

# BASIC SURGICAL TECHNIQUES

SIXTH EDITION

R. M. KIRK

CHURCHILL  
LIVINGSTONE  
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# BASIC SURGICAL TECHNIQUES

*For my grandchildren*

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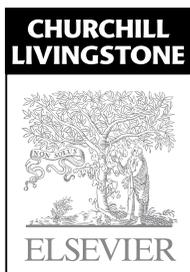
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SIXTH EDITION

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# CHURCHILL LIVINGSTONE

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# Preface

*Not everything that counts can be counted, and not everything that can be counted counts.*

(Sign on Albert Einstein's study wall at Princeton University)

This is a 'How to do it' book. 'What to do' is described in surgical texts such as *General Surgical Operations* and *Essential General Surgical Operations*, both also published by Elsevier Churchill Livingstone. I have spent my whole career working with, and observing, masters and trainees in all branches of surgery. They all have their individual techniques but one aim in common – the safe, effective performance of operations on fellow humans.

Before the middle of the 19th century, surgeons were forced to operate on unanaesthetized patients as swiftly as possible. In Boston, Massachusetts, William Morton demonstrated the use of ether in 1846 and Sir James Young Simpson used chloroform in 1847. Now surgeons could work more gently and deliberately. Three giants and friends, Theodore Kocher in Berne, William Halsted in Baltimore and Harvey Cushing in New Hampshire, laid down the precepts of good operative skill. Techniques, instruments and materials have subsequently changed, but the correct method of handling living, healthy or diseased, human tissues has not. That is the subject of this book.

Success in surgery is not achieved just in the operating theatre; excellent decision-making, planning and preparation are undermined unless the operation is competently performed. Surgery (G *cheir* = hand + *ergon* = work; manual work), is a craft procedure. Craftsmen are expert at manipulating (L *manus* = hand + *plere* = to fill) a specific material, such as wood, leather, textiles and glass, and develop intimate knowledge on how to control them. We must learn to control our 'material', the living flesh of our patients; hence each chapter heading incorporates 'Handling ...'.

How do you acquire exceptional skill? Much as I should like to claim it, this book cannot transmit surgical skill, neither can skills courses. As a former deviser and teacher of skills courses I am aware that they are a valuable introduction to – but not a replacement of – operative experience under expert guidance. They set basic standards of safe procedural practice and handling of instruments and equipment. They cannot show how to handle the target of the instruments, which is the patient's body, for which we have yet to produce simulations with the necessary complex, varied characteristics and texture.

A skill is so much more than a knowing. Great craftsmen, artists, actors, sportsmen, musicians may have inborn talent but they have applied it with enormous concentration, effort and single-minded purpose to reach the heights. Many, at the pinnacle of their success, nevertheless engage trainers and coaches to encourage, focus and correct their performance. Few of us have the potential but all of us who wish to apply ourselves to the highest achievable level need to recognize the complex mix of components required, and have the determination to achieve the best standard that we can.

To become a surgeon you need to fulfil certain training criteria and pass a number of examinations and assessments. Modern demands for objectivity determine the inclusion of tests that can be answered 'Yes' or 'No', awarded a statistically justifiable mark or produce a list. Thus the examiners influence the curriculum by including only what can be examined, not the whole of what is important. Questions that can be answered objectively are 'black' or 'white', whereas most of the questions of importance are various shades of grey – and are subjective. Lists beguile you into giving equal

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# Acknowledgements

This is a 'one man' production. Because I wished to demonstrate that skills are transferable, I did not wish to make it a multi-author text. However, I have a number of distinguished colleagues, with specialized knowledge, who have generously read through chapters, advised, inspired me, and corrected me, to whom I wish to pay tribute. Any remaining inaccuracies are mine.

