed, which monitor trends in adverse events and can thus identify wider system problems.

In the UK there are several reporting mechanisms:

1. The National Reporting and Learning System (NRLS) for adverse and patient safety incidents—NHS trusts have to report all incidents resulting in patient's death or severe harm. This provides a central agency, which can analyse the various reports to identify trends, risks, and potential areas for improvement. It is estimated that since the NRLS was established in 2003, more than four million incidents have been submitted [19].
2. The Yellow Card scheme for reporting adverse drug reactions [20].
3. Medical devices regulation and safety notification system, for events involving medical devices [21].

In the USA adverse incidents involving medical devices are reported to the Food and Drug Administration Agency (FDA). This is mandatory for manufacturers, device user facilities and importers, or voluntary for healthcare professionals, patients, and consumers [22].

Yet, there still seems to be lack of sharing of information, filtering of findings from one department to another, from one institution to the other. Healthcare seems to lag far behind the aviation and other high risk industries in both reporting and learning.

12.8 Disclosure

I make mistakes; I'll be the second to admit it.

Jean Kerr [6]

A vital component of the management of adverse events is informing the affected patients or their relatives of their occurrence, disclosing complications or medical errors. If something has gone wrong better to hear it from you with an explanation, rather than the patient finding out later from others. Anything said afterwards may sound more like an excuse rather an explanation.

In the USA, the American College of Physicians' ethics manual states that "physicians should disclose to patients information about procedural and judgement errors made in the course of care, if such information significantly affects the care of the patient" [23]. In the UK, the General Medical Council (GMC) guides that "every healthcare professional must be open and honest with patients when something that goes wrong with their treatment or care causes, or has the potential to cause, harm or distress" [24] This guidance advises that healthcare professionals should inform the patient when something wrong has happened, apologise, offer an appropriate solution to improve the situation (if applicable) and explain the short and long term consequences of the harmful event [24].

In the UK, in addition to the professional duty of candour set by the GMC for individual healthcare workers [24], the Care Quality Commission has introduced an organisational duty of candour whereby healthcare providers are required to inform patients and apologise to them about adverse events [25].

12.8.1 Challenges of Disclosure

Nothing is so firmly believed as what we least know.

Michel de Montaigne [6]

Even though doctors recognise the importance of disclosing and informing patients of things gone wrong, patients are often not told.

Wu et al. [26] reported that junior doctors (house officers) told patients about serious medical mistakes in less than a quarter of cases and informed their senior physicians about such mistakes in only half of the cases encountered.

The observed low disclosure rates may not come as a surprise when one considers the challenges that disclosure of medical errors entails, especially in cases where the patients or their families may not be aware that such errors have occurred. There may be worry of the reactions of patients and their relatives to such news who may become upset and angry, worry about the harm it may do to the patient-surgeon relationship, concern of legal action and law suits, anxiety about the impact on career progression [27–30].

In disclosing complications, no matter how well recognised the occurrence of these is, you may be afraid of getting criticised, concerned that you are having

troubles when others are thriving, worried that the complications are due to personal under-performance, anxious that your practise may get restricted, you may dread that foes will capitalise on these to get at you. You may fear that your reputation or authority are at stake. Such emotions may even slow your ability to identify and hence deal with complications; sometimes one may rush to recognise complications of others, but deny or fail to accept that these could be happening to them.

Disclosure is a hard and difficult task, but may become easier if one develops the ability to recognise that:

- Informing the patient when things go wrong is the right thing to do, because it helps maintain honesty and trust that is central in the patient-surgeon relationship. Patients who are not informed of medical errors may feel let down and betrayed when they eventually find out. Trust and honesty are central in a surgeon-patient relationship [27–30] and it is necessary to put patients' interests above our own interests, our career progression or professional well-being.
- Disclosure may allow patients to better understand what has happened, rather than second guess of what went wrong, or keep wondering why their condition is not improving. Disclosure may also allow patients to seek further essential treatment in a timely fashion. In addition, compensation can be sought to cover further care and lost earnings incurred due to the injury sustained [27–30].
- Humans are fallible, and is it important to recognise and accept that mistakes are part of clinical practice. This may help create a culture whereby emotional and practical support is provided to those who have made a mistake, and help those surgeons involved navigate through a turbulent period.
- One may see a mistake as an opportunity to self- reflect, learn and get better and the ability to disclose adverse events as the just and noble action to take. Facing the real facts may help one improve. And if that means you have to get more training, one may accept that life is a process of continuous learning.

Most surgeons are technically sound and when complications occur it may be factors other than the surgeon to blame.

12.8.2 Delivering the Disclosure

In the UK, the GMC states that the most appropriate team member for disclosing medical errors will usually be the accountable clinician for the patient's care [24]. Nevertheless, when errors involve not just an individual but a whole system or institution then members of the wider team of the institution hierarchy may participate in the disclosure.

If you are a junior, involve your seniors at an early stage of the adverse event, and it may be advisable to disclose the error to the patient together. If you are a senior clinician it may be advisable to involve the appropriate hospital authorities who may accompany you at the time of disclosure [31]. Disclosure should take place as soon as possible once established that an

adverse event has taken place, to avoid giving the impression that there is an attempt of cover up.

When faced with such adverse events seek help and advice from your seniors, peers and colleagues. They may help you analyse the situation better and help you prepare for what you will say and how you will say it. Albert Wu, Professor in the John Hopkins School of Public Health, and his team give practical guidance as to how to disclose medical errors to patients as below [31]:

- Begin by stating that you have made a mistake.
- Describe the mistake.
- Explain in detail the events surrounding the error.
- Describe the consequences of the mistake.
- Describe actions taken or will be taken to remedy the error.
- Express personal regret and apologise.
  Enquire about any questions or concerns.

12.8.3 Disclosure When Another Surgeon Is Involved

A difficult situation is when one is aware that another physician has made a mistake. Wu et al. [31] describe the options in this situation:

1. Wait for the physician involved to disclose the mistake.
2. Advise the physician to disclose the mistake.
3. Arrange a joint meeting with the patient and the physician who made the mistake to facilitate disclosure.
4. Tell the patient yourself about the mistake.

It is indeed a challenging situation when one faces this dilemma. One has to balance the need for disclosure, whilst at the same time respecting the relationship the patient has with the physician concerned. It is an awkward situation due to the fear of damaging relationships with colleagues, worry of betraying their trust. If is not certain whether a mistake occurred avoid jumping to conclusions. Speak to the physician involved, in a non-judgemental way, and gain more information to see whether a mistake did occur. As part of this process you may facilitate and encourage the physician involved to disclose the mistake (if a mistake took place). This will ensure that the relationship between patient and physician is not disturbed but at the same time disclosure does occur. One may view the disclosure of someone else's error as the last resort, which must be done in an impartial unbiased way. If necessary, one may, at the same time, inform the relevant authorities of the Institution (such as the Quality Assurance Personnel) to facilitate disclosure [32].

