Chapter 1
THEATRES

Surgical instruments, 1
Sutures, 10
Theatre etiquette, 12
Patient safety and the WHO surgical checklist, 17

Surgical instruments
Matt Stephenson and Cheryl Funnell

Introduction
So many things in surgery are never actually taught; you will just be expected to pick them up by osmosis during your time in theatre. Learning the names of surgical instruments is one of those things. There is no secret course or lecture you’ve missed, it simply doesn’t get taught to trainee surgeons. Yet it sounds so much more professional to ask for Gillies Forceps rather than ‘some tweezers’.

One of the big problems with learning the names of instruments is that some hospitals call certain instruments one thing while others call them something else; this is usually the case at least with scissors and forceps. There is little continuity between units, sometimes even day surgery will call an instrument one thing and the main theatres another – all in the same hospital. However, you can turn this to your advantage; you can quite easily make up any name you like, who are they to say you’re wrong? OK perhaps not.

Some have eponymous names, others simply are called what they are. Even if you don’t learn the eponymous names (if there is one), learn how to describe the instrument, e.g. long dissecting scissors versus stitch cutting scissors. We have used some of the more commonly used names here, but in your own hospital they may very well be different.

There is such a vast array of instruments they cannot all be covered here. The best way to learn each of their names and what their special powers are, is to spend some time with an experienced scrub person.
Commonly used general instruments

Rampley sponge holder

The Rampley sponge holder is frequently used to hold a swab, which can be used to prep the skin and then discarded. You can also wrap a swab around its jaws and use this to dissect or dab blood – the so called ‘swab-on-a-stick’. It’s also useful in its own right to grasp hold of the gallbladder and pull it this way and that.

Forceps

Forceps vary first on whether they are toothed or non-toothed. Toothed forceps are good to grasp the skin edge when closing the subcuticular layer, but never use them in the abdomen where you risk making an enterotomy – non-toothed forceps are much safer for this. They also vary dependent on their length and robustness. The average toothed forceps common to many sets are Gillies forceps (although you can get non-toothed versions), whereas McIndoe forceps (sometimes called DeBakey forceps) are common non-toothed options. Lanes forceps can be toothed or non-toothed and are a little larger. More robust tips, for grabbing hold of firmer material such as tendons or cartilage, are Ramsey forceps.

Scissors

Scissors, broadly speaking, are divided into dissecting scissors (such as...
McIndoe scissors) and stitch-cutting scissors (such as Mayo scissors). You shouldn’t use the former to cut stitches because it blunts the blades, and you shouldn’t use the latter to dissect as they aren’t delicate enough. Sometimes there is tough tissue to cut through, however, such as when opening the abdomen, and here using the Mayo scissors to chomp through the linea alba once the bowel is out of the way is the preferred method for some. They can also be used on tough scar tissue. Dissecting scissors are almost always curved, as this makes dissecting easier. Mayo scissors can be curved or straight.

**Haemostatic clips**

You’ll need something to clamp off vessels, or bits of tissue in which you
think there is a vessel. You need a haemostatic clip, or clamp, more confusingly also generally called artery forceps. They range in size, can be straight or curved, and can be slender or thicker. Mosquito or Dunhill artery forceps are on the smaller side. Spencer–Wells artery forceps are average in length but quite slender, whereas Birkett artery forceps are fatter and more robust for grasping chunks of tissue. Going up in size are Roberts artery forceps and, even bigger for fat chunks of tissue deep in the abdomen for instance, Moynihan artery forceps.

Lahey artery forceps have a right-angle turn on their tips. This makes them very useful for dissecting around the back of vessels or ducts, and you can also mount a tie on them and pass it easily around an inaccessible vessel in order to ligate it.

**Special tissue-holding forceps**

There are three particularly special tissue-holding forceps (the names of which you’ll be glad to know are usually quite consistent across the land and therefore worth memorising). Babcock forceps have atraumatic tips that are excellent for encircling the appendix or picking up bowel or other tissue. Atraumatic should really be in inverted commas – they can damage the serosal surface of the bowel, so when fishing around for the caecum in an appendicectomy you should still be careful. Allis forceps are perfect for picking up the subcuticular layer of skin to retract or lift it up, or to place on some tissue that you’re resecting and want to draw up into the wound. Beware, however: these cannot be used on bowel – they will damage it. Then there are the Lanes tissue-holding forceps (not to be confused with Lane forceps). With very much traumatic tips, they will grasp anything firmly by biting into it, so these should only be used on structures such as the fascia of the abdominal wall – never inside the abdomen.

**Needle holders**

Needle holders, like everything else, vary depending in length and the robustness of the tip. Clearly a small needle requires a fine tip, a big needle requires a robust tip. A deep suture requires a long needle holder, a skin suture requires a shorter one. If the handles are golden,
the tips are made from **tungsten carbide** – a very strong needle holder that won’t slip.

**Retractors**

Retractors can be either of the kind that you pull on or the kind that holds itself apart, i.e. self-retaining. Probably the commonest example of the former is the **Langenbeck retractor** – excellent for retracting the edge of a wound – which come in a variety of sizes. An alternative is the **Czerny retractor**, which has two prongs to lift up the skin edge. To retract the abdominal wall you need something more robust like a **Morris retractor** or to retract deeper layers, a **Deaver retractor**.

Sometimes you only need to retract the skin edge, when creating a flap for instance in a mastectomy or thyroidec-tomy. An instrument with a single hook is a **Gillies skin hook**, and with two hooks a **McIndoe double-prong skin hook**.

The commonest and most ‘middle-sized’ **self-retaining retractor** is a **Travers retractor**. For a deeper wound, use a very similar instrument – the **Norfolk and Norwich retractor**. If you need a small version, for
A Yankauer sucker is a disposable plastic sucker that sucks from the tip and is thus useful when you want to suck in a particularly focal place. Often you may just want to suck more blindly in a pool of fluid, or if the tip keeps getting blocked with lumps of fat, in which case you can use a Pooles sucker, which has an inner piece and an outer guard that screws on to it. It sucks over a broad surface area. The inner piece on its own can be a useful instrument for doing blunt dissection.

Diathermy equipment

Sucking up the blood isn’t going to stop it bleeding though, unfortunately; for that you may find the diathermy helpful. Diathermy comes in two broad kinds:

- **Monopolar** – the AC current passes from a diathermy machine through a lead to a diathermy instrument, usually forceps, a finger switch or point. It then passes through the tissue you want to coagulate or cut, through the patient’s body, the earthing plate, a wire and back to the diathermy machine. Never use it on an extremity or the returning current to the earthing plate will concentrate at the narrowest point and heat up – a lot.

- **Bipolar** – the AC current passes between two metal components of the instrument, for example the tips of some forceps or the blades of scissors. It passes from one tip, through the tissue to be cut or coagulated and back up to the machine through the other tip (thus also having the advantage of going nowhere near the patient’s pacemaker).

It is strongly recommended that you always ensure that the smoke produced from burning flesh, also known as the diathermy plume, is extracted by an evacuation device, because of the potentially oncogenic contents.
Miscellaneous general

**Pledgets** are small, almost pea-sized things, usually made of gauze, which can be grasped in the end of a **Kocher forceps** (one of the few useful roles for such forceps as they have an extremely traumatic bite to the tip). These can be very useful for fine blunt dissection, for instance when trying to define the structures in Calot’s triangle or the axilla.

Bowel clamps can be **non-crushing (Doyen)** or **crushing (Stevens)**, curved or straight. Never use crushing bowel clamps unless you’re planning on removing whatever bit of bowel you’re crushing, and sending it off to the lab.

Blades are mounted on **Bard-Parker handles**, or colloquially known as **BP handles**. They come in a variety of sizes.

The **Howarth elevator** and the **McDonald dissector** have a variety of uses. They can help in bluntly dissecting a plane, for instance during an endarterectomy, or lifting up the nasal mucosa.

The **Volkmann spoon** is a type of curette; they come in various sizes and can be used to scrape out the lining of an abscess cavity or sinus, for instance. Larger ones can be used to scrape out the femoral canal.

**Orthopaedic**

**Bone spikes** and **ring handled spikes** are useful to get control of fragments of bone when operating on a fracture site, for instance.
Northfield bone nibblers come in a variety of sizes and do the function you’d expect – nibble bits of bone – useful for anything from nibbling off osteophytes to removing residual bony spikes in a toe amputation. Bailey bone cutters are the bony version of scissors and also come in a variety of sizes.

An orthopaedic mallet can be used for chiseling, banging home prosthetic hips and generally making a lot of noise.

Remember, bone is covered in a layer of periosteum which you frequently need to peel off the bone cortex.
itself. The **Bristow periosteal elevator** will do this for you nicely.

**ENT**

The **dental syringe** has greater versatility than just invoking fear at a visit to the dentist. It stores a glass vial, the contents of which can be inserted into mucous membranes of the nose or mouth.

The **toffee hammer** is the much more genteel version of the orthopaedic mallet. It is light and easily handled, and can be used to chisel up the nasal carriage, for instance.

**Tilley–Henkel forceps** can be used to extract tissue deep within the nasal cavity and beyond. There are a variety of other **nasal polyp forceps** and **nasal scissors** to fit up the nose.