## **Past and present colleagues at the Royal Free Hospital and in the UK**

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# Contents

<b>1.</b>	Handling yourself.....	1
<b>2.</b>	Handling instruments.....	9
<b>3.</b>	Handling threads.....	21
<b>4.</b>	Handling ducts and cavities.....	47
<b>5.</b>	Handling blood vessels.....	83
<b>6.</b>	Handling skin.....	103
<b>7.</b>	Handling connective and soft tissues.....	119
<b>8.</b>	Handling bone and joints.....	133
<b>9.</b>	Handling dissection.....	149
<b>10.</b>	Handling bleeding.....	165
<b>11.</b>	Handling drains.....	171
<b>12.</b>	Handling infection.....	179
<b>13.</b>	Handling minimal access surgery.....	185
<b>14.</b>	Handling craft skills.....	195
	Index.....	203

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## Handling yourself

### CHAPTER CONTENTS

Attitudes – the five ‘Cs’	2
Physical attributes	2
Hands	2
Stability	2
What is skill?	3
Exercises versus practice	4
Haptics	4
Transferable skills	5
Speed	5
Sequence	6
Skills courses	6
Rational assessment of information	6

The personal qualities you bring to medicine are the same as those that drive all clinicians. We are all primarily physicians, endeavouring to apply the same knowledge and judgement that our medical colleagues apply to diagnosing and treating patients.

1. The extra, practical aptitude you must acquire beyond clinical competence is operating skill – the ability to manipulate living human tissue with intimate knowledge of its characteristics in health and disease, while endeavouring to preserve its physical and functional qualities. In the medieval period surgeons, unlike physicians, did not study at a university but were ranked as craftsmen, learning as apprentices from masters. As in other trades, surgeons use tools or instruments to facilitate controlling their materials but recognize that they are intermediates between their hands and the object of their skill.

Your awareness of this should impress on you the need to use every practical task you perform as a means of improving the skills required in surgery – all day, every day, not just in the operating theatre.

2. Individual components of operative skill can be listed but do not define the way in which they are put together to create a successful surgeon. Few of us are fully equipped mentally and physically, but by putting in the extra effort to overcome our weaknesses, we hope to compensate for them. In contrast some, fortunate enough to be born with natural aptitudes fail to put in the extra effort.
3. In this chapter I hope to demonstrate how to identify in yourself some of the qualities you need to utilize and develop in order to become a skilful surgeon. You can recognize the presence or lack of them in your everyday life and initiate your training even before you step into the operating theatre. Continue this process when you watch operations, become an assistant, and are eventually allowed to perform part or all of an operation.
4. It is not necessary to see someone operating to identify the presence or absence of desirable qualities. Watch others performing everyday tasks such as carving a joint of meat, peeling fruit, eating a meal; is the food on the plate still orderly – or does it look like a battlefield? Note someone who habitually drops objects and swears at them muttering ‘Bad luck. That happens every time.’ Why do experts not suffer such misfortunes? They recognize the likelihood and incorporate precautionary measures into their routines.
5. Some accomplish everyday tasks calmly, safely, in an orderly manner, maintaining uncluttered surroundings. Others are casual, messy, rough, clumsy with their hands, the equipment, or the object which

they are handling, and do not seem to anticipate an imminent fault or accident that is evident to the onlookers. They may be outstanding at their vocation but you would feel anxious if they claimed to be surgeons or intended to pursue such a career.

### Key points

- **'Get it right first time'** incorporates the recognition that faults occur and that they must be anticipated and avoided.
- Do not hope for the best. If an error is likely, build into your routine a check or corrective.
- Correcting errors is more time-consuming than avoiding them.

## ATTITUDES – THE FIVE 'Cs'

1. **Common sense** encompasses being aware at all times of what is going on around you and reacting to it in a logical and rational manner. It is eroded if you are distracted, lose your composure and temper, so your anticipation of impending danger is blunted, as is your ability to react sensibly and perform effectively. If you encounter a difficulty do not rush wildly into 'doing something'. Respond to changed circumstances; errors often result from dogged and blind continuation with the intended procedure; this is sometimes (but not by me) entitled 'situational awareness'.
2. **Competence.** Make it a habit in your everyday life to carry out your duties in a relaxed atmosphere of expertise and calm. List your intentions in descending order of priority and ensure you are able to carry them out proficiently and professionally. Take each step in its correct order, complete it, check it and continue with the next one – but react to new input and if necessary respond to it.
3. **Commitment.** Keep in mind your prime purpose. Unless circumstances change, concentrate on this and do not be deflected from it without good reason. Be willing to defer or cancel other duties in order to fulfil the most important one. Except in an emergency, complete every task.
4. **Compassion.** How privileged you are to be a physician, able to treat patients who are in pain, or anxious. Now you wish to add to your skills and offer another means of treatment. Operating on people can be dramatically successful – and also disastrous. Expect to have occasional sleepless nights from anxiety and guilt as you retrospectively consider your recent actions.
5. **Communication.** You are in a professional relationship with your patients, their relatives, and your colleagues. Technical skill in the operating theatre is not sufficient on its own to make you

a successful surgeon. It is a vital add-on but it is one component among many others. You must communicate and be open to communication – listen, as well as talk.