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Chapter 13
Surgical Interviews

Surgical career progression often involves multiple applications for training or non-training posts, clinical, research, or academic placements. Such interviews may be highly competitive with one having to shine to impress.

Hence, the ability to successfully perform at surgical interviews is an important skill to develop.

This chapter discusses considerations in choosing a surgical specialty or subspecialty, which may help justify in an interview an application for a post. It also provides advice as how to construct a surgical CV and put together a surgical portfolio, in preparation for surgical interviews.

Finally, potential topics and questions that may be encountered in surgical interviews are presented.

C. Panayiotou Charalambous, *Career Skills for Surgeons*,
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Dear interviewers what would you like to see first, my surgical logbook or self-reflections?
LOG BOOK
SELF Reflections

13.1 Choosing a Surgical Specialty or Sub-Specialty

As a child my family's menu consisted of two choices: take it or leave it.
Buddy Hackett [1]

Choosing surgery as a long term career is only the first step in a long journey. Soon you may have to decide which surgical specialty to follow. The days of one surgeon undertaking a wide variety of procedures, sometimes ranging from abdominal to vascular, orthopaedic to gynaecological, are in many countries well gone and one will be asked to choose one path to follow amongst specialties; Cardiothoracic Surgery, Abdominal Surgery, Neurosurgery, Orthopaedic Surgery, Head and Neck, Paediatric Surgery, Plastic, Urology, Breast, Endocrinological, Vascular Surgery.

And even if you know the broad area where you wish to practise, what sub-specialty do you next choose? Sub-specialty division may be based on an anatomical area, type of surgical procedures (open or minimally invasive—arthroscopic, laparoscopic), the underlying disorders treated (neoplasia, endocrinological disorders), patients' age (adults or kids). You may decide to do Orthopaedics but you may then have to choose a joint, a limb, or a procedure to specialise in. You may decide to become an abdominal surgeon but then you have to choose between the upper and lower gut or the hepatobiliary tract. Specialties and sub-specialties may vary in different areas or countries.

Apart from the above, in deciding which career path to follow you may also consider:

- Will I enjoy that surgical specialty? Not just the operating, not just the cutting, but also clinics, ward work, perioperative care.
- What does the specialty involve? One stop treatment delivery or life-long care?
- What are the on calls like? Resident or from home, up all night or very rarely called in, covering admissions ats one hospital or jetting round the country for organ harvesting?
- How physically demanding is surgery? Does it involve quick operations or lengthy prolonged procedures with in between lunch breaks, sitting down or standing up, using fine instruments, needle and forceps, or heavy power tools, mallets and hammers?
- What skills are required and are you good in those? Fine suturing skills, ability to operate under the microscope, arthroscopic or laparoscopic triangulation skills.
- How competitive is it to get into the specialty? Is there a need for special qualifications, postgraduate degrees?
- How competitive is it to be employed at the end of training? But be aware that what is in demand now may not be so by the time you are looking for a job.
- What support do I need for operating? Surgeon and scrub nurse or whole team?
- Where could I be employed? Public Hospital (secondary care or super-specialist centre), private clinic, own clinic.
- What equipment would I need if I decided to practise independently?
- Work intensity and pattern.
- Remuneration.
- Lifestyle.

You may already know what specialty you are after, you may be clear as to your destiny, but it is also possible that you want to experience different areas before you commit. Take your time, is there so much rush?

To help you decide you may:

- Speak to those already in the specialty and those out of the specialty to get a balanced view. We did those in the specialty choose it? Why did those out of specialty avoid it?
- Spend time in specialty, get to see what the juniors but also seniors do.
- See all aspects of the specialty—the theatre, ward, clinics, multi-disciplinary meetings, on call shifts.

And if still undecided and not sure what to do, take time, consider carefully, spend time in a post where you can gain basic surgical skills that can become of use whichever pathway you follow.

13.2 Surgical CV

Resume: a written exaggeration of only the good things a person has done in the past, as well as a wish list of the qualities a person would like to have.

Bo Bennett [1]

CV format

The exact format and layoutof your CV is a personal preference but the following may be considered:

- Keep it simple and short.
- Use succinct sentences, avoiding unnecessary text.
- Choose easy to read font and size and use this consistently.
- Use plain text avoiding excessive bolds, italics, underlining.
- Consistent use of subheadings.
- Present posts in reverse chronological order starting with your current post.
- Give dates of any described events (research publications, audits, qualifications, courses etc.).
- Consider starting important CV sections on a new page, where they can be easily identified.

CV content

The content of your CV will depend on the stage of your career but consider including the following:

- Personal details: name, address, phone, email.
- Qualifications: professional exams, postgraduate and undergraduate degrees.
- Academic achievements: awards, honours.
- Hospital posts:
  - Current and previous posts.
    You may list your duties for each post (on-call commitments, attendance of theatres or clinics, ward cover, peri-operative care).
    You may combine posts that were part of a training program (internship, residency, basic surgical training, higher surgical training).
- Postgraduate education: courses, conferences, visitations.
- Membership of professional bodies:
  - Postgraduate surgical college or society, medical association, medical indemnity/insurance body.
- Research:
  - Publications—give full reference with its serial number in any indexed database such as PubMed.
  - Articles submitted for publication, or in preparation, ongoing research (state stage of research development).

For each study state the names of all authors (with your name included) in the order they would appear in any future publication.

- Audit:
  - Initial audit, re-audit.
    Consider providing a summary of each audit with standards assessed, achievements, change in practise.
- Teaching and other educational activities—students, format, target population (institution, regional, national, international).
- Administrative/managing experience.
  - Duties—rota master, doctors mess treasurer, management courses.
- Interests: anything out of the ordinary?
- Referees:
  - Type of referee—academic, clinical.
  - Names.
  - Position.
  - Contact details.

Be accurate and honest in what you include in your CV, do not overplay or exaggerate, have the evidence to back it up.

13.3 Surgical Portfolio

Portfolio is a collection of documents providing proof and evidence of one's personal development, training and progression [2, 3]. It helps to support the contents of your CV but may also contain information not provided in the CV.

Portfolio format

- The portfolio should be thorough yet short and succinct. It should be thorough in providing the necessary supportive information, but succinct to allow its quick, easy assessment by an interviewer. Huge pieces of documentation, resulting in multiple portfolio volumes may not make such an assessment easy, hence selection of the most relevant documentation may be more appropriate.
- The portfolio should look professional in terms of presentation; invest in a robust folder, high quality printouts.
- Use easy to read text, consistent use of font and size, format of headings and subheadings.
- Include indexing with initial contents page.
- Use a filing system that allows the reader to access information, without having to take pages out of the folder and then replace them.
- Information that an interviewer may be specifically looking for, may be highlighted with a marker to facilitate its identification.
- In line with data privacy rules and confidentiality, ensure no information is contained that may identify a patient (such as on case presentations, radiographs on presentation slides, logbook of procedures)
- Use original certificates or certified copies, clearly demonstrating the authority issuing them. If including a letter from a hospital or senior, a hospital stamp may be necessary to confirm authenticity. Avoid letting the reader wonder whether a document is genuine or not.