**Killian nasal speculums** also come in a wide range of sizes and are obviously inserted into the nostril to gain access.
Sutures
Matt Stephenson and Cheryl Funnell

Introduction
There is a bewildering array of sutures, and because there are different manufacturers, there are different commonly used names for essentially the same sutures. In general, it is acceptable to use the trade name of a suture in exams, as long as you know what it is and why you'd use it. You're also more likely to get a blank look from your scrub person if you ask for Polyglactin 910 rather than Vicryl.

Two of the commoner suture manufacturers are Ethicon and Covidien. Your hospital may stock sutures from both suppliers, and there will therefore be a different trade name for each supplier for what is more or less the same suture, making it very frustrating to learn them all. We'll discuss the common attributes of sutures that you need to be aware of to help you choose which one to use, and then some examples of commonly used sutures.

If you really want to get into sutures though, there are many other characteristics to be aware of which aren't covered here, such as breaking strength (limit of tensile strength), capillarity (extent to which fluid is absorbed up its length), knot-pull tensile strength (tensile strength after knot tied), fluid absorption (amount of fluid absorbed after immersion), natural or synthetic, etc.

Absorbable versus non-absorbable
In a vascular anastomosis of Dacron graft to aorta, the join is never going to heal in the way a bowel anastomosis will.

Figure 1.35 The average suture stock.
The suture must be as strong 20 years down the line as it is the day you put it in, so you need a non-absorbable suture. The same goes for hernia meshes. However, if what you’re stitching together is eventually going to heal up, e.g. a bowel anastomosis, the linea alba, the fascia lata, etc., you can use an absorbable suture, so that there won’t forever be a foreign body there to act as a nidus for infection, for instance. Some tissues take longer to heal, therefore you will want to use suture material that dissolves over a longer time period.

**Monofilament vs braided (polyfilament)**

Ideally all sutures would be monofilament, as there are fewer microscopic grooves and hiding places for organisms to fester and cause an infection. However, monofilament sutures have two significant disadvantages: first, they tend to have more memory (they keep recoiling to their awkward shape even if you stretch them out); and second, they are less strong.

**Size (thickness)**

Whoever came up with the sizing system for suture thickness should be ashamed of themself. It is of course a throwback to when sutures were much thicker. Originally they were numbered 1 to 6, 1 being the thinnest available, 6 the fattest. However, with great advances in suture manufacturing and materials technology, thinner sutures could be used instead with equivalent strength (and less foreign body). So they started numbering back to 0 and then 2-0, 3-0, 4-0, etc., down to 11-0, which is like trying to suture with a spider’s web, and only used in ophthalmic surgery. In general, it’s rare now to use a suture thicker than a 1.

**Needle type**

Some more mature theatre sisters will tell you how they used to have to thread the suture through a hole in the needle. Of course this has been superseded by sutures that are attached to the needle already (using a process called swaging). The former were necessarily more traumatic as there would be a tiny bulge at the site where the needle had been threaded. The latter are described as atraumatic needles. There is a variety of shapes of needle and they also vary in the geometry of the point. Shapes include straight, ¼ circle, ⅙ circle, ⅘ circle, ⅜ circle and J-shape, and they can be selected mainly based on the space you have available to put the stitch in. For instance, a J-shaped needle is ideal for getting down a deep dark laparoscopic porthole. Point geometry variations include the following.

- **Round body** – which smoothly tapers to the point; a commonly used standard needle. They make the smallest possible hole in the tissue, good for anastomoses but not really strong enough for tough skin.
- **Cutting** – triangular needle body with extra sharp cutting edge on the inside (i.e. on the side of the wound edge); for tougher tissues.
**Reverse cutting** — again for tougher tissues but having the cutting edge on the outside, i.e. not the side of the wound edge, which means there’s less likelihood of the needle cutting out through the tissue edge.

**Tapercut** — a cutting needle body that also tapers to a diameter not exceeding that of the suture (ideally), thus attempting to combine the powers of both the round body and cutting needle.

**Blunt** — no sharp point but can still be passed through some tissues, as in mass closure of the abdomen, with less risk of pranging bowel or your fingers.

### Specific examples

The commonest absorbable sutures you are likely to come across in most surgical practice are **Vicryl** or **Polysorb** (roughly equivalent). They can be used for general ligating and transfixing of vessels or chunks of tissue, or closing layers of tissue in most cases. The average thickness is 2-0. So if in doubt in your exam, the answer is probably 2-0 Vicryl. For thicker leashes of tissue or bigger vessels, use a thicker thread such as 0 Vicryl. It’s important to choose an appropriate thickness of thread for the tissue you’re ligating. You wouldn’t tie a boat to a dock with a fishing line, just as you wouldn’t use a rope to go fishing. Vicryl and Polysorb can be used for closing skin too, although because skin heals quickly, many people prefer to use **Vicryl Rapide**, or **Monocryl** or **Caprosyn** (roughly equivalent), to minimise the time foreign material is in the wound. Also you wouldn’t want to use Vicryl or Polysorb to close tissue that will take several weeks to heal — the linea alba after a laparotomy for instance. Here, **PDS** or **Maxon** (roughly equivalent) will do the job.

The main non-absorbable sutures in common use are **Prolene** or **Surgipro** (roughly equivalent), which are biologically inert and have good strength — use them for vascular anastomoses and hernia repairs. Again, 2-0 is the average for a hernia repair or a large vascular anastomosis such as the aorta to a graft, for instance; whereas 7-0 would be used for a radiocephalic fistula. **Nylon** sutures tend to be used mainly for interrupted sutures when closing skin, but are also useful for incisional or parauembilical hernias where you want the tissue to be held together for as long as possible to give it time to heal. **Silk** sutures have disadvantages, mainly because they’re braided and can cause a biological reaction in the tissue. They are generally reserved for stitching in the drain, marking a specimen or practising tying knots.

### Theatre etiquette

**Matt Stephenson and Ginny Bowbrick**

**Introduction**

Theatre is a unique environment and one in which, as a surgeon, you will want to be most comfortable. Sometimes on entering a new theatre you find yourself entering a peculiar world filled with fragile egos, ambitious
Table 1.1 Commonly used sutures with some of their important characteristics

<table>
<thead>
<tr>
<th>Ethicon name</th>
<th>Covidien name</th>
<th>Half life and complete absorption</th>
<th>Mono or braided</th>
<th>Examples of use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Absorbable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PDS (polydioxanone)</td>
<td>Maxon (polytrimethylene carbonate)</td>
<td>T½: 21 A: 180</td>
<td>Mono</td>
<td>Mass closure</td>
</tr>
<tr>
<td>Vicryl (polyglactin 910)</td>
<td>Polysorb (lactomer copolymer)</td>
<td>T½: 14–21 A: 56–70</td>
<td>Braided</td>
<td>Very versatile, commonly used suture</td>
</tr>
<tr>
<td>Vicryl Rapide (polyglactin 910)</td>
<td></td>
<td>T½: 5 A: 42</td>
<td>Braided</td>
<td>Subcuticular</td>
</tr>
<tr>
<td>Non-absorbable</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prolene (polypropylene)</td>
<td>Surgipro (polypropylene)</td>
<td>N/A</td>
<td>Mono</td>
<td>Vascular anastomoses, hernia repairs</td>
</tr>
<tr>
<td>Ethilon (nylon)</td>
<td>Monosof (nylon)</td>
<td>N/A</td>
<td>Mono</td>
<td>Skin stitches</td>
</tr>
<tr>
<td>Permahand silk (silk)</td>
<td>Sofsilk (silk)</td>
<td>N/A</td>
<td>Braided</td>
<td>Drain stitches</td>
</tr>
</tbody>
</table>

*T½ = half life in days; A = complete absorption in days.*
career climbers, clandestine political wrangling and complex power struggles. Patients also have operations there. For that reason, learning to grease your way through this often complicated domain is very important.

You might broadly divide the rules you should observe into before, during and after the operation. In general it is just common sense.

**Before the operation**

Few things are more like a red rag to a bull for a consultant than somebody turning up to his list without having done a bit of groundwork beforehand. Not going to see the patient before the operation, or at least having a good read of the notes and review of the imaging if applicable, is asking for trouble and you will have little or no chance of being allowed to operate on that particular patient. It is a good idea to bring up any relevant imaging such as computed tomography (CT) scans or arteriograms on the theatre computer and this can also turn into an impromptu teaching session with the boss while waiting for the patient to be anaesthetised. But it’s not enough to know the patient; you need to have some idea of what the operation is about, too. Read about and watch the video the night before if you know what’s on the next list. The sooner you show that you know and understand the operation, the sooner you’ll be allowed to do it yourself.

It’s a favourite pastime of all surgeons to conveniently forget that their knowledge of anatomy probably wasn’t very good at your stage of training either, but still scoff and bemoan the demise in undergraduate anatomy education if you can’t recall some obscure anatomical fact. In fairness, there is probably some truth in this – anatomy has taken a battering in many undergraduate courses. Make sure you’ve opened an anatomy textbook and/or atlas before the operation so that you can at least guess the answer to any questions fired at you.