### Key point

- You will carry these attitudes that you strive to develop, from your everyday life to the operating theatre.

## PHYSICAL ATTRIBUTES

### Hands

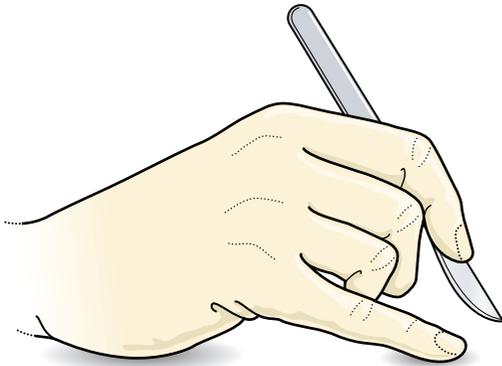
1. There is no ideal surgeon's hand. The shape of your hand has little or no bearing on your manipulative skill. However, identify the peculiarities of your own hands and fingers in order to exploit the benefits and make the best use of them. For example, the terminal phalanx, nail shape and extent of nail bed towards the tips of your fingers affect your preference for fingertip pressure or pulp pressure.
2. Your hands are important assessors of tissues. Their sensitivity is affected by wearing gloves. When clinical circumstances require you to wear gloves, consciously note the changes. Make sure you wear the correct size of gloves and wear them correctly. Do not allow the glove fingertips to project beyond yours – pull the glove fingers on fully, if necessary creating concertina'd wrinkles near the base of your fingers.
3. There are many outstanding left-handed surgeons so this is no disability, even though many instruments are designed for right-handed people.

### Stability

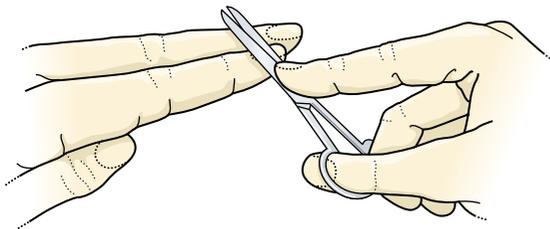
1. Surgeons do not usually have extraordinarily steady hands. Our ability to perform finely controlled movements diminishes as we age.
2. If you hold long-handled instruments at arm's length, the tips magnify the tremor – and anxiety exaggerates this. Do not feel embarrassed. The further the distance from a firm base to the point of action, the less steady are your hands.
3. Stand upright with feet apart, arms and fingers outstretched. You will detect a slight tremor at your outspread fingertips. Now press your elbows into your sides and you should find your hands are steadier. Sit, or brace your hips against a fixture to become even steadier. Rest your elbows on a table; also rest the heel of your hand or your little finger on the table (Fig. 1.1).

**Key point**

- Keep a firm base as close as possible to the point of action.



**Fig. 1.1** Your wrist and little finger rest on the base, forming a steady bridge while you hold the scalpel to make a precise incision.

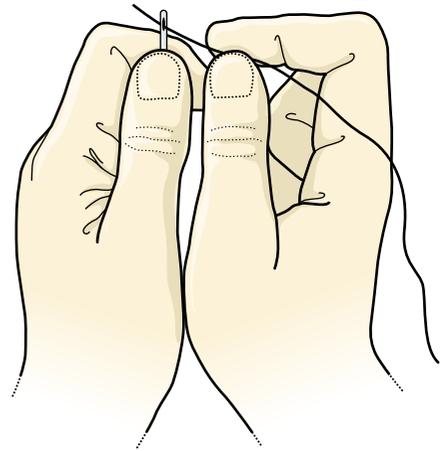


**Fig. 1.2** Steadying an instrument by resting it on the fingers of the other hand.

4. If you cannot use a base close to the active fingers, use the other hand to steady the dominant hand by grasping the wrist. If you need to reach to make an action – for example when you are cutting ligatures as an assistant, use the fingers of the inactive hand on which to rest the scissors (Fig. 1.2). If no other base exists, place the ‘heels’ of your hands together when carrying out a manoeuvre such as the nowadays rare need to thread a needle (Fig. 1.3).
5. If you need to carry out a smooth movement, try practising it in the air first, as a golfer does before making a stroke.