You may consider the following sections, along with examples of supportive documents for each:

- Personal details (passport or identity card copy).
- Qualifications and other awards: university and other certificates.
- Personal statement about career interests and aspirations, commitment to surgery.
- Hospital posts—including voluntary, honorary, observation attachments.
  - Confirmation of post completion from institution (human resources, supervising senior doctor, training program).
- Postgraduate courses: attendance certificates.
- Assessments of competence—completed work based assessments.
- Surgical logbook: summary of surgical procedures you participated:

  - Record date of surgery, type of surgical procedure, level of participation (performed unsupervised, performed with senior scrubbed or present, 1st assistant, 2nd assistant, observed).
  - Complications (intra-operative, post-operative).

- Membership of professional bodies/societies.
  - Certificates of membership.
- Research:
  - Publications: copies of articles published (full copy or 1st page).
  - Presentations—a copy of conference program confirming presentation, and a copy of the presentation slides.
- Audit:
  - Copy of presentation slides if presented.
  - Confirmation letter from the audit department or lead.
  - Summary—standards, methodology, findings, change in practise, re-audit, findings.
- Teaching:
  - Letter from senior overseeing activities.
  - Copy of teaching slides.
  - Summary of teaching—aim, target student population, format, date, number of students.
  - Feedback with regards to effectiveness of teaching session from students.
- Leadership/managing experience:
  - Confirmation letters from seniors or institution.
  - Short description of role.
  - Description of projects undertaken.
- Self –reflections
  - Summary of event, how it was addressed, learning points, change in practice.
- Feedback:
  - Colleagues, co-workers—structured feedback or letters.
  - Patients—formal survey results, complaints (summary of complaints received, action taken and outcomes), compliments—thank you cards, letters.

- Appraisals: documents summarising formal appraisals.
- Revalidation/relicensing: certificate from regulatory body.
- Other evidence showing commitment to surgery.
  - Surgical journal subscriptions.
  - Surgical Elective at Medical School.
- Personal Interests—supporting certificates such as golf club membership!

In some interviews there may be a pre-defined marking scheme for portfolio that the candidates are allowed to access prior to the interview. Such scheme may give marks to domains that rely on activities from multiple areas (such as commitment to surgery domain, team skills domain, leadership domain). Consider adding to your portfolio separate sections reflecting such domains and gathering relevant information from all areas in your portfolio (surgical research, audit etc.) to those domains. This could make it easier for an interviewer to extract evidence hence allocate marks, rather than having to go back and forth through the folder to find information for each domain.

13.4 Surgical Interview Questions

> *It is better to ask a question that is deep and strange and unexpected than having an answer to everything.*
>
> Werner Herzog [4]

Surgical interviews aim to examine multiple aspects of your ability to be a surgeon or your qualities to successfully perform in the post you are applying for.

Surgical interviews may be in the form of multiple stations, each examining an area, and run by different interviewers. Alternatively, they can take place as a single interview, in front of a single panel, where multiple themes and areas are covered.

Whatever the interview format, certain themes are commonly encountered, and some of these are presented next.

13.4.1 CV—Portfolio Questions

The interviewers may ask you questions related to your CV or portfolio. Ensure you can talk about them and justify all you claim in these.

What have you done up to now?

You may start by reminding the interviewers as to which Medical school you graduated from and what year, and then summarise the posts you did since then. You may group certain posts e.g., under "core training," "higher specialist training."

What is your surgical experience?

You may split this into:

- Surgical posts—duration, level, sub-specialty.
- Surgical operating: may summarise it in terms of overall number of procedures, with numbers assisted or performed, or may split it into emergency procedures versus elective procedures.

Depending on the post you are applying for you may list the numbers of procedures you have done that are directly relevant to that post.

What surgical procedures can you do?

Split your response into what you can do with minimal supervision, and what you could do unsupervised. If you are at a junior level, and do not have much surgical operating experience, you may refer to procedures done in the ward (cannulation, catheterisation, central line insertion). Be pragmatic rather than exaggerating your abilities, as they will be soon tested if you are successful in getting the post.

What is the most complex procedure you have performed?

This may vary, if applying for a junior post it could simply be an incision and drainage of an abscess, excision of "lumps and bumps."

Do you consider yourself to be a good surgeon? How do you know you are a good surgeon? You may refer to feedback you have received from trainers and seniors, the good outcomes with few complications you encountered amongst those you have operated upon.

Why did you go into surgery?

- The ability to use technical skills, to help to cure.
- Combines technical and non-technical interventions.
- Good with my hands!
- Well defined problems that can then be tackled.
- Enjoyed surgical attachments.

Why this specialty?

- Requires team work and multi-disciplinary approach.
- Well defined surgical problems in otherwise medically well patients.
- Enjoy technical aspect—power tools, microscope, laparoscope.
- Mind stimulating with multiple potential solutions to one medical problem.
- Restore sight, save limb or life, improve pain or function.

Why this post? What are you aiming to get out of this post**?**

- Acquisition of generic skills such as suturing.
- Acquisition of specific skills—related to the specific surgical sub-specialty.
- Learning new skills or the strengthening of established skills.
  The post may be research orientated or academic.

13.4.2 Surgical Clinical Scenario Questions

You may be given a clinical scenario and asked how you would deal with it. This is often an acute or emergency surgical presentation, but a scenario of a chronic presentation (that you may expected to deal with in that post) may also be given.

In Orthopaedics this may be related to the management of a trauma patient, supracondylar fracture in a child with or without pulses, management of an open fracture, management of compartment syndrome, open book pelvic injury, displaced intra-capsular fracture in the young adult, septic arthritis in a child, cauda equina, fracture with neurovascular compromise.

In General Surgery it may be related to an acute abdominal presentation (appendicitis, cholecystitis, viscus perforation, bowel obstruction), gastrointestinal bleeding, or related to the management of a trauma patient (splenic, kidney, liver or other viscus injury).

In Vascular Surgery it may be related to a ruptured aneurysm, acute limb ischemic limb, or related to the management of a trauma patient.

The scenario examined may not require surgical management but may be related to medical conditions that can be encountered in surgical patients—such as post-surgery chest infections, peri-operative myocardial infarction, anticoagulation for atrial fibrillation, alcohol withdrawal symptoms following hospitalisation.

The aim of a clinical scenario is to determine that you:

- Adopt a systematic approach in assessing a patient, to ensure that you do not concentrate on one problem and end up missing another.
- Look at the patient as a whole rather than concentrating on the presenting complain.
- Involve appropriately the various members of the team required in patient care.

Try to demonstrate that you are safe, that you are aware of the steps in clinical assessment and management, speak as if you are living it in real life, give the minor details that differentiates one who has previously experienced the scenario as compared to one that has simply read about it, demonstrate an ability of lateral thinking.