If it’s your first time in a particular theatre and you’re not familiar with the theatre staff, introduce yourself before the list starts. With a theatre sister not known for her friendliness to new intruders, having a little one-to-one time in theatre will make it a lot more challenging for her to make your life more difficult. Communication is key to the successful running of a theatre list – if, for instance, you know of a change in circumstances that will affect the list, let the theatre staff know as soon as you can. Respect the theatre staff – they often have an extraordinary amount of knowledge and experience, which will help you out in times of trouble. If left to operate without the boss, an experienced scrub nurse may for instance suggest instruments that the boss uses at different steps of the operation, but if you have not made any effort to get to know them then they will not. Never underestimate the relationship between the long-standing theatre staff and your boss.

**Dress appropriately.** It’s obvious what you should and shouldn’t wear but it’s surprising to see how many new students or trainees arrive in theatre with a big fringe hanging down from under their hat or bling jewellery dripping off their fingers. Some theatres have colour-
coded hats such as green for students and blue for qualified staff, whether medical or nursing, so it pays to ask first if this applies in each hospital you work in. Don’t wear your identification badge dangling somewhere near your genitals where people can only look at it by making themselves feel uncomfortable. If you need to speak to someone in theatre, it’s always a good idea to get changed into scrubs and go inside, rather than trying to talk through a crack in the doorway. It’s usually best to pass on a message via the scrub person who can then speak to the operating surgeon at an appropriate time. Never ever wear someone else’s clogs or you may end up with an irate and barefoot consultant hunting you down from theatre to theatre.

When watching an operation, make a big show of taking great care of preserving the sterile field. Don’t, for instance, walk between the scrub person’s sterile trolley and the operating table, and avoid walking around the anaesthetic end of the table when scrubbed – remember all surgeons view anaesthetists as dirty.

You need to get the theatre staff on side. This is immeasurably important. Make yourself useful and show that you’re happy to muck in with whatever needs to be done and that you have no airs and graces about doing so. If the phone is ringing in theatre answer it. If there’s a dirty swab dropped on the floor pick it up. When the patient is transferred help. If there are no snacks or sugary treats in the preparation room buy some. Be ready to catheterise the male, or female, patients if required.

Leave your bleep wherever it’s supposed to be left (often this is at the front desk of theatres) or, if you can, hand it to a colleague to cover. Return the favour for them another time. Don’t screw your colleagues over. Turn off your mobile phone. Don’t be shy about asking to scrub up. Obey the World Health Organization (WHO) checklist (see Patient safety section), or instigate it yourself.

During the operation

Get to know your consultant’s glove and gown size and open theirs for them before the case, as well as your own. Scrub thoroughly in the usual way and always scrub for slightly longer than the next most senior person to you. Hold your hands together across your chest when walking from the sink towards the table, and maintain sterility at all times.

When assisting, look and be attentive but don’t grovel. If and when it seems appropriate, try and ask appropriate questions but don’t be too talkative, unless that’s the way your boss is. Suggestions and discussion of technique and steps in the operation are welcome – criticisms or saying how much better your last boss did something are not. Don’t yawn and don’t gossip with the other staff. Try to blend in with whatever the mood and ethos of that theatre seems to be. Make yourself as useful as possible when assisting. Try to anticipate what the operating surgeon is about to do next, which often takes a lot of practice, as you may not yet know the next step, but if a knot’s being tied for instance, you’re
Theatres

likely to need to cut the suture soon, so have scissors ready.

But of course, you don’t want to be assisting all your life. You want to get your hands on the knife. Your success in this depends on many things, not least the generosity, patience and self-confidence of your boss (perhaps the three most important characteristics to have in a trainer), and the relationship you develop with them. Make sure you know the basics: suture, tie knots, hold instruments, etc. The Basic Surgical Skills course helps with this. Many bosses will judge whether you can do the operation on whether you can assist well, so get the basics right. Borrow instruments from theatre to practise with in the coffee room and practise tying knots – there is many a surgical trainee’s bag or theatre coffee room chair leg with Vicryl ties hanging from them used to practise knot tying until smoothly performed.

If you’re not getting much operating time, make it known gently that you’re very interested in getting your hands on such and such a case. Tell him or her you’ve assisted in x number of procedures before and demonstrate your knowledge of the steps, and hint at how hard you’ve been working on the wards. If this doesn’t work, your options range from purposely finishing scrubbing before your boss and then standing on the operating side of the table, to snatching the knife out of his hand. The latter, in general, is not recommended. If all else fails talk to your surgical tutor about your predicament.

When the patient is awake, under local anaesthetic, the atmosphere in theatre is usually very different. Remember you are there purely for that patient. Their comfort should be the focus of everyone’s attention. They should have someone available to talk to them (unless they are sedated) all the way through. Take great care to remember all the way through the operation that the patient is awake and refrain from discussing your plans for the weekend or a recent mess party. In some theatres, a large sign is placed in a highly visible place to remind everyone – it can be easily forgotten. Ask the patient if they would like to listen to music during the procedure and if so listen to what they would like, rather than your preference.

All consultants have their own way of doing things, such as a preferred skin suture, so if allowed to operate on one of their patients it is only polite to do what they prefer, otherwise you will find yourself no longer operating on their patients, and rest assured the theatre scrub nurse will tell them if you digress. If you also always do it your consultant’s way while you’re working for them, for example doing all the dissection with a knife or scissors rather than the diathermy pencil, it also allows you to build up a wider range of skills by the end of your training. Eventually, you’ll be able to decide the way you prefer to do it.

After the operation

You haven’t finished the operation until you have helped transfer the patient back on to the bed. Clean up any detritus on the floor or around the operating trolley – make yourself useful. Offer to make the boss a coffee or take the op notes through to recovery when
written – an all-day list requires a lot of concentration and is tiring, so these things will help to enhance your relationship with your boss.

It is mandatory to go and see your patient afterwards and let them know how it went. Sometimes at the end of a late list that’s very difficult to do, especially if it’s anticipated they’ll take a long time to wake up. Make sure that at least the nursing staff or on-call surgeon is well informed from your op note. Make the op note as clear as possible with your postoperative instructions (see How to write the operation note section). Thank everyone in theatre, especially if you’ve delayed the list because you were being trained. If you performed the operation, try to have a debrief with your trainer on what you did well and not so well, preferably in the format of a procedure-based assessment (PBA). Record the operation in your logbook.

Patient safety and the WHO surgical checklist

Matt Stephenson and Christopher M Butler

Introduction

A relatively new hot topic in surgery is patient safety. But what does that mean exactly? The true magnitude of adverse events for patients during their time in contact with healthcare services was underappreciated until the 1990s. Statistics such as ‘1 in 10 patients affected by an adverse event’ during their inpatient stay raised a few eyebrows. In 2007 in England and Wales, a whopping 129,419 incidents relating to surgical specialties were reported to the National Learning and Reporting Service (a branch of the NPSA, see later) – including 271 deaths – and that’s just the ones that were reported (bear in mind that reporting adverse events is now more than ever considered a crucial part of our duty as doctors). All sorts of factors impact on errors in patient care, from simple human errors to complex systemic failures. This is a growing discipline of healthcare science. But what is most relevant to our practice as surgeons now?

The National Patient Safety Agency (NPSA) is charged with the responsibility for patient safety within the NHS and a check of their website (www.npsa.nhs.uk) will reveal a wide variety of guidelines for aspects of surgical and anaesthetic care, from alerts about the use of throat packs to avoiding wrong side surgery for burr holes. Make yourself aware of these guidelines and advice – they’re there for a reason. Serious problems have happened in the past, which have resulted in harm to patients. There’s only one thing better than learning from your own mistakes, and that’s learning from someone else’s.

What’s the worst thing that could happen to you in your career? Your patient’s anastomosis breaks down? You get a complaint from a patient because
they had to wait too long for their hip replacement? Your young RTA victim didn’t survive their serious injuries despite your heroic efforts? How about taking out the wrong kidney? Or getting your patients mixed up and stripping someone’s long saphenous vein when you were supposed to be fixing their hernia? Or performing major elective vascular surgery and realising too late that there’s no blood available and they exsanguinate? In the first three, within reason there’s probably nothing else you could have done. The latter examples are catastrophic, avoidable and violate the first rule of the Hippocratic Oath: First, do no harm.

The patient safety checklist

In June 2008, the World Health Organization launched a global initiative (as by no means is this problem peculiar to the UK) called ‘Safe Surgery Saves Lives’. At the core of this, is a simple checklist. The idea behind it is to partially ritualise the process of perioperative care to make certain that in every single case, the most significant errors are avoided. Some of these errors have been termed never events – in other words, they should in no circumstances ever occur because they are avoidable and disastrous.

The checklist (see page 21) comprises three stages: sign in, time out and sign out. One member of the theatre staff – and it can be anyone, including you – must read each of these steps out aloud to the team. They may vary slightly from hospital to hospital, but this is the blueprint.