**WHAT IS SKILL?**

1. The Old Norse word ‘skil’ signified distinction (from *skilja* = to separate, discriminate). In everyday use it commonly signifies expertise and dexterity



**Fig. 1.3** Press your wrists together while threading a needle.

in performing a practical procedure as opposed to facility in a theoretical or abstract accomplishment.

2. As an example, a tennis beginner must learn to control the racket to strike a ball. Initially the player must concentrate on the dominant hand controlling the racket head. As the presence of the racket becomes a familiar extension of the hand, the concentration can be transferred increasingly to the ball, which becomes the prime focus as its flight is observed and predicted. The racket head is relegated to subsidiary focus<sup>1</sup> and seems to move naturally so that the sweet spot impacts on the ball.
3. This ability to ‘download’ the means of accomplishing something, so freeing the performer to focus attention on the prime object of the procedure, is a skill. It is a fundamental achievement that has to be acquired by assiduous, intelligent practice. It frees the player to see the game as a whole, able to plan, anticipate and be correctly positioned for the next shot.
4. It is remarkable that having acquired a skill and then trying to add further ones, the first skill is initially lost. When you learn to drive a car, having learned to control the accelerator and brake, if you now look at the other traffic, as you wish to signal your desire to move off and steer into the road, your control of the accelerator and brake pedals often regresses.
5. When you have acquired a skill, however simple, you will find that if you concentrate on it, you become clumsy. If you are familiar with a QWERTY keyboard on a computer or typewriter, ask yourself if you can continue the line of letters after the ‘Y’ or list the next line. Why do you have difficulty? Your fingers go to them automatically because you have relegated them to a subsidiary awareness. Your focal awareness is directed at what you are writing.

6. You will appreciate that if you attempt to hurry, you are moving your primary focus from the accomplishment of the skilful performance to the individual movements, and you make mistakes. Take the example once again of the keyboard. Try typing at speed. Your focal awareness shifts to the keys, not to the content – and you make mistakes.

### Key points

- Having acquired a skill, always perform it at a natural pace.
- Hand speed and work speed are not parallel – they may even be opposed.
- Indeed, it often takes longer to repeat and correct a rushed and imperfect act than to perform it deliberately and correctly in the first place.

7. In order to acquire a skill you must practise it assiduously until you can perform it repeatedly and reliably. Just going through movements does not demonstrate a skill. You need to perform it perfectly, every time.
8. Watch and copy experts. Of course, they cannot bestow skill. Differentiate between trainers and masters. A trainer or coach can tell you what to do, assess you and identify ways to improve but does not necessarily have the personal skill to do it at a high level. A craft master (L *magister*) is one who is expert at *performing* the craft – and can show you. Watch and remember how they achieve their success.

## EXERCISES VERSUS PRACTICE

1. Since you need to carry out the task repeatedly to acquire skill, differentiate between exercise and practice. It is a distinction recognized more by instrumental musicians and those pursuing a career in sports, than by surgeons.
2. **Exercise.** If you wish to become accomplished at a particular procedure you have been shown, you may repeat it until it becomes second nature and you can carry it out without the need to concentrate on the component actions. Each repetition is the same as the previous one. The Suzuki method of teaching young violinists uses this method.
3. **Practice.** You may instead perform the manoeuvre, identify a difficulty or a means of facilitating it, adjust the next trial to judge its success in eliminating the difficulty, and making the procedure easier, better controlled and feeling more natural. Continue until you cannot improve it further and only then do you convert it into an exercise.<sup>2</sup>
4. Remain willing to modify it again if you find a better routine. One of the benefits of watching others is that it gives you the opportunity to see new approaches to difficult manoeuvres. Musical instrumentalists often ask experts to ‘finger in’ passages which they find difficult.
5. This intelligent practice augments the natural process of skills learning in which as we repeat a manoeuvre we develop a confidence in the probability of the next result and adjust the ‘feed-forward’ motor signals. During the performance, sensorimotor signals provide ‘feed-back’ adjustments to create the optimum result. This is a form of Bayesian integration.<sup>3</sup>