In describing how you would approach an acute scenario consider:

- Start with the basics.
- Follow protocols: Advanced Trauma Life Support (ATLS) protocol for trauma patient [5], Advanced Life Support (ALS) [6] for a non-trauma patient.
- Resuscitate and stabilise an unstable patient alongside your clinical evaluation: large bore cannulas, IV fluids.
- Take history and examine.
- Examination—start from basic observations blood pressure, pulse, temperature, neurovascular status, compartment syndrome, skin integrity. State what positives you are looking for such as "tenderness and guarding in the right iliac fossa."
- Investigations: start with basic investigations (FBC, UEs, plain radiograph) and work up to more complex ones (Amylase, CT). Explain what you are looking for in these investigations: FBC looking for an elevated WCC, urea and electrolytes looking for low calcium, erect plain radiograph looking for free air, CT scan looking for an intra-abdominal abscess.
- State your preferred treatment option, but be aware of other options, and be prepared to justify your choice.
- If stating that you need to take a patient to theatre consider mentioning:
  - Consent.
  - Inform theatres.
  - Keep nil by mouth.
  - Inform anaesthetics and other specialties, your senior, the radiographer.
  - Positioning, incision, approach, procedure, postoperative care.
- If you are not able to operate you may state "I would ask my senior to operate but the principles of surgery would be to……"

In the emergency scenario, when you need to take a patient to theatre consider situations where not all is going smoothly:

- The theatre is blocked by another case and will not be free soon. Would you consider opening another theatre, transferring patient out, can patient wait?

- What if it is a shared theatre list and another specialty is refusing to give your case priority, even though their patient is not as unwell?
- What if patient is a child?
- What if the patient is not fasted?
- What if refusing treatment?
- Refusing blood transfusion?

13.4.3 Leadership/Management Questions

Only the guy who isn't rowing has time to rock the boat.

Jean-Paul Sartre [1]

Generic questions:

- Types or qualities of leader/manager.
- Differences between manager and leader.
- Does a surgeon need such skills?

Questions specific to you:

- Do you consider yourself to be a leader? And if yes why?
- Examples where you demonstrated your leadership/managerial skills?

Scenarios:

- You are tasked with introducing a new rota—how would you bring it about?
- Two of your juniors are not getting in and keep fighting. What would you do?
- A junior keeps turning up late to theatre. How would you address that?
- How do you achieve compliance with a new thromboprophylaxis protocol?

13.4.4 Awkward Scenarios

If you're in an awkward position, feel comfortable enough to walk away.

Beau Mirchoff [1].

As part of the interview you may be given a scenario of an awkward situation, and asked how you would deal with it.

You are facing difficulties at the workplace—how will you deal with it?

- You are not getting enough training.
- Your rota keeps changed at short notice.
- Being pushed around by your senior, a scrub nurse in theatre, a ward nurse.
- Your junior keeps turning up late.

Be able to address the issue with the person concerned but if not getting the appropriate response escalate it to the right authorities.

There is a need to demonstrate that you are aware of the different hierarchy structures that various co-workers may be answerable to and hence the pathways for escalation:

- For a training issue this may be: clinical supervisor educational supervisor, postgraduate director of your hospital, regional head of training, postgraduate dean.
- For a non-training issue this may be: clinical supervisor, head of department, department manager, human resources department.

You become aware of improper behaviour—what will you do?

You may be given a scenario whereby you are faced with improper behaviour and you are asked as what you would do. You may consider:

- You turn up to theatre and your senior smells of alcohol and behaves oddly.
- You become aware that your senior is mis-documenting the surgical procedures, to increase the remuneration of the institution or for personal financial gains.
- You see your senior, helping themselves to an implant from the hospital's theatres store room, to take away.
- You see your senior helping themselves from the opioids store cupboard.
- You walk into your seniors office to find them looking at illegal, inappropriate websites.

The aim is to determine if:

1. You recognise what the issue is—patient safety issue vs. fraud/criminality.
2. You take appropriate action—you don't leave the matter rest but you report/escalate to the appropriate authorities.

If patient safety is at stake, then the first priority is to ensure patient safety: by removing the person endangering patients.

If it is an issue of fraud/criminality you may confront the individual first or directly report it to the Human Resources or fraud office of your institution and to appropriate law enforcement authorities (according to the institution or healthcare system you are practising in). Offer that you may seek advice from your medical protection society or a senior colleague as such events can be challenging and testing.

13.4.5 Communication Questions

If you can't convince them, confuse them.

Harry S Truman [1]

You may be given a scenario where you have to show your communication skills. This could involve speaking to patients, relatives, another colleague or co-worker. You may be asked to pass on news, break bad news, disclose an error or an adverse event, explore why a patient is refusing treatment. You may face an anxious patient, an upset patient, an angry relative, a non-cooperative colleague.

The exact approach of how to communicate will depend on the scenario and exact circumstances but you may consider the following:

- Be courteous and polite.
- Introduce your-self, your role.
- Determine what needs to be communicated.
- Sympathise and apologise if necessary.
- Empathise, be understanding, show you appreciate the worries, do not be dismissive.
- Give clear plans for action.
- Check if anything else to be said, Any questions? Any remaining queries?
- If dealing with complaint offer to escalate, or provide information about the available escalation routes.
- Ensure you pass the message, it may be easy to keep going round the topic and not transferring the information you have been asked to communicate.

In an interview the process may feel very artificial, especially if it involves role playing with an actor. Treat it as if you are in the ward, in clinic, as if it is just another day at work.

13.4.6 Political Issues Questions

In a democracy, dissent is an act of faith.

J. William Fulbright [1]

You may be asked about your opinions with regards to an issue of the day affecting surgery.

The aim is to determine:

- If you are aware of challenges your specialty or the profession faces.
- What your views are.
- Your approach in dealing with controversial topics (dogmatic or more conciliatory way).

Political issues examined may include:

- Seven day working [7].
- Role of physician assistants [8–10].
- Role of surgical assistants [8–10].
- Non-medically qualified surgeons doing surgical procedures—such as podiatrists [11, 12].
- Shortening of surgical training [13, 14].
- Role of general surgical training prior to specialist training.
- Targets from referral to surgery [15–18].
- Commissioning public contracts to private hospitals [19, 20].
- Bundled payment initiatives [21].

If you are aware of the issue you may consider:

- Avoiding strong, passionate views, as the interviewer may be on the other side of the argument. Aim for a more balanced approach.
- State a summary of the issue.
- Give one side of the argument- positive site e.g., the benefits of 7 day working—increased productivity, better access of patients to healthcare.
- Give the other side of the argument—negative side—difficulties and challenges of introducing 7 day working in an under-staffed healthcare system.
- Summarise the arguments, and offer a half way solution e.g., 7 day working would be welcomed once adequate resources become available.

If you haven't come across the issue the interviewer refers to, ask the interviewer to explain "I'm not aware of the issue you describe, can you please elaborate?"