**Sign in**

Before the patient is even induced, the first part of the checklist must be completed. First, has the patient confirmed his or her identity and procedure, and have they signed the consent form? This is probably the most crucial step of all and it’s generally taken for granted by us as surgeons that the right patient will turn up on the operating table. But without this step, you are essentially entrusting your GMC registration to the quality of your hospital porters. Second, is the site or side marked? In every case, if the operation is planned on one side of the body, they must be marked preoperatively, with the patient awake and witnessing where you’re marking them so they can correct you if you’re wrong. It doesn’t matter if it’s the only foot that’s gangrenous or the only groin with a massive lump poking out (which may reduce on lying down and muscle relaxation). Third, is the anaesthesia machine and medication check complete? Yes, well, presumably that would be important, but one doesn’t want to trifle too much with what the anaesthetists do. Fourth, does the patient have a known allergy? The importance of this speaks for itself. Put away your betadine if it turns out they’re allergic to iodine. Fifth, is there likely to be a difficult airway or aspiration risk? Should you have put a nasogastric tube into your bowel-obstructed patient before induction? Sixth, is the risk of blood loss likely to be greater than 500 ml (or in a child 7 ml/kg)? In which case
make sure blood resources are available to you if necessary.

Time out

The patient is now asleep and on the table. The theatre team reassembles and introduces themselves by name and role. Obviously this is particularly important if you’re new to the theatre, but even in theatres with consistent staff and a consultant who’s been there for 30 years, think about how often there’s an agency nurse or a new medical student. One infamous case of a ‘wrong side’ nephrectomy occurred despite the medical student noticing they were about to operate on the wrong side and flagging it up – she was ignored. The concept of flattened hierarchy is that no longer should anyone feel they’re not important enough to raise a concern. The HCA should be able to tell the consultant she’s noticed the patient has a pacemaker and that therefore monopolar diathermy is contraindicated, for instance. By getting everyone’s names and roles clear at the start, communication between the team can then flow much better.

You must then check again – what is the patient’s name, what procedure are you planning, on which side, and what position do you want the patient in? It may sound far-fetched, but cases have occurred when the patient who came into the anaesthetic room is not the one who comes on to the operating table. Imagine you are on call and this is the emergency list. Your patient was in the anaesthetic room and you were called off to A&E for an emergency. You return to theatre half an hour later to drain said patient’s abscess, only in the time you were gone an urgent testicular torsion took precedence over your patient who’s been returned to the ward. It has happened! Don’t rely on everyone else to prevent your mistakes.

As doctors we don’t tend to like protocols, but in some cases they can truly get you out of some very unpleasant situations. Put up with the fact that perhaps 99% of the time there are no hidden surprises in order to safeguard that one patient, and you, from those odd freakish out-of-nowhere events that will have life-changing consequences not only for your patient, but for you, too.

Next, you want to warn the team about any critical events you anticipate. This could range from needing a rigid sigmoidoscope to assess the rectal mucosa when draining a perianal abscess, to a crucial piece of equipment you might need should something go wrong. There is then the rather unfortunately phrased: ‘Are there any critical or unexpected steps you want the team to know about?’ It doesn’t mean ‘do you expect there to be any unexpected steps’, which would indeed make no sense, it means are there any steps that you know might happen but the team weren’t expecting (however, this question invariably invokes incomprehension and derision from theatre staff every single time it’s mentioned)? How much blood loss are you anticipating? Of course it may be difficult to say, but you’re best placed to make an educated guess. There are also some questions for the anaesthetist regarding their concerns and their American Association of Anesthesiologists (ASA) grade etc., and also for the scrub person.
If you haven’t heard of the **surgical site infection bundle**, here it is. It comprises four aspects of care that have an evidence base to reduce the risk of surgical site infection. Quite why it’s called a bundle is anybody’s guess.

1. Has **hair removal** been performed adequately? Ideally it should be avoided altogether, but where necessary it should be done with clippers, not a razor, with minimal disruption of the skin and as close to the time of surgery as possible.

2. If **antibiotics** are indicated (always for instance when bowel may be opened, including always before an appendicectomy) have they been given within 60 minutes prior to the operation?

3. Has the patient’s **blood glucose** been adequately normalised?

4. Has the patient’s **temperature** been adequately normalised?

The morbidity from **venous thromboembolism** is very significant to us all in our surgical practice. All patients must be **assessed** for their need for low molecular weight heparin and intraoperative pneumatic calf compression or at least thromboembolic deterrent stockings (TEDS). Finally, are the relevant **images** up on the computer screen or X-ray box? If you need to see a mammogram to help guide you in your wide local excision, you don’t want an added 10 minutes of anaesthetic time while someone runs around the ward trying to find it.

**Sign out**

Once the procedure has been completed there is a third and final step to the process. The **name of the procedure** needs to be clearly stated (it often seems strange, when you’ve been slaving away at a laparotomy for the past two hours, how no one else in the theatre actually knows quite what you’ve been doing – least of all the anaesthetist). This enables safe handover to the recovery staff and recording of the procedure in the log. The scrub person **must confirm that the final count of swabs, needles and instruments is correct** (by the way, when they tell you this don’t just ignore it, thank them, it’s also for your benefit – who do you think will be in court if a swab is left in the abdomen?). The **specimens** must be appropriately **labelled** and any **faulty equipment reported** and acted on. Finally, are there any concerns for recovery or the ward for the ongoing management of this patient? Do they, for instance, have palpable pulses at the end of the operation and would you want to know if they vanish?

**Summary**

The WHO surgical safety checklist is not a tick box exercise. OK, so it is in fact exactly a tick box exercise, but for it to have value, it must be much more than that. It is not simply the observance of these steps in order to get through them quickly to satisfy sister; much more important is the **spirit** in which the checklist is handled. It is there for your **benefit** as much as anyone else’s. It is there to prevent a once-in-a-career event that could ruin your patient’s life, and yours. It’s there to help mitigate against our natural **human tendency to err**, even if we’re so superhuman
Figure 1.36 WHO surgical safety checklist. This checklist is not intended to be comprehensive: additions and modifications to fit local practice are encouraged.
we only err once every few decades. What’s more, there is an evidence base to it. Despite all of that, you will find that surgeons’ opinions about its usefulness are split, in common with pretty much anything else ‘new’ that’s ever been introduced to an established system, be it Ignaz Semmelweiss’s attempts to introduce hand washing in the 1840s or laparoscopic surgery in the 1970s. Get used to it, embrace it, it’s here to stay.

How to write the operation note

Matt Stephenson and Petra Marsh

Writing the operation note is one of those things no one ever shows you how to do. In truth it’s not difficult and you basically just write down what you did. But there are a few simple things to remember to include and a commonly used standard format adopted by many surgeons for most operations.

You want your operation note to be easily found in the notes, to accurately answer any questions a nurse or doctor might have when looking after your patient on their first postoperative night and to contain all the useful information that might be sought 10 years down the line. The more experienced you become and the more hospitals you travel around, and then back to years later, the more you come across your own operative record written years back – you can then judge your own work retrospectively.

It’s obvious of course, but begin by putting the patient details at the top of the page – name, hospital number and date of birth as a minimum. Put the date in the left margin and the time of the operation – not so essential for elective cases but for emergency ones it’s more important. Some people like to write the start time (knife to skin) and the end time (closed up) with an arrow between the two; it’s often helpful to know how long the operation took.

So, on to the operation note itself. What colour do you write it in? Well you will doubtless have heard innumerable times that you mustn’t write in the notes in red ink. This dates back to pre-ancient times when photocopiers struggled to copy red ink, in the event that your notes might be requested by the coroner or similar. Well if you can find a photocopier these days that can’t photocopy red ink, hats off to you. The idea of using red ink is that when you’re in a hurry leafing through vast volumes of notes, 95% of which are taken up by completely superfluous paperwork, you can more rapidly identify the important operation note. However if your trust condemns such practice, obviously one must submit and write it in black.

In some hospitals it’s normal practice to type all operative notes. This is particularly helpful if your handwriting isn’t up to scratch. The only caveat to this is make sure it is typed straight away, not dictated on to tape to be typed the next day. If your patient has a problem in the middle of the night and the team looking after them doesn’t have the op note to

Theatres
find out what went on in theatre, you’ll be in big trouble.

At the top of the page write:

OPERATION NOTE (if it’s not preprinted)

And below this, the name of operation for instance:

RIGHT INGUINAL HERNIA REPAIR

Then put:

Surgeon: YOUR NAME
Assistant: SOMEONE ELSE’S NAME

Then the form of anaesthesia used, who did it, if any antibiotics were given and what venous thromboembolism prophylaxis measures were taken. For some situations it’s also worth writing down the patient’s ASA.

GA + Ilioinguinal Nerve Block: DR GAS

You should then say whether this was an elective case or an emergency case done on the CEPOD list. Sometimes it’s obvious, but occasionally it’s not and that can be useful in the future and also helps the clinical coders (the people that break down all hospital episodes into codes, and codes mean prizes, for the hospital at least). In some hospitals you even have to look up the code yourself.

Do you know why the emergency list is called a CEPOD list by the way? In the olden days emergencies would go to theatre as and when, tacked on to the end of elective lists (as they still are sometimes) or carry through into the middle of the night. In 1982 there was a study – Confidential Enquiry into Peri Operative Deaths – looking at outcomes from surgery and anaesthesia dependent on various factors, including when it was performed. One of the outcomes was that it was best not to do non-life- or limb-threatening surgery in the middle of the night, and recommendations were made to create dedicated theatre space during the day to accommodate emergencies. This enquiry was the precursor to the formation of the National Confidential Enquiry into Patient Outcome and Death (NCEPOD), which has looked into many other clinical governance issues. We digress. So simply state:

EMERGENCY (CEPOD list)

Then write the indication for the surgery, although this isn’t always necessary as it’s often self-evident why you’re doing the operation, but you might do a Hartmann’s procedure for instance either because of bowel obstruction or perforation.