## HAPTICS

1. Do not be distracted by this word (G *haptein* = to fasten). It is well known in industry but relatively new in medicine and surgery. It becomes increasingly important as we introduce methods of ‘handling’ tissues by instruments that reduce or remove our ability to feel them, assess their surface, texture, temperature, and appreciate the force we are applying to them and their resistance to that force. It is the science of touch (possibly related to L *tangere* = to touch), creating an interface mainly between us and technological apparatus and instruments.<sup>4</sup>
2. During clinical examination of our patients we recognize and identify many structures by touch, assessing the surface, texture and temperature. We employ our kinaesthetic sense (G *kinein* = to move + *aisthesis* = perception) to explore them for homogeneity, strength, friability, flexibility and attachments. We may receive force feedback from resistance or vibrations. We rely heavily on our knowledge of the texture of structures and when we wear gloves, even thin surgical gloves, our appreciation of touch is impaired.
3. When you interpose an instrument between your hand and the target structure your tactile input is drastically reduced. Rigid instruments such as dissecting forceps, transmit more than do soft or flexible ones; when you pass a soft urinary catheter into the bladder you need to move it extremely delicately to appreciate the progress through the urethra. The more complex the link between hand and target structure, the greater the loss of touch.
4. You will find, as you embark on your surgical career that much of your training will be using instruments. Do not be misled into feeling that skill in manipulating them alone confers surgical skill. However, many surgical procedures are now performed without the operator touching the tissues. In order to reduce the exposure, minimal access procedures have been widely developed. When using

instruments, whether hand-held, mechanically or electronically linked, the sense of touch is reduced or lost. You may have the opportunity to experience on a simulator, the use of minimal access instruments, often with relatively long handles and the need to move your hand in the opposite direction to the intended tip movement. In robotic surgery the hand and target tissue are decoupled, being driven through electronic systems. Much research is directed at providing force feedback to the operator to help in the estimation of the tissues held within graspers.<sup>5</sup>

5. **Force and torque.** In other occupations artificially produced haptic feedback systems are in use to provide operators with, as yet limited, sensation of feel and measure of applied force and torque (*L torquere* = to twist). These are being introduced into surgical applications. When you watch an expert tighten a ligature it is impossible to know, and accurately replicate, the tension. Again, in the case of hand-held or electronically controlled robotic instruments, appreciation of the force transmitted is reduced or not sensed. It is now possible to measure the force exerted through some instruments.<sup>6</sup> An important finding is that novices tend to exert up to 130% more force or torque than is required by experts to perform the same procedure.

You do not need elaborate equipment to recognize the potential damage you can inadvertently create by pinching tissues with instruments. If the handles of hinged forceps are twice as long as the blades, your squeezing force is doubled at the tips. You may exert very high compression per unit area through fine forceps with tip surfaces as fine as 2–3 mm<sup>2</sup>. Use too much force and when you release your pressure the crushed tissue soon looks normal – but it will die or at best be partially replaced with scar. When you look at some old wounds, you see scarred lines crossing the healed wound – they result from too tightly tied sutures.

Whenever you encounter resistance, of any type, make it a habit to apply the minimum force to overcome it. Often this means changing your approach, method, or removing an obstacle that adds to the difficulty. When you watch or assist an expert surgeon you will be surprised how little force is used. Magically, the tissues seem to behave well out of respect for the surgeon. It is not magic. It is the result of intimate familiarity in guiding the tissues to conform to the operator's wishes. This is the essence of craftsmanship.

### Key points

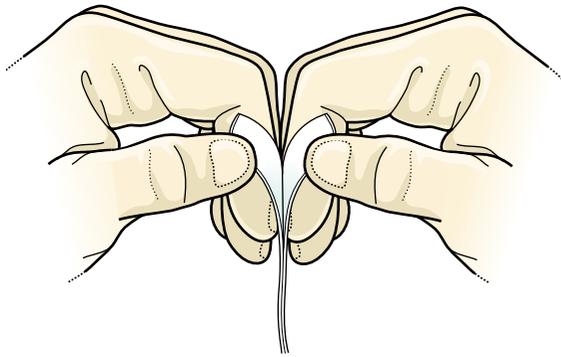
- Make it a habit in everyday activities, to achieve manipulations with minimal force.
- Consider trying several methods and choose the gentlest.