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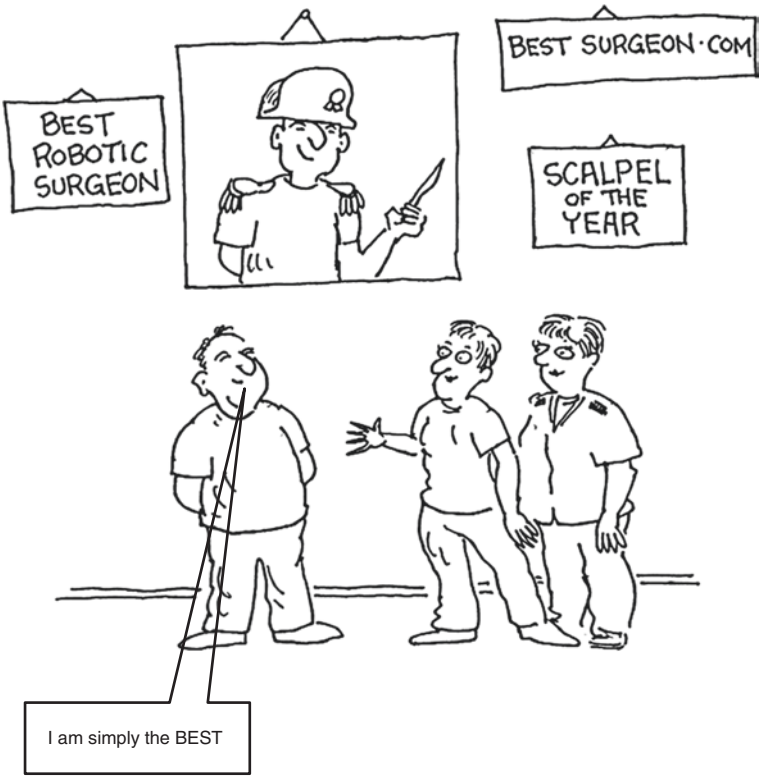
Chapter 14
Emotions in Surgery

Surgeons are sometimes perceived as acting in an emotionless way, cold executors of tasks and procedures, but the reality may be different. In your surgical training or career you may be faced with a roller coaster of emotions, both positive and negative.

Considering your emotions, and appreciating their potential effects upon your wellbeing and performance are important skills to develop. They may assist you in dealing or coping with such emotions and help you recognise that the experience of those emotions may make you part of the norm rather than the odd one out. Considering emotions may also assist you in appreciating what colleagues, and co-workers faced with similar situations are going through, which may guide your actions and behaviours towards them.

This chapter discusses the concept of emotional intelligence, addresses the emotions that a surgeon may face in different scenarios, and suggests ways in which one may deal with those. It discusses emotions one may experience when under excessive pressure and stress, when encountering complications or errors, dealing with work environment challenges, and when faced with an established stereotype and trying to fit in.

C. Panayiotou Charalambous, *Career Skills for Surgeons*,
DOI 10.1007/978-3-319-57490-5_14


BEST ROBOTIC SURGEON
BEST SURGEON·COM
SCALPEL OF THE YEAR
I am simply the BEST

14.1 Types of Emotions

Flowers are restful to look at. They have neither emotions nor conflicts.

Sigmund Freud [1]

Several names or labels have been used to describe emotions, with many theories available on the subject. In describing the emotional world, one may consider basic emotions and more complex emotions. Robert Plutchick, a well-known Psychologist and Professor Emeritus at the Albert Einstein College of Medicine in New York, described eight basic emotions as pairs of opposites: joy versus sadness, anger versus fear, trust versus disgust, and surprise versus anticipation. These emotions may vary in intensity, or may interact to form more complex emotions such as optimism, contempt or disapproval, a concept Plutchick successfully presented in his Wheel of Emotions (Fig. 14.1) [2]. Even though Plutchick's theory may have limitations, such as by not including "pride" as an emotion, it can nevertheless help one to appreciate the complexities of our emotional world.

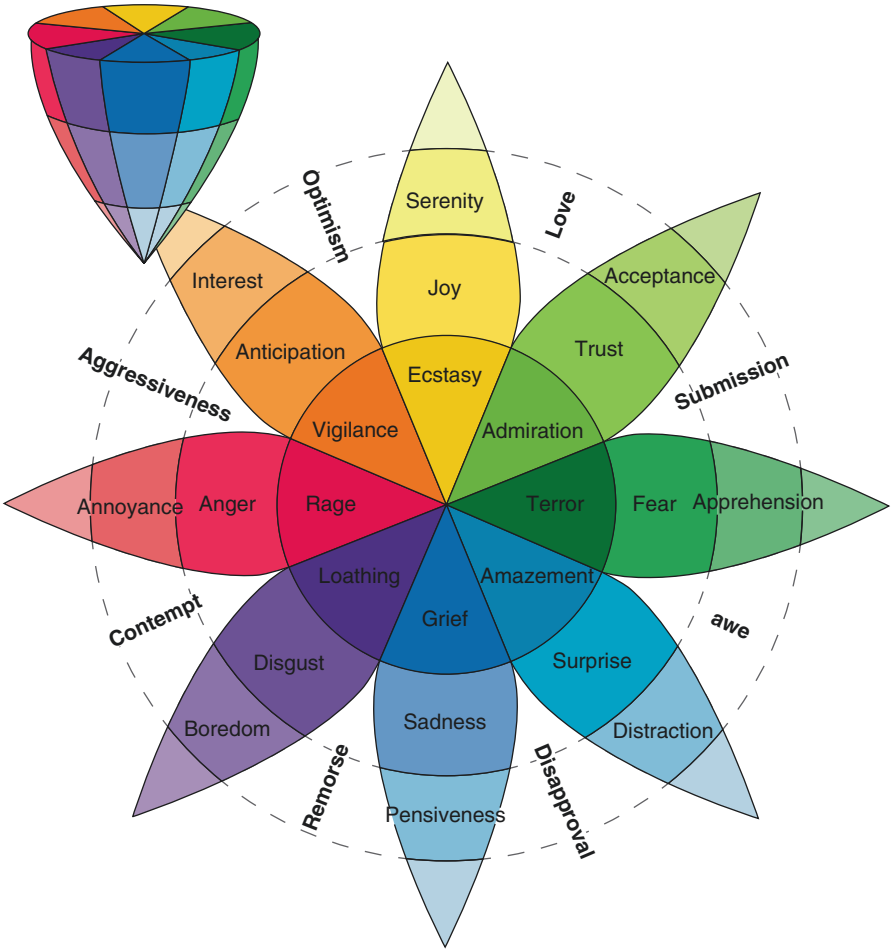


Fig. 14.1 Plutchick's Wheel of Emotions. From Plutchik R [2]. Reprinted with permission

14.2 Emotional Intelligence

The audience likes their emotions to be touched. They want to laugh and cry and feel good.
Magic Johnson [1]

Emotional Intelligence has been described as the ability to perceive, understand and manage one's own and other people's emotions [3]. It's increasingly recognised as an important skill to develop, as it may facilitate inter-personal interactions and relationships. Emotional intelligence has been described as consisting of five components [4]:

- Empathy—the ability to consider the feelings of others to guide behaviour and actions.
- Motivation—drive to achieve.
- Self-awareness—ability to recognise own emotions and their impact upon others.
- Self-control—ability to control own potentially disruptive emotions and impulses.
- Social skills—to manage relationships, to minimise confrontations and conflicts, to constructively engage, negotiate.

