

Inguinal hernia repair

In excess of 100,000 inguinal hernia repairs are performed in the UK each year (Devlin & Kingsnorth 1998). It is the most commonly performed general surgical procedure and is routinely undertaken in patients receiving local anaesthesia in the day case setting. The Royal College of Surgeons has recommended that >50% inguinal hernias are undertaken on day cases, although at present this figure is only 30% (RCSE 1993). This article defines hernias and describes the aetiology and surgical treatment of inguinal and femoral hernia. The differences between the traditional and laparoscopic repair of hernias are explored as well as the use of materials such as polypropylene mesh to enhance the repair. The need for thromboprophylaxis and antibiotic therapy are outlined together with patient discharge advice.

Introduction

What is a hernia? The broad definition of a hernia is '*...the protrusion of an organ or part of an organ through the wall of its containing cavity into an abnormal position*'. Because we normally mean abdominal hernias we can narrow the definition: '*...a hernia is a protrusion of part of the contents of the abdomen through a weakness or defect in the abdominal wall*' (Wikipedia 2007). This is usually small bowel or omentum but may be colon or bladder. Herniation of other abdominal organs has been reported (for example, ovary, appendix), but this is rare.

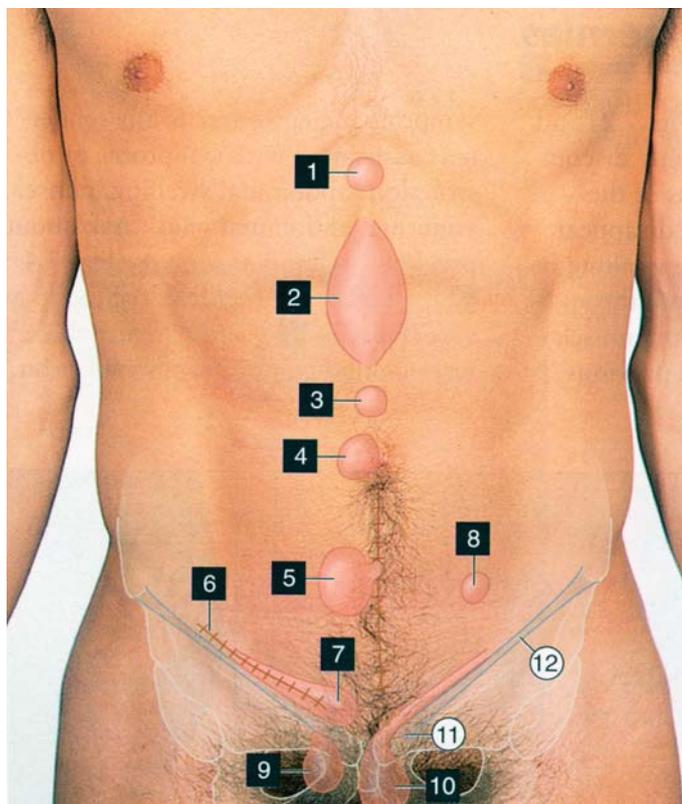
Where on the abdomen do they occur?

Hernias arise most commonly in the groin (inguinal or femoral), at the umbilicus, or above the umbilicus in the midline (para-umbilical or

epigastric hernias). An abdominal hernia will also occur when a previous abdominal incision breaks down – an incisional hernia. The rare spigelian hernia occurs at the lateral edge of the rectus abdominus muscle (Spiegel's line). Lateral abdominal or flank hernias are also rare and usually occur through a previous nephrectomy incision. There are some very rare lumbar hernias which occur through anatomical gaps in the paraspinal muscles, and a hiatus hernia is a herniation of the stomach into the chest through the hole (or hiatus) in the diaphragm through which the oesophagus passes (see Figure 1).

Why do hernias occur?

There is certainly an anatomical basis to the development of an inguinal hernia, relating to the inguinal canal and the descent of the testicle at birth, and man's upright posture. The aetiology is



1: Epigastric; 2: Divarication of the recti; 3: Paraumbilical; 4: Umbilical; 5: Incisional; 6: Previous hernia repair scar; 7: Direct inguinal; 8: Spigelian; 9: Femoral; 10: Indirect inguinal; 11: Pubic tubercle; 12: Inguinal ligament

Figure 1 Relevant surgical anatomy. Abdominal wall hernias occur through points of congenital weakness, or through surgical scars (incisional hernias)

probably multifactorial though convincing evidence is poor (see Table 1).

Groin hernias – inguinal and femoral

About 93% of all groin hernias are inguinal. Femoral hernias are much less common but are important because they have a high incidence (25–40%) of strangulation. The female: male ratio is 4:1. This article will concentrate on inguinal hernia repair, the most common general surgical operation, with over 100,000 cases carried out in the UK each year (Devlin & Kingsnorth 1989).

- Prolonged raised intra-abdominal pressure, chronic constipation.
- Sudden sharp rise in intra-abdominal pressure (includes trauma).
- Coughing.
- Heavy manual work.
- Metabolic (collagen) defect.
- Association with aortic aneurysm (defective collagen metabolism).
- Smoking.
- Repetitive strain injury.

Table 1 Aetiology of Inguinal and Femoral Hernias

Making the diagnosis

An inguinal hernia will present in one of three ways:

- A swelling in the groin which appears on straining, lifting or standing.
- Pain or discomfort in association with the swelling (that may not be very obvious)
- With a complication: obstruction or strangulation (see figure 2)

Pain and no swelling suggests other pathology such as a groin strain, sports injury, hip or lower back pathology. However pain with a tender irreducible swelling means the hernia has strangulated – this is a surgical emergency.

How should an inguinal hernia be treated?

Prior to the era of modern surgery many hernias were treated with a truss – a device that held a pad firmly against the deep inguinal ring and prevented the hernia coming out. With modern surgical techniques one would advise operation in almost all patients, and nowadays age alone is no longer a contra-indication. The surgical repair aims to:

- eliminate the swelling
- relieve discomfort
- remove the risk of strangulation (figure 2). ➔