## TRANSFERABLE SKILLS

1. Even before you enter the operating theatre you can start to develop or improve the manipulative facility and sensitivity that you will require as a surgeon. Adapt every possible normal routine to hone your skills. Watch skilled workers in other vocations and you will see common traits, some of which you can incorporate into your training. It is a joy to see someone carefully assessing a problem, unhurriedly preparing the materials and tools, doing the preparatory work to facilitate the task, now seemingly effortlessly carrying out the needed procedure, reassembling, testing and approving the result. This is a demonstration of seamless assessment, decision, preparation, accomplishment, final assessment without haste or the need to correct imperfections.
2. The French surgeon Alexis Carrel (1873–1944) developed his suturing technique after watching an expert embroiderer in Lyon. He practised by inserting up to 500 stitches in a cigarette paper without once tearing it, becoming a founder of vascular surgery, for which he received the Nobel Prize in 1912. The British surgeon Lord Moynihan (1865–1936), who was famously skilled, was reported to carry a piece of string with which he practised tying knots whenever he had a spare moment.
3. As examples, when you peel a fruit, or open a sealed envelope, you can practise separating tissues without damaging them, while keeping in the correct plane. You achieve this by keeping the distance between the adherent surfaces and the distracting force to a minimum. Every time you open a sealed envelope, raise an edge of the flap and extend the parting. Grasp each edge between thumb and index finger. While keeping your index fingers pressed together, evert your hands so that the edges are separated. Limit the extent of the cleaving tension by compressing the still sealed section just ahead of the split between your middle fingers (Fig. 1.4). You are remarkably sensitive to incipient tearing. Unless you readjust your grip every few millimetres, your hands move apart, the extent of paper at risk is lengthened and you may not detect a tear starting anywhere along it.
4. Use your ingenuity to find other practice opportunities. Try to perform every action gently, neatly and with minimum disturbance.

## Speed

The examples of focal awareness demonstrate the importance of allowing your hard-won skill to be applied naturally. Do not compromise the benefits of this by hurrying.



**Fig. 1.4** Peeling apart two adherent strips. Trap the strips between the thumbs and index fingers. As you supinate your wrists, you separate the strips but maintain contact between your index fingers and then your middle fingers. This keeps the length of strips being distracted to a minimum. Do not separate your hands but repeatedly change your grip.

## Sequence (L *sequi* = to follow)

If you need to take apart, adjust and repair any structure or equipment, determine to attempt it without misplacing or dropping any part, and carry out the dismantling and re-assembly in the correct sequence. The value of the habit will be evident when you watch or participate in a surgical operation. There is a well-tried procedural order.

## SKILLS COURSES

1. In the past trainee surgeons watched, assisted and then operated on patients. Indeed there was an adage, 'See one, do one, teach one.' It is preferable for you to be shown in a course, away from the potentially tense atmosphere of an operating theatre, how to perform the procedures and carry them out under supervision and guidance. Take every opportunity to attend such courses.
2. Practice operations on live but anaesthetized animals is strictly limited except for microsurgery. For many years dead animal tissue has been used but increasingly, because of public health fears of transmitting viral and other infections, simulated tissues are used. The available models may look like the real body parts but it is not yet possible to create simulations with the complex, varied structure and consistency that you will encounter in surgical practice. This is a serious deficiency. The ultimate purpose of these courses is to teach you to operate on living tissue, yet this is lacking.
3. You must become familiar with handling surgical instruments and courses offer you this facility. You initially need to concentrate your attention on

controlling them, rather than controlling what is at the other end of them. As you become more familiar they become natural extensions of your hand and when you come to operate on living tissues, you can focus your concentration on the tissues rather than on the instruments, with which you are now proficient (see below).