Emotional intelligence may help to emphasise the need of not just concentrating on the completion of a task or the achievement of a technical goal, but also consider how one interacts with others, and the need for basic social skills in such interactions.

As surgeons we may experience emotions, both pleasant and unpleasant, positive or negative. Hence, when we look at or question our emotional world we may consider that what we experience is part of the norm rather than the exception. Also, appreciating that similar emotions may be experienced by those around us, our trainees, juniors, colleagues, co-workers, followers or leaders may enable us to consider what effect our words or actions may have upon them, consider how they might make them feel. Similarly, by appreciating the emotions others may be experiencing, we may be able to support and help them through difficult situations, help them pull through challenging times.

14.3 Emotions and Stress

James Donovan: Aren't you worried?
Rudolf Abel: Would it help?

Bridge of Spies [5]

Stress is defined by the Oxford dictionary as "a state of mental or emotional strain or tension resulting from adverse or very demanding circumstances" [6]. It is essentially a reaction to outside demands or pressures.

Stress may be due to heavy workload, lack of senior support, institutional pressures, organisational dysfunction, a disruptive colleague, a challenging situation, a change from one post to another, from one training level to the next, may be due to workplace or personal life pressures.

A small amount of stress may make us more alert, but if stress is excessive our performance may be impaired. Stress can lead to negative emotions, anxiety, agitation, unhappiness, moodiness, thought preoccupation, loneliness, loss of enjoyment, lack of concentration, feeling overwhelmed (Fig. 14.2). Excessive stress may have physical effects leading to inability to fall asleep or early awaking, sometimes almost acting like a "paralysing" force impairing physical skills or actions [7–11].

Prolonged high levels of stress may lead to burnout that is characterised by [12, 13]:

- Emotional exclusion
- Depersonalisation
- Feelings of insufficiency

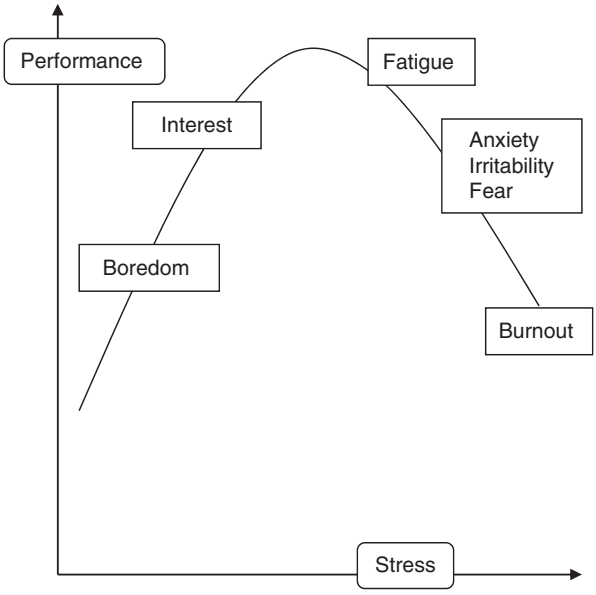


Fig. 14.2 Stress-Performance curve and associated emotions. Adapted from Bradberry [11]

But can we really be impaired by stress? Are surgeons truly susceptible to such pressures? After all, the surgeon is often pictured as strong, tough, as the one who "takes risks, defies death, comes close to the edge and carries it off" [14].

Nevertheless, several studies report high levels of stress and burnout amongst surgeons. Yoo et al. [15] surveyed General Surgery residents in New England. Of 166 respondents, 92% reported moderate to extreme work related stress which in 72% affected their overall wellbeing. Arora et al. [16], in a review of published studies, evaluated burnout levels amongst orthopaedic surgeons and reported this as affecting 50–60%, with the highest levels seen in residents, followed by departmental chairs and faculty members.

Klimo et al. [17] reported 27% burnout rate amongst neurosurgeons in the USA whereas Businger et al. [18] reported a 39% moderate or high burnout rate amongst surgical residents and surgeons in Switzerland. O'Kelly et al. [19] surveyed 575 urologists, members of the Irish Society of Urology and the British Associations of Urological Surgeons. They showed moderate levels of emotional exhaustion and de-personalisation on burnout assessing questionnaires. Fifteen percent of the respondents reported self-medication with non-prescription drugs and alcohol to counteract symptoms and signs of burnout, whilst 8% sought professional help for such symptoms. Shanafelt et al. [20] surveyed 7905 members of the American College of Surgeons, of which 6.3% reported suicidal ideation during the previous 12 months, which was related to symptoms of burnout and depression.

Orri et al. [21] evaluated through interviews the emotions of 27 pancreatic and liver French surgeons before, during and after surgery. Their emotional world was influenced by interactions with patients and their relatives, their co-workers, and the framework of their institutions. Time pressures, fatigue and the need to conform to the expected image of a surgeon influenced their emotions. They reported emotions of pleasure when operating, but also negative emotions anxiety, fear, guilt, distress and accountability, experienced even in the absence of any adverse events occurring.

If faced with negative or unpleasant emotions one may consider as to whether that could be the result of stress, and if it is stress try and deal with it rather than just letting it get you down. In doing so you may consider:

- Avoid the stressor—walk away.
- Deal with the stressor—explain your feelings, ask them to change attitude, escalate the issue to someone able to help with the problem.
- Put it all in perspective—is it really worthy the fuss? How do my difficulties compare with all other problems that trouble the world? Is worrying an appropriate use of my intellect, when others are using theirs brains to send a mission to Mars [22]?
- Find interests and activities that encourage more positive emotions, that help you relax.
- Concentrate on the present, block the rankles for the past and the worries about the future [23].
- Eat and sleep well, exercise.
- Avoid unhealthy coping mechanisms (caffeine or alcohol).

14.4 Facing Complications

People who do no work, make no mistakes.
People who make no mistakes get promoted [24]

A complication may be described as an unfavourable, an unwanted consequence of an intervention. Complications may occur even when all possible care and precautions are taken; the infected hip replacement despite all antibiotic prophylaxis, the wound breaking down despite proper layer stitching, the grafted artery thrombosis despite good intraoperative flow, the bowel anastomosis leaking despite meticulous suturing, the nerve palsy despite careful dissection and nerve retraction.

There may be times when you are riding high and all are satisfied and pleased. But then there may be times when all you touch seems to go wrong, with complications coming in one after the other. You may be perplexed as to why in situations where you thought you did very well problems arose, but where you were worried recovery happened fast.

The effects of complications can be devastating both on the wellbeing of patients and on the emotional world of surgeons. Patients with complications may stay in the mind of a surgeon for a really long time, may recall their details years or decades later. As in many aspects of surgery we deliver care not simply by decision making but with our own two hands, one may feel a greater ownership, personal responsibility for the occurrence of complications.