INDICATION: INCARCERATED INGUINAL HERNIA

So now to the nitty gritty of it. For most operations you can follow the same formula: incision, findings, procedure, closure, usually abbreviated to I, F, P and C. Generally move to lower case unless your handwriting is a real problem.

I: Right groin crease

Then tell them the punchline straight away, what did you find? After going through the skin, everybody gets to the hernia in roughly the same way, so you don’t have to repeat every obvious step about going through fat, fascia, etc. Diagrams can be really useful; they don’t have to be complex, but when trying to explain what vessel you anastomosed on to what, for instance, or what the configuration of the fracture and
your plates and screws were, a picture tells a thousand words.

**F:** Incarcerated indirect inguinal hernia
   Sac containing viable omentum, no bowel
   No direct hernia

So **what did you do** about it?

**P:** Sac dissected and opened
   Cord structures identified and preserved
   Sac contents inspected and returned to abdomen
   Sac transfixed and divided
   Polypropylene mesh shaped and sutured in place
   Haemostasis

Include any biopsies or microbiology samples taken. And then how did you **close the wound** and did you put in any more local anaesthetic?

**C:** External oblique – Vicryl 2-1 continuous
   Fat/superficial fascia – Vicryl 2-0 interrupted
   Skin – subcuticular continuous monocryl 3-0
   Opsite dressing to skin

Finally, what are your **postoperative instructions.** It’s really important to be as clear on this as possible. If you don’t know when the drain should come out or when the patient should start mobilising on their fixed fracture, how will anyone else? Were there pulses in the affected limb at the end of the operation? Can they eat and drink?

**Post op:** Can eat and drink when desires
   Routine ward observations
   Aim for home tomorrow after review

Make sure that the **drug chart** has everything necessary prescribed – do they need antibiotic cover, for how many days and what is the indication? Do they need low molecular weight heparin deep vein thrombosis (DVT) prophylaxis? What analgesia is prescribed? If the patient is a day case it’s usually best to write the **discharge letter** along with any medication to take out (TTOs) at the same time as the op note just to save time.

Of course not all operations conform to this system and you can adapt it as much as you see fit, as long as it’s still clear. Just make sure you’ve included all the important things. It’s a general rule of thumb when writing any notes that you write as much detail as you would want to have at your disposal in the unfortunate scenario of having to explain something to the coroner. So, for instance, if you changed the pre-arranged plan midway through an operation because of unforeseen circumstances and called your boss to discuss it, say so. If you carefully checked there was no bleeding at the end of the operation put it in.

Your operation is not over of course until you’ve helped **transfer** the patient back on to their bed. Then write the note. It’s usually best, especially if it’s been a long case, to leave the theatre for a few moments and sit down quietly in the coffee room to write all this out. Perching the notes on the edge of the catheter trolley while the anaesthetist’s shouting at the patient to wake up and the floor’s being mopped around you is not conducive to good note writing. Make sure that the op note is **filed in the right place** in the notes, not just tucked in the front to get lost, and then take the notes round to recovery.
<table>
<thead>
<tr>
<th>Patient Name</th>
<th>Tom Thumb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hosp No.</td>
<td>00464783</td>
</tr>
<tr>
<td>Date of birth</td>
<td>12/03/1995</td>
</tr>
<tr>
<td>Date</td>
<td>3/8/2010</td>
</tr>
<tr>
<td>Elective/emergency</td>
<td></td>
</tr>
<tr>
<td>Consultant</td>
<td>Mr N Bottom</td>
</tr>
<tr>
<td>Surgeon</td>
<td>T Brett</td>
</tr>
<tr>
<td>Assistant</td>
<td>F Tyler</td>
</tr>
<tr>
<td>Anaesthetist</td>
<td>A Goldstein</td>
</tr>
<tr>
<td>Type of anaesthetic</td>
<td>GA</td>
</tr>
<tr>
<td>VTE prophylaxis</td>
<td>LMW heparin 30/1/0</td>
</tr>
<tr>
<td></td>
<td>0.25</td>
</tr>
<tr>
<td></td>
<td>TEDS</td>
</tr>
<tr>
<td>Antibiotic prophylaxis</td>
<td>amoxicillin</td>
</tr>
<tr>
<td></td>
<td>gentamicin</td>
</tr>
<tr>
<td>WHO Safe surgery checklist</td>
<td></td>
</tr>
<tr>
<td>Position</td>
<td>supine</td>
</tr>
<tr>
<td>Start</td>
<td>14:00</td>
</tr>
<tr>
<td>Finish</td>
<td>14:20</td>
</tr>
<tr>
<td>Indication for surgery</td>
<td>pain &amp; tenderness Mc Burney’s point</td>
</tr>
<tr>
<td>Operation</td>
<td>Open appendicectomy</td>
</tr>
<tr>
<td>Operative Diagnosis</td>
<td>acute appendicitis</td>
</tr>
<tr>
<td>Operative Codes</td>
<td>4340</td>
</tr>
<tr>
<td>Incision</td>
<td>Lanz, muscle-splitting</td>
</tr>
<tr>
<td>Findings</td>
<td>acutely inflamed appendix, no free peritoneal fluid or pus</td>
</tr>
<tr>
<td></td>
<td>No fluid in pouch</td>
</tr>
<tr>
<td>Procedure</td>
<td>Appendix base divided between clamps, ligated using 2/0 absorbable tie</td>
</tr>
<tr>
<td></td>
<td>Appendix base crushed &amp; clamp applied distally. 0 absorbable tie to base.</td>
</tr>
<tr>
<td></td>
<td>Appendix sutured using short suture and sent for histology</td>
</tr>
<tr>
<td>Closure</td>
<td>4-0 continuous closure 2/0 absorbable suture</td>
</tr>
<tr>
<td></td>
<td>Then layered closure</td>
</tr>
<tr>
<td></td>
<td>TA &amp; IO closed with loose apposition suture</td>
</tr>
<tr>
<td>Local anaesthetic</td>
<td>0.2% 0.5% lidocaine block to wound</td>
</tr>
<tr>
<td>Drains</td>
<td>none</td>
</tr>
<tr>
<td>Samplest</td>
<td>appendix specimen to histopathology</td>
</tr>
<tr>
<td>Postoperative</td>
<td>Routine postoperative observations</td>
</tr>
<tr>
<td>Instructions</td>
<td>Start sitting and drinking as tolerated</td>
</tr>
<tr>
<td></td>
<td>2 more doses of antibiotics</td>
</tr>
<tr>
<td></td>
<td>LMW heparin and TEDS as prescribed</td>
</tr>
</tbody>
</table>

Figure 1.37 Example of an operation note. Source: WHO
Introduction to operative sections

To be a successful surgeon you need the eye of a hawk, the heart of a lion and the hands of a lady
Sir Lancelot Spratt, Doctor in the House (1954)

It isn’t really the purpose of this book to show you how to operate. No book can show you briefly how to do many different operations, you need a minimum level of detail to be able to really get it. So instead we’ve focused on just three common operations that you’re very likely to encounter, but in all the detail you’ll ever need. You’ll need a different product for more on operative technique – go to Wiley.com and search for How to Operate, which shows you just that including DVDs with videos of the operations.

Appendicectomy

Matt Stephenson and George HC Evans

Introduction

Older surgeons often like to wax lyrical about how they were sent off to do an appendicectomy on their first day of being a houseman without any supervision or prior training. They apparently did about 1,400 appendicectomies in their first year and by the end of two months they could finish one in five minutes and still have time to have a drag on their pipe, check the cricket score and arrange a date with the scrub nurse. Either rose tinted be their spectacles or they really were a breed apart back then. It’s true to say that an appendicectomy can be very straightforward, but if you believe they’re all like that, you probably haven’t done enough or you’re just using a giant wound every time.

Procedure

With the patient supine and under general anaesthetic, shave and prep the whole of the abdomen but drape just the right lower quadrant. Identify McBurney’s point, which is two-thirds of the way from the umbilicus to the anterior superior iliac spine (ASIS). A gridiron incision is an incision centred on this point but running perpendicular to this line – this is rarely needed and is mainly of historical interest, back in the days when cosmesis was lower on the surgeon’s agenda. Instead perform a Lanz incision, which is centred on the same point but in the line of the skin creases, so essentially horizontal. A modified Lanz is another option, which is the same incision, just slightly lower, for the cosmetic benefit.

Cut through skin, superficial fascia comprising the fatty-laden Camper’s fascia and then the more clearly seen thin whitish layer of Scarpa’s fascia. Then through true fat and look out for the fibres of the external oblique, which are coursing inferomedially. Here, insert a self-retaining retractor – such as a Traver’s
retractor. Get **haemostasis** as you go with the diathermy.

Make a **small stab incision** in the external oblique and slide your dissecting scissors beneath that layer in both directions creating a space. Then cut the aponeurosis of external oblique with the scissors in both directions in the line of its fibres and insert your retractor into this space.