4. Minimal access surgical courses are particularly valuable because you need to become familiar with the opposite effects of hand movements on instrument tip movement through the pivoted access port (see Ch. 13).
5. Virtual reality instruments and courses based on them provide you with the opportunity to learn how to control complex instruments that further remove you from the target tissues. At present they mainly offer exercises that you control under visual guidance. They offer the promise of greater haptic and force/torque feedback (see above).

## Key points

- Skills courses offer excellent introductions to operative procedures. They are adjuncts, not replacements, for training on living tissues.
- Skills courses do not transfer skills to you; they should reveal to you what skills you need to acquire by active practice.

6. *Create your own simulations.* Courses offer you a limited experience of carrying out operations. You need to create opportunities for practising the routines and become familiar with them. Use your ingenuity to create an arrangement that allows you to repeatedly follow through part or all of an operation. When you are offered the opportunity to carry out the same procedure in the operating theatre you will have the confidence to perform it competently. In the future, the surgeon, who is responsible to the patient, will be more willing to delegate a procedure to you if you have already demonstrated on a simulation that you can perform it safely.<sup>7,8</sup>

## RATIONAL ASSESSMENT OF INFORMATION

1. Part of your complex development as a competent surgeon is how you discriminate the information you receive. You will be simultaneously trying to improve as a physician-scientist, a practical craftsman, learning current accepted practice, yet being aware that this may be rapidly changing.

2. Be willing to follow the practice of your teachers. This often means that you have to change your methods as you pass through the rotating appointments. It is important that you do not become too rigid early in your career. Sometimes an unfamiliar method proves, with practice, to be an improvement on your current one.
3. Your trainers may claim that their success depends upon some possibly unique change in their technique or material, yet they seem to get similar results to others who do not perform in the same manner. You will learn that it is not the method or the material that is the component of success but rather the care with which it is incorporated into the procedure. Your teacher is too modest in attributing success to one change, when it is the result of outstanding commitment to skill and competence.
4. Improvements in techniques, instruments and materials constantly appear. Welcome them but assess them critically. Those who introduce them often unconsciously or consciously select the patients, and by committing to it greater effort and enthusiasm, obtain improved outcomes. Improvement in performance may also result from increased attention to it. This is often called the 'Hawthorne effect', named after a noted rise in productivity at a factory in Hawthorne near Chicago when the workers became aware that they were being assessed. It is only when uncommitted researchers detect improvement that you should embrace the claimed improvement.

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## FURTHER READING

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# Chapter

# 2

## Handling instruments

### CHAPTER CONTENTS

Scalpel	9
Scissors	10
Dissecting forceps (thumb forceps)	11
Artery forceps (haemostatic forceps, haemostats)	12
Tissue forceps	13
Needle-holders	14
Retractors	14
Clamps	15
Haemostatic clips	16
Stapling devices	16
Dissection aids	18
Electrosurgical dissection	19
Ultrasonic dissection	19
Miscellaneous methods	20
Intraoperative diagnostic ultrasound	20

Learn to handle and become familiar with standard instruments, since they are surgical extensions of your hands. Practise using instruments that are employed in open surgery to carry out functions that you would expect to carry out in surgical procedures. Acquaint yourself with minimal access instruments using simple simulations (see Ch. 13) and for both these and endoscopes attend courses and practise on any available virtual reality instruments.

### Key points

- Do not delude yourself into thinking you are expert because you can handle instruments.
- Your expertise is measured ultimately by how you deal with the tissues.
- But familiarity with instruments frees you to concentrate on the living tissues.
- **You are ultimately responsible for the instrument count.**
- Make sure you retrieve them all before closing.

### SCALPEL

The scalpel (*L. scalpere* = to cut) is the traditional instrument of surgeons. Solid reusable knives are still used for cutting tough tissues, but some instruments are totally disposable.

If you use a scalpel with a disposable blade, fit and remove the blade while holding it clear of the sharp edge with forceps or needle-holder, not with fingers. If it slips you will avoid sustaining a cut.

1. Use a scalpel for making deliberate cuts into tissues, dividing them with the minimum trauma in order to cut skin, separate tissues to reach a targeted area, divide and resect tissues.
2. Draw the belly of the blade across the target rather than exerting excessive pressure that may result in an uncontrolled cut. Draw the knife blade under controlled pressure to determine the depth of cut.