Complications may bring the constant worry about your patients not doing well, the constant questioning whether you could have done better. They may also bring the worry of legislation, having to face the coroner or even the press. The pressures may be mounting of the personal repercussions, the loss of face, reputation, good name, the damage to one's career prospects, loss of a job. One mistake, a judgement error may transform one from "pioneer" to "maverick"; one's working environment may be threatening, with minimal support, you may be in constant fear that they are all out to get you. You may be anxious of the breakdown of the relationship you had with a patient and their close ones, of them feeling that you let them down. You may feel regret—could you have done more, could you have accepted less, could you have taken a different course of action?

Pinto et al. [25] examined the impact of major surgical complications on 27 general and vascular surgeons practising in the UK. The emotions they experienced are shown in Fig. 14.3. Many felt that strong blame culture and inadequate support by their institutions hastened their response in those difficult times. In a subsequent study [26] the authors reported that one third of 47 surgeons assessed, exhibited acute traumatic stress of clinical concern a month after their patients sustained a major complication whilst under their care.

	No. of participants (*n*=27)
Emotional impact	26
Guilt	15
Crisis of confidence	8
Worry about reputation	8
Worry for the patient	6
Anger (at self or at seniors for inadequate supervision)	6
Anxiety	6
Disappointment	3
Sadness	3
Behavioural impact	21
Surgical practice affected (become more cautious/risk-averse)	18
Increasing efforts to improve	4
Becoming aggressive in interactions with colleagues	4
Cognitive impact	10
Rumination	6
Reflection on what went wrong	6
Loss of concentration	3
Social impact	8
Interference with personal life	6
Relationships with colleagues enhanced	3
Other impact	12
Learning	11
Physical reactions (feeling sick)	2

Fig. 14.3 Emotions experienced due to major surgical complications amongst general and vascular surgeons practising in the UK. From Pinto et al. [25]. Reprinted with permission

Cristancho et al. [27] evaluated how surgeons perceive the context in which they find themselves practising, through interviews, drawing sessions and observations. One surgeon's words from that study demonstrate the emotional pressures faced with in decision making,

> *"people may be standing around saying, why did you even bother operating on this person? What were you thinking when you did this, this is ridiculous? You've created a problem where there was no problem"* [27].

Complications are part of surgery and will occur, no matter how careful one is; we aim to minimise complications as it is unlikely we can fully abolish them. It may be that the only way to completely avoid surgical complications is for one not to operate.

When faced with complications you may consider:

- Discuss with supportive colleagues of peers. Someone reliable who will take your worries seriously, will be fair and just in their comments, and will neither dismiss them, just telling you what they think you want to hear, or make you feel even more guilty.
- Break down the complication. Could something else have been done, and even if something else were done would the outcome have been any different?

But it is also important to recognise that bad outcomes do not always relate to how good technical job one did. Poor outcomes may be:

- Due to the natural history of the underlying disorder with progression despite intervention.
- Poor biology to allow a favourable response to our intervention—a well sutured bowel anastomoses may break down if the blood supply is not adequate, a well fixed bone fracture may fall apart if the biology of healing is not there.
- Poor compliance with treatment.
- Factors such as ongoing compensation claims, psychological status [28–30].

Give complications the consideration they deserve, examine them fully, learn from complications, progress and develop, but try not let them get you down.

14.5 Dealing with Errors

> *I've safely delivered one million passengers over 40 years and tomorrow I'm going to be judged over 208 seconds.*
>
> Chesley Sully Sullenberger [31].

Medical errors can have a devastating effect on the doctors involved who may struggle to recover, if they can recover at all. The term "second victim" has been used to describe such individuals, emphasising that in addition to the patient who is the first victim of any error and harm, the physician can also be a victim [32, 33].

The culture of perfection whereby human fallibility and mistakes have no place may be encountered in Medicine but more particularly amongst surgeons. Hence when faced with a medical mistake, feelings of failure and despair may occur along with questioning one's own clinical skills and even career choice.

Scott et al. [34] interviewed 31 health care professionals who were second victims following adverse patient events and described six stages in the second victim phenomenon:

1. Initial shock.
2. Intrusive reflections characterised by re-enactments repeatedly asking what if a different pathway had been taken, if different actions had happened.
3. Support from a trusted colleague, friend or relative was sought to help restore personal integrity along with prevalence of self- doubt and worry about the future.
4. Enduring the inquisition—a stage marked by concerns about litigation, career and professional repercussions.
5. Emotional support sought.
6. Moving on—characterised by an attempt to move on and leave the past behind. These could be achieved in various ways such as:

    - Dropping out—leaving the profession, changing professional role, or moving to a different location to practice.
    - Surviving—continues to work and function keeps haunted by the event.
    - Thriving—tries to see that something good has come out from the adverse event, to improve the service or the individual as a professional or person.

Surgeons, exhibit similar responses to adverse events. Luu et al. [35] evaluated the emotional reactions of surgeons to adverse events and reported four phases in their response:

1. The kick—characterised by feelings of failure, self-doubt, and a substantial physiological response.
2. The fall—characterised by a feelings of chaos and an attempt to assess own role in the adverse event.
3. The recovery—characterised by attempts to reflect and learn from the adverse even, to move on.
4. Long term impact.

Like complications, adverse events can haunt the surgeon for years to come. As Rene Leriche, a French Surgeon that practised in the early nineteenth century once wrote:

> "*Every surgeon carries about him a little cemetery, in which from time to time he goes to pray, a cemetery of bitterness and regret, of which he seeks the reason for certain of his failures*" [36].

In helping to deal with adverse events you may consider:

- Life is a long learning process.
- Things can go wrong even when our intentions are right, even when we set out to do good.
- What we do has limitations, surgery has its limits too.
- The fallibility of humans, and that surgeons are humans too.
- Having insight as to what happened, recognising what went wrong, constructively self-reflecting and learning can be a positive light amongst the perceived darkness.
- Even though we may find ourselves at the receiving end of legislation, one may accept that those harmed are entitled to seek mend and compensation for what went wrong.

14.6 Coping with the Stereotype

In the John Wayne movies, the Indians were savages that were trying to scalp you.

Ricky Schroder [1].

Stereotypes is described as "a widely held but fixed and oversimplified image or idea of a particular type of person or thing" [6]. As for other professions, and medical specialties, the surgeon stereotype has been repeatedly described, with such descriptions sharing common themes:

- *"He is big bold, beer swilling rugby fan, and when it comes to clinical practise he prefers to cut and run, rather than communicate with patients"* [37].
- *"Decisive, well organised, practical, hardworking, but also cantankerous, dominant, arrogant, hostile, impersonal, egocentric, and poor communicator"* [38].
- *"Dominant and arrogant doctor, aggressive, energetic, and very concerned with his own prestige. He is seen as decisive, efficient, and a realist, but as an impersonal and autocratic person. Egocentric, he is more interested in rapid actions and immediate results than in interpersonal relationships"* [39].
- *"…admires cars, sports, speed, competence"* [40].