Next you have to open the **internal oblique** layer – there’s a very thin layer of connective tissue around this which is usually easier to just incise, but then you need to split this muscle – here it runs perpendicular to the external oblique. You can open up a space initially with a clip but then it’s easiest to use Langenbeck retractors. So this is a **muscle-splitting** technique. The same needs to be done for the next layer, the **transversus abdominus**, which runs transversely. If the patient is obese there’s often a layer of fat in between each of these layers.

After you’ve opened the transversus abdominus you’ll come to the **peritoneum** itself, which may be covered by an **extraperitoneal fat** layer. Here you can see the peritoneum as a whitish, often described as glistening, membrane. Put **two clips** on it and feel between finger and thumb to check you haven’t caught any bowel. Then **snip** the peritoneum with your scissors and allow air to enter the peritoneal cavity – the bowel will then fall away to safety. Note any free fluid, and if there is any, take a **microbiology swab**; also note any free air, which you will see as a
bubble under the peritoneum. Now **enlarge the hole** in the peritoneum with the scissors and then stretch it with your fingers.

So now we have to find the appendix, which is sometimes easier said than done. First of all, remove your retractor and clips as these just get in the way and put your finger into the peritoneal cavity. **Feel for the appendix** – a tubular structure, maybe there’s a mass due to an inflamed appendix and adherent omentum. But the likelihood is you won’t feel anything useful at all, at least until you’re a bit more experienced at it.

You now need to deliver the appendix into the wound. **Non-traumatic forceps** such as *Dennis-Brown forceps* are very useful for this – some prefer using their fingers or *Babcock forceps*. Try to look for the caecum and deliver that out. When reaching in and delivering blindly, which to a certain extent you sometimes have to do, what you will deliver will be one of three things and none of them is the appendix: omentum, small bowel or caecum. It’s the caecum you want. If you keep getting omentum or small bowel push it medially out of the way with a swab on a stick. If you’re really struggling with small bowel it sometimes helps to ask the anaesthetist to tilt the table to the left so gravity helps tilt the small bowel away. You will recognise the colon by its pale pink colour and presence of those longitudinal *taenia coli*. Once you’ve got it, trace the taenia coli inferiorly – they converge on the appendix. **Deliver** it into the wound using *Babcock forceps* around the proximal appendix, and another around the distal appendix to secure it.

First you need to **ligate and divide the mesoappendix**. Do this by clipping, cutting and tying, with absorbable ties like 2-0 Vicryl. Now crush the appendix base gently with a clip and then immediately replace the clip just distally.
to this. **Transfix or tie** the base of the appendix and cut the appendix off flush with the clip, leaving a short stump of appendix. Some people bury the stump with a purse string suture. Others diathermy the mucosa on the appendix stump. Others do neither of these and leave it as is. There is no strong evidence for any particular choice.

If the appendix was normal, **examine the rest** of the ascending colon, the distal small bowel for a Meckel’s diverticulum, the reproductive organs in the woman and anything else you can reach through your small incision. If the appendix was really inflamed with contamination in the abdominal cavity, **wash** the peritoneal cavity out with normal saline. **Close the wound in layers** with absorbable sutures. You may find it helpful to close the peritoneal layer just because it keeps the bowel from interfering with the rest of the closure, but it’s not imperative. Close the transversus and internal oblique together with a couple of interrupted stitches just to show them the way and then the external oblique with another continuous stitch. If you have any thread left you may try to close the fat and fascia layer altogether, but this isn’t essential. If the appendix was normal or only mildly inflamed, close the skin with an absorbable subcuticular continuous suture. If it was gangrenous and there was lots of free pus, use **skin staples**, the rationale being that it’s easier to remove one or two staples in the event of a wound infection than it is to open a wound that’s been closed subcuticularly. Some do not agree and will always close using subcuticular stitches. Consider giving some **local anaesthetic** depending on whether the anaesthetist’s already given a block. Apply a dry dressing like Mepore or Opsite.

**Notes**

So what do you do if you can’t bring out the appendix just like that? Welcome to the club. Well first of all, the appendix may be **stuck** to some omentum and you will need to feel with your fingers to free it up, particularly if it’s a pelvic appendix stuck, say, to the pelvic side wall. You need a little experience to know how much force you can use when blindly trying to free up adhesions, but most adhesions will come away with fairly gentle probing fingers, making it
much easier to try again and deliver the appendix.

You’ll regret thinking appendicectomies are easy when faced with a 35 stone patient with a high retrocaecal appendix. First, the obese patient will obviously mean that before you’ve even got to the external oblique, you’re already looking down a very deep hole. Try using a Norfolk and Norwich self-retainer – like the Travers but with deeper scope. Second, always warn patients about this beforehand – you’ll almost certainly need a longer incision. Third, there will probably be additional layers of fat in between all the muscle layers and in the preperitoneal space, just anticipate this and make your way through it. Fourth, even if the caecum and appendix are nicely mobile and easy to deliver out of the wound, in an obese patient that still only means at the bottom of a deep dark hole. You need good retraction from your assistant and a generous-sized hole.

More problematic is the retrocaecal appendix. In your exam you will probably get away with saying ‘mobilise the caecum’, which means dividing the peritoneum holding down the caecum. You’ll need a bigger hole for that, so extend the wound. Alternatively, if you can get the base of the appendix but the tip seems to be vanishing off into the distance and you can’t deliver it, consider starting by amputating it at the base before you divide the mesoappendix. You can then divide the mesoappendix in a retrograde direction. This can make the appendix much easier to deliver. Bear in mind, however, that the appendix or even just the tip of the appendix can be very friable – you need to take care not to leave chunks of it behind.

Even more problematic is the sub-hepatic appendix. In other words, you’ve hunted everywhere for it and eventually find that it’s coursing up behind the ascending colon and its tip is nestled somewhere in the region of the hepatic flexure. Bummer. Again, there are no two ways about it – you need excellent assistance and a generous-sized wound. Many people advocate extending the wound laterally by curving the incision superiorly, creating what looks like a hockey stick, or even turning it into something heading towards being a Rutherford-Morrison incision, which is a continuation of the lateral end of the wound obliquely up towards the loin. You obviously can’t keep to the gentler muscle separation technique you usually use for an appendicectomy – you’ll need to just cut through the muscles en masse. With the right exposure, the rest of the operation becomes much easier whatever the position of the appendix.

Remember, if you’re struggling, the likeliest problem is that you have inadequate access – make the hole bigger – much better a safe operation at the cost of a larger scar. In fact, if you call your boss, the first thing he’ll do is extend the wound – you can always do the operation if the hole is big enough. Remember, big mistakes through small holes.

Summary

- The patient is supine under general anaesthetic (GA) with the abdomen shaved and prepped and the right lower quadrant draped.
Inguinal hernia repair

Matt Stephenson and Stephen Whitehead

Introduction

Inguinal hernia repairs are easy aren’t they? Ermm... no, not really. Or at least not to begin with. The learning curve for an inguinal hernia is actually quite steep, probably because they can look so different every time you open the inguinal canal – it can be very frustrating. We’ve all been there. It never looks as clear as it does in the textbooks or atlases, it’s almost as if the people who wrote those books had never seen one in real life.

Like the appendicectomy, the inguinal hernia repair can be difficult for the beginner, yet these two operations are still left to the most junior surgeons, often without supervision.

Nevertheless, take heart that everyone struggles to begin with and that once you’ve seen and done a few it will become second nature. Here we describe the Lichtenstein mesh repair – the most commonly used technique in the UK.

Procedure

With the patient supine and under general or local anaesthesia, shave,
prep and drape the groin. Note the bony landmarks of the anterior superior iliac spine (ASIS) and the pubic tubercle. The inguinal ligament runs between these two. Your incision therefore needs to be a finger breadth or two above and parallel to the medial half to two-thirds of this.

Incise through skin, Camper’s fascia and Scarpa’s fascia (which is white and membranous) then through fat. It’s likely you’ll encounter a chunky vein running vertically in your wound – ligate and divide it if it’s substantial enough, otherwise use diathermy. Keep incising down to external oblique maintaining haemostasis as you go. If the abdominal wall is quite thick, inserting a Travers retractor at this stage can be quite helpful.

You’ll recognise the aponeurosis of external oblique by the fibrous strands running parallel to your wound. Once you’ve reached it, you need to decide the level at which you’re going to open it. Trace the fibres down towards the pubic tubercle and look for where they decussate. That’s what the external ring is, a triangular gap where the upper fibres plunge inferiorly to the lateral tip of the pubic tubercle and the lower fibres criss-cross over and leap over to attach more medially. You can actually see this decussation and it marks the apex of the external ring where the hernia may be popping out.

So make a stab incision in the line of the fibres at the level of the apex of the external ring. Take a small clip and clasp the upper leaf and the same with the lower leaf. Using closed dissecting scissors bluntly, create a plane below the external oblique in the line of the canal, thus separating off the cord or the ilioinguinal nerve which may be sticking to it just below the surface. Score with the scissors inferomedially down to the external oblique and the same superolaterally. With upward traction on the external oblique clips gently dissect beneath external oblique, superiorly and then inferiorly, thus creating a plane beneath it. Insert the Travers retractors into this plane. Congratulations, you have now opened the inguinal canal. But I’m sorry you haven’t fixed the patient yet, now comes the hard part. You look into the canal and unless you’re very lucky, you’ll just see a big, bulging, muscley, fatty, tissuey lump. What you’re

Figure 1.47 The bulging cord is shown outlined. Note the ilioinguinal nerve running over the front of it and the lower fibres of transversus abdominus which at their most inferior part form the conjoint tendon along with the internal oblique.
looking at is two things: the **cord** and the **sac** and they may be intimately entwined.

The first thing to do is separate the **cord (+/− sac)** from the **pubic tubercle**. Begin by **gently snipping** with the tips of your scissors any loose connective tissue that you can obviously see tethering the cord (+/− sac) down to the posterior wall of the inguinal canal. Next you need to **hook** the cord (+/− sac – that’s getting boring, assume we mean potentially both for now) up with **your finger**. Insert your index finger into the inguinal canal with fingernail lying against the inside of the inguinal ligament and fingertip pointing to the pubic tubercle. Push your finger under the cord keeping your fingernail apposed to the pubic bone (there should be almost nothing between your fingernail and the bone; all the vessels, etc., arching over the tubercle are staying with the cord – you don’t want to leave them behind). Hook up the cord with your finger and **gently probe** with the fingertip until you **see it emerge** on the medial side of the cord. There is a knack to it and it comes with practice. It helps if you keep the axis of your finger horizontal, i.e. in line with the superior edge of the pubic bone, rather than pointing it upwards, as you may just be pushing straight into a direct hernia.

Once the cord is suspended over your hooked finger you need to work out **what’s cord and what’s sac**. First, is it an **indirect hernia** or a **direct hernia**? In an indirect hernia, the **whole cord is bulky** but it has a **relatively narrow base** (well, the same width as the rest of the cord) emerging from the deep ring and you can easily peel it off the posterior wall, which isn’t bulging out. In a direct hernia, however, you will either feel a **thin cord** and behind it the **posterior wall is bulging out**, or more likely, the whole cord seems to be coming from a **very wide base** stretching out over the whole of the back wall. This is because the sac emerging from the posterior wall has **fused** with the cord structures running past it. If this is the case, hook the cord inferoanteriorly and you’ll see the posterior wall tethered up to the back of it. **Dissect** the connecting strands with scissors all the way back to the deep ring and the direct hernia bulge will fall back into its rightful place on the posterior wall and the cord will thin out. You may of course find **both**.

So, for the indirect hernia the first part of this game is to find the **white edge** of the peritoneal sac. Everyone has their own favourite method of doing this. Here we show dissecting scissors gently peeling off the outer layers of the cord, all those cremasteric fibres, by firmly stroking the closed tips in the direction of the cord. Some people like to pinch the cord between finger and swab to firmly wipe off the outer layers and systematically go from one edge transversely across to the other, thinning out the cord as they go. However you

![Figure 1.48 The cord has been hooked up by the index finger.](image)
do it, you’re looking for a white edge somewhere within the cord.

Once you see it, get a clip on it, get two if you can. Lift them up and gently dissect all the adjacent tissue away from the white edge, keeping close to the white edge, until the white edge gets bigger and bigger and more and more separate from the rest of the cord. If you’re not sure where it’s going, for example if you think it’s going all the way down into the scrotum, you can open it and put your finger inside. Get the whole sac dissected out down to the level of the deep ring.

**Twist the sac** several times thus pushing any contents back into the abdomen and transfix it at the base with an absorbable suture such as 2-0 Vicryl. Cut the stalk of the sac first, not the stitch, that way you can check it’s not bleeding before it dives back into the abdomen. If the deep ring has been widened by this intruder a simple stitch or two, medially and/or laterally, to the ring will help.

Now what if you find a direct hernia? This is much easier, you could just go straight to the mesh step but it’s usually easier to push the hernia back in with your finger, thus invaginating it, and then plicate the posterior wall. This stitch doesn’t have much strength but it does make it easier to get the mesh down flat on the posterior wall. **Poke the hernia** back in with your index finger, this creates a little ridge of tissue (made of a bit of transversus abdominus and transversalis fascia) just above and below the tip of your finger in the medial part of the posterior wall – take a bite of the

**Figure 1.49** Dissection of the sac with the tips of the dissecting scissors.

**Figure 1.50** Identification of the sac.

**Figure 1.51** The sac has been dissected from the cord and is being retracted superiorly with clips while a Lane retractor is retracting the cord inferiorly. A Langenbeck retractor exposes the posterior wall.
bottom ridge and then the top ridge and tie a knot (obviously taking care not to include your finger in the stitch). Keep stitching bottom ridge to top ridge until the hernia is essentially inverted and the back wall looks flat. Don’t be overly ambitious with those stitches, trying for example to stitch strong muscle all the way down to inguinal ligament – this is unnecessary and just creates tension, which is not what you want for wounds to heal. Also don’t place the stitches too deep, don’t forget that the inferior epigastric vessels aren’t far behind.

Now for the mesh. Shape it roughly before inserting it. The corner that will lie over the pubic tubercle can be rounded off. Create a slit so that you can wrap it round the cord – and at the apex of the slit create a V shape so that the cord can fit through.

Stitch or staple the rounded corner to the tissue lying just over the pubic tubercle. It’s very important that the mesh overlaps the pubic tubercle and, superiorly, extends well beyond it, ideally to the midline – this is where the hernia will recur if you don’t. Hold the lower part of the mesh down so its lower edge is right over the inside of the inguinal ligament. Run a continuous non-absorbable suture such as 2-0 Prolene, suturing the two together, alternatively use staples. When you get to the deep ring, suture or staple the upper leaf to the lower leaf just lateral to the deep ring thus recreating a new deep ring. Stitch the upper leaf down to the inguinal ligament. Not much else needs to be done laterally. Medially you need to stitch the edge of the mesh down to the posterior wall, or staple it. Stretch the mesh out over the posterior wall so that it isn’t heaped up or too tight and continue the suture or staples around the medial edge onto the superior edge. Take care to avoid including a nerve in your suture or staple.

If you’ve got this far and it’s your first hernia, very well done to you. Now close up. Reapply clips to the upper and lower edges of external oblique and run a continuous absorbable suture such as 2-0 Vicryl from lateral to medial or medial to lateral, thus reconstructing the external ring. The fascia and fat can be closed with continuous absorbable suture and the skin with an absorbable subcuticular suture.

![Figure 1.52. Gentle anteroinferior traction on the cord reveals the posterior wall – here it has been plicated.](image)

![Figure 1.53. The shape to cut the mesh into for a right-sided inguinal hernia. On the left, obviously it’s the mirror image.](image)
Notes

In women, inguinal hernia repairs are considerably easier. They have only rudimentary structures, principally the round ligament, passing through their inguinal canal, and this can be simply ligated and divided. The hernia can then be invaginated back into the abdominal cavity and the posterior wall plicated as for a direct inguinal hernia. You can then apply a piece of mesh without the usual slit to accommodate the cord, directly on to the posterior wall and stitch or staple it in.

In inguinocrotal hernias, the sac passes right through the canal into the scrotum, where it’s usually firmly adherent. Don’t try and dissect the sac out of the scrotum – this will just result in lots of bleeding and is unnecessary. Instead, dissect out the sac in the usual way from the cord and transect it, leaving the distal part in the scrotum undissected, and leave it open. Any fluid that builds up in the residual sac will drain out of the hole, so don’t close it or you’re effectively giving the patient a hydrocoele. Deal with the proximal side in the same way as you would for any indirect hernia.

Summary

- The patient is supine and under general or local anaesthetic
- The right groin is shaved, prepped and draped
- Incise skin above the medial half of the inguinal ligament
- Incise down to external oblique
- Open external oblique at the level of the external ring
- Create a plane beneath external oblique
- Separate cord +/− sac from the pubic tubercle
- Separate cord from sac
- Transfix and amputate indirect sacs
- Plicate posterior wall if bulging
- Shape and insert a mesh securing it, most importantly, medially
- Close the external oblique
- Close fascia then skin
**Dynamic hip screw**

Matt Stephenson and Lisa Leonard

**Introduction**

So when should you perform a **dynamic hip screw (DHS)** and when should you perform a **hemiarthroplasty** for a **fractured neck of femur**? The choice depends on whether or not the fracture is likely to compromise the blood supply to the femoral head, resulting in **avascular necrosis**. Remember that the **blood supply** to the femoral head comes from three principal sources:

1. **through the foveolar artery** in the ligamentum teres (not usually affected by a hip fracture and doesn’t supply much blood anyway so clinically irrelevant, except in children)
2. **the nutrient artery** of the shaft
3. **the retinacular vessels** that run within the hip joint capsule, these are the most important ones.

Femoral neck fractures can be broadly divided into **intracapsular** and **extracapsular**. Remember that the capsule inserts **low down** on the femoral neck, perhaps lower than you might think.

**Intracapsular** fractures are then classified by the **Garden classification** into the following four stages.

- **Stage 1**: A valgus impacted fracture, and undisplaced.
- **Stage 2**: Complete fracture of the neck but undisplaced.
- **Stage 3**: Complete fracture and partially displaced, because the femoral head is still hinged on to

![Figure 1.56 The blood supply of the femoral head.](image-url)
Types of hip fracture

Normal hip joint  |  Femoral neck fracture  |  Intertrochanteric fracture

Figure 1.57 Types of hip fracture – extracapsular and intracapsular

the shaft to some extent, and the bony trabeculae of the femoral head no longer line up with those of the adjacent acetabulum.

**Stage 4:** Complete fracture and completely displaced, now the head is free to rotate back to the anatomical position in the acetabulum and the trabeculae lines now line up again.

In **Garden 1 and 2,** the femoral head should still be perfused by a combination principally of the retinacular vessels and to a lesser extent the nutrient artery. Therefore all that is required is to fix the fracture site to give it time to heal – a **dynamic hip screw** is indicated. If the head is displaced, however, i.e. **Garden 3 and 4,** then the nutrient artery will certainly have been torn, as almost certainly will the retinacular vessels because the capsule will also have been torn. The femoral head, even if you fix it in place, will die. Replacement of the femoral head is indicated – a **hemiarthroplasty.** You can use the mnemonic: **one, two: screw; three, four: Austin-Moore.** This is a slight oversimplification (see the Notes section).

In **extracapsular fractures,** the retinacular vessels will still be intact and all that is required is fixation of the fracture, hence a **dynamic hip screw** is needed in these patients.

**Procedure**

The patient is under either **general** or **spinal anaesthetic** and **supine** on an **orthopaedic traction table.** The **feet** are **secured in stirrups** allowing the legs to be manipulated into various positions. There are numerous joints and adaptable components on this equipment, making it very versatile. The first thing to do in a displaced fracture is to **reduce the fracture,** obviously
Figure 1.58 The Garden classification of intracapsular fractures.
Figure 1.59 The patient is on an orthopaedic traction table with the affected leg on traction, abduction and internally rotated. The unaffected leg is abducted allowing the II to easily view the hip. Note the traction groin post between the patient’s legs; this allows traction to be applied to the leg without the patient falling off the table – take care of the genitals though.

you don’t want to fix it into an abnormal position. To do this, put traction on the affected leg and apply internal rotation to it so that the patella is facing the ceiling.

Clearly you’re going to need to have X-ray vision to see whether you’ve returned it to a satisfactory position. And that’s what the image intensifier (affectionately known as the II) is there for. It is shaped like a large C, emitting X-rays from one end with an X-ray detector on the other end. By abducting the unaffected leg widely, you can get the II into position to view the fracture site in both anteroposterior (AP) and lateral views. Make sure that there’s nothing obstructing the movement of the II so that it can be easily changed to the AP or lateral positions during the course of the operation. Of course, if the fracture is undisplaced, you can fix it where it is without any manipulation.

Once you’re happy with the position prep the whole of the thigh and surrounding areas and apply a drape to the upper lateral thigh. This drape is pretty huge with a sticky bit for the operative site, and peripherally to this is a large transparent plastic sheet that can be fixed to some drip stands and an intervening horizontal bar or similar equipment to give a very large sterile wall from floor to above standing height. It also has a collecting pouch beneath the operative field that will help to collect any blood dripping out of the wound and stop it getting to the floor.

So now make the skin incision, this should be about 15 cm long, commencing just behind the palpable greater trochanter and continuing longitudinally down the thigh over the lateral femur (often easily palpable in thin old ladies). Cut straight down through subcutaneous fat, maintaining haemostasis as you go. The first obvious layer you see will be the fascia lata – a white fascial layer. Incise straight through this, inserting a self-retaining retractor such as a Travers or in a deeper wound, a Norfolk and Norwich retractor (or even two), will help exposure.

The next layer is the vastus lateralis. This can be retracted anteriorly and approached from behind, but this can
result in a lot of bleeding because of an abundance of perforating vessels posteriorly, so simply split it in line with its fibres. First cut the fascial envelope of the muscle with a knife and then bluntly dissect your way through the muscle. Replace the self-retaining retractor within the muscle and you will find yourself down on to the periosteum-covered lateral femur. There will be strands of muscle attached to the surface too, so strip all these off with a periosteal elevator, including the periosteum, to give a broad surface of upper lateral femur to later place the plate of the DHS device on to.

Apply an angle guide to the lateral femur and feel the anterior and posterior edges to make sure you’re in the middle. Insert the guide pin through the appropriate hole, which will give you a 135 degree angle into the femoral neck, matching that on your plate. Once your guide and pin are laid against the bone take an X-ray to check the position.

Drill the guide pin into the femur a few centimetres, keeping the angle guide firmly pressed against the femoral shaft and directing it just very slightly anteriorly, as the head is usually slightly antverted on the shaft (you can see this on the lateral film). Take another X-ray in the AP position and check that it’s advancing in the right direction. If it is, keep drilling it into the femur with regular X-rays to check its position. You’re aiming for dead centre within the femoral head. If it’s going in the wrong direction, reposition the angle guide, checking that it’s flat against the femoral shaft. Once you’ve gone some way in towards the femoral neck, reposition the II to check the lateral view.

Sometimes you think you’re doing a great job and the angle looks great in the AP view, and then you change to the lateral and realise you’ve gone out the back of the hip altogether. So the guide pin must be going directly up the axis of the femoral neck in both views. If not, correct it early by withdrawing,
Theatres

Figure 1.64 On the left, the AP view is seen, and on the right, the lateral view, with the guide pin in an acceptable position.

Figure 1.65 You can see two guide pins here, the second is to stop the femoral head from spinning when the screw is screwed in. The measuring device is being fed over the primary guide pin.

next step: reaming. Remove the angle guide.

Once you’ve got a guide pin in the right position, you need to measure the length of screw you need. Slide a measuring device over the exposed guide pin down to where it vanishes inside the femur. This is specially calibrated to give the length of screw needed, determining how much guide pin is inside by subtracting how much is left outside. Ask for the screw at this stage at the same length as your measurement, but ask for the reamer to be set at 5–10 mm less than the measurement. Check the reamer length you are given and feed it over the guide pin and ream out the space for the screw to go in, checking on the II that the pin hasn’t been pushed in through the acetabulum.

Now insert the screw into the reamed out space and screw it in firmly so that the screw engages deep within the femoral head. Once it’s in position, the handle of the screwing device should be parallel with the axis of the femur. This is important because the end of the screw is shaped to engage with the plate in this orientation, thus preventing rotation of the femoral head once the plate is in place.
Confirm the position throughout with the II.

Next, slide the barrel of the plate down over the distal end of the screw and lay it down along the long axis of the femur. Make sure there are no strands of muscle interposed between it and the femur. Because of the shape of the screw, the plate will fit on to it and not be able to rotate; however, the screw will be able to slide in and out of the buttress plate, hence the term dynamic, and this allows the fracture site to collapse, compress together and unite. Using an orthopaedic mallet, hammer the buttress plate firmly into position.

There are several holes along the plate to accommodate the screws. Check that the most distal screw hole lines up with the femur. The first thing to do is drill a hole all the way through the femur through the proximal plate hole. You’ll feel the resistance in drilling while going through the lateral cortex and then a give as it passes through this because the drill passes easily through the soft medullary canal. There will then be another wall of resistance as it engages the medial cortex. Drill through this and there will be another give of overcoming resistance as you pass through the other side of the femur – obviously stop as soon as you feel this.

Remove the drill and insert a depth gauge. This consists of a long central pin with a hooked end that you pass straight through your drill hole out the other side of the femur and then pull back allowing the hook to get caught on the outer surface of the medial cortex. There is then an outer component that slides down over the central pin to abut the surface of the buttress plate, allowing you to measure the depth the pin has gone in and thus the length of screw required.

Repeat this for all the screw holes and screw the appropriately sized screws into position. Check the final position of the dynamic hip screw, buttress plate and femoral screws with the II.
Irrigate the wound with normal saline to remove any fragments of bone that can act as a nidus for infection, and check for haemostasis. Close the fascial envelope of the vastus lateralis and then the fascia lata with absorbable sutures. Closing the fat layer is optional, but then close the skin with a subcuticular absorbable continuous suture.

Notes

In young and fit patients (for example under 40) with a displaced subcapital fracture you want to try to retain the femoral head if at all possible as an emergency, accepting the higher risk of avascular necrosis, with cannulated screws or a short dynamic hip screw with an anti-rotation screw. In a slightly older age group, but still fit, a total hip replacement might be a better option as these give better long-term functional results. Uncemented hemiarthroplasties are now usually reserved for medically unfit poorly mobile patients. Cemented hemiarthroplasty or bipolar prostheses are other options.

Summary

- The patient is under GA or spinal, supine on an orthopaedic traction table
- Reduce the fracture and abduct the unaffected leg
- Position the II and confirm reduced position in AP and lateral views
- Make skin incision
- Incise through fat, fascia lata and vastus lateralis
- Scrape muscle and periosteum off femur
- Drill guide pin using angle guide
- Confirm position with II in both dimensions
- Consider inserting second pin if risk of femoral head rotation
- Measure size of screw
- Ream appropriate size space for screw
- Screw in dynamic hip screw
- Confirm position with II
- Insert buttress plate
- Drill holes in femoral shaft and measure depth
- Screw in appropriately sized screws
- Check position
- Irrigate and close in layers

Reference