Surgeons may have a stereotype of how they are perceived, one framed by many years of surgical practise, thought of by the public, perpetuated by colleagues of other medical specialties [41], television dramas [42], soap operas, the media and the press [43]. Given the stereotype you may be anxious, worried, concerned as whether you could be it. "How could I fit in? How could I be accepted?"

Try not to be put off by the stereotype, try not to rush to decide that surgery it's not for you, that you could not fit in. Professions can benefit from individuals of all talents, sexes, ethnicities, personalities, backgrounds or beliefs. You could be the fresh air, the breath of welcomed change. Surgery has struggled to recruit female trainees, and the perceived macho stereotype may be at least partly to blame [44]. But there is evidence to suggest that even male trainees that have spent time in the specialty may feel not measured up to the masculine stereotype, leading to inability to fit in and a struggle to engage with the profession [45].

Avoid trying to act or behave in certain ways simply to match the stereotype, the perceived norm, in an attempt to be accepted as part of the team. Be genuine, be your-self, be the real you, avoid trying to pretend being what you may think is expected from you.

Many of us may have been in situations where we felt that others did not look at us as if we were up to scratch, as if we could make it, that our behaviours, personalities and actions did not conform to the departmental norm, and sometime later, we may gladly say, we proved them wrong. Some of us may have even been on the other side, looking at early starters and thinking that they most likely won't make it, that they may just scrape through, that they just don't have what it takes to be a surgeon, simply to be later glad that we were proved wrong.

One does not have to act or behave in a specific way in order to fit in. Professional behaviour doesn't mean changing one's own identity. A workplace, an institution or

profession may be enriched by actors of various talents, different personalities, communication skills, backgrounds, aspirations.

Stereotypes are often perceptions, and to perceptions there can be exceptions. The most noisy, the most pushy, the most outrageous behaviours may be more easily remembered, more easily recalled, and hence attributed to the so called "norm." But you may also recall peers, seniors, trainers or teachers who were thought of as of low tone, quiet and content, but excelled through hard work, perseverance and respect. Luis Toledo-Pereyra, Editor in Chief of the Journal of Investigative Surgery writes of the "Gentleman Surgeon" a someone who "demonstrates that he/she cares, respects and helps all of those involved in the profession", co-workers, students and patients alike [46].

Don't fall for the stereotype, it may be out of date or just an illusion. Stay yourself, do it your way.

14.7 Struggles in the Workplace

If you expect the world to be fair with you because you are fair, you're fooling yourself. That's like expecting the lion not to eat you because you did not eat him.

Pravinee Hurbungs [47].

As a surgeon you may be lucky enough to practise in a workplace where you can have real influence and control in what you do, in a well organised system, where all share the same vision, where mutual respect prevails. But on occasions, whether self-employed or an employee, you may find yourself in a less calm, less peaceful, less well functioning workplace or more general working environment, where behaviours and actions of those around you may adversely affect your emotional world.

You may feel anger that your rota is constantly altered and you cannot plan your life, or that you get asked to hold the on call pager at short notice losing out again on that long awaited theatre session.

You may feel let down for even though you followed the instructions of your immediate senior to accept and admit the referred patient, they are staying silent when you get grilled the next morning by the most senior as to the reasoning behind your admission.

You may feel upset that you are being placed more in ward cover and others are placed in theatre most of the time, or that you are asked for a business case each time you request a new suture whilst others get with real ease any surgical kit they wish.

You may feel bewildered that whilst you are courteous and considerate, others try to step on your toes, that even though you are careful not to infringe on anyone's space others try to break into yours, that although you stick to your theatre list other trainees jump into yours.

You may feel disheartened for whilst you try to lift others up, others try to put you down, for even though you don't bother with others, others try to wind you up, even though you don't gossip, others keep talking behind your back. You may be worried that you are targeted and picked on due to association with others, rather than for whom you are, for what you stand for.

You may feel disbelief of the actions of others, that their priorities, or motives don't match yours, saddened that bad politics, targets, financial incentives, struggles for power, competition to impress seniors, personal gains are put before high quality care, dispirited of the constant struggle you have to face in trying to make good, of the multiple heads deciding but the responsibility still residing with you.

You may feel betrayed for those you once bailed out are now turning against you, those you supported are ignoring you, for others are rushing to say you did wrong, without even bothering to check the facts or rules.

You may be disappointed that your work is recognised round the globe but you are dismissed at home, your work admired by strangers but belittled by those close, that what you may have built others try to flatten, what you may introduced others try to abolish.

One may try to accept the human nature, accept that we cannot be all the same, have the same personalities, uphold the same principles or values, think and act in similar ways. Bad politics, plots and intrigues, unpleasant behaviours, hidden agendas, uncompromising egos, struggles for power, may be encountered in any workplace and the surgical field cannot stay immune from those.

Instead of drowning in your emotions you may consider:

- Try to better the working environment, start by reflecting upon your own behaviours and actions.
- Appreciate that disagreement with your proposals, or reversal of what you previously set up, is not necessarily criticism of you or your efforts, but just a different approach to a challenging problem. Even "Obamacare" was revoked on the first day of the new chief in town [48].
- Stand up for yourself, your rights, fight your own corner. Let others know what effects their actions have, make it clear that you are upset. Make it clear that what matters to you most is YOU [49].
- Avoid, despite the pressures, taking sides, joining factions, talking down some to please others.
- Concentrate at what you do best, to train, to learn, to care.
- Argue and fight for causes, not for or against personalities.
- If possible avoid those that upset you, they may quietly go away.
- And if you can't fit in, if you have had enough, move on, search for new shores, leave them to it, life is too short.

14.8 Be Proud

I am very proud, I am very proud. It's a hard honest work, you get an accomplishment, You make something and you see the final product.

Pat Eslich, Steel man, Canton, Ohio [50].

Becoming a surgeon is a long, challenging journey. You may face obstacles, barriers, hurdles, may have to work hard and persevere, make personal sacrifices, devote time and effort.

Be proud for what you have achieved, the knowledge and experiences you have gained, for the acquisition of fine motor skills, the critical clinical thinking you may have attained, for reaching the peak of your learning curve, building up the cases in your logbook, getting faster in operating, cracking the nerve racking interviews, passing the really hard exams, stopping being the most junior for the first time, getting to operate unsupervised for the first time, reaching a senior position, getting your first research article and every subsequent one published. Be proud for the status in the community you may have gained, for the respect, the reputation, the remuneration.

But also be proud for those in need that you helped, the fallen that you picked up, the hurt you comforted, the worried you reassured. Be proud for keeping patients in the centre of what you do, in the centre of your actions and motives. Be proud for recognising that slowing down your ward round to prop up someone sliding down their hospital bed, to place another pillow under their head, to push their tea cup closer so they can reach it, to have a social chat to make their day, to help them arrange care for their dog who has been left home alone, to get them a phone to ring their son who must be really worried, may be as valuable and important as the clever robotic surgery, the minimally invasive techniques, the latest durable implants that you may employ.

Be proud for providing humane care alongside skilled technical surgical care.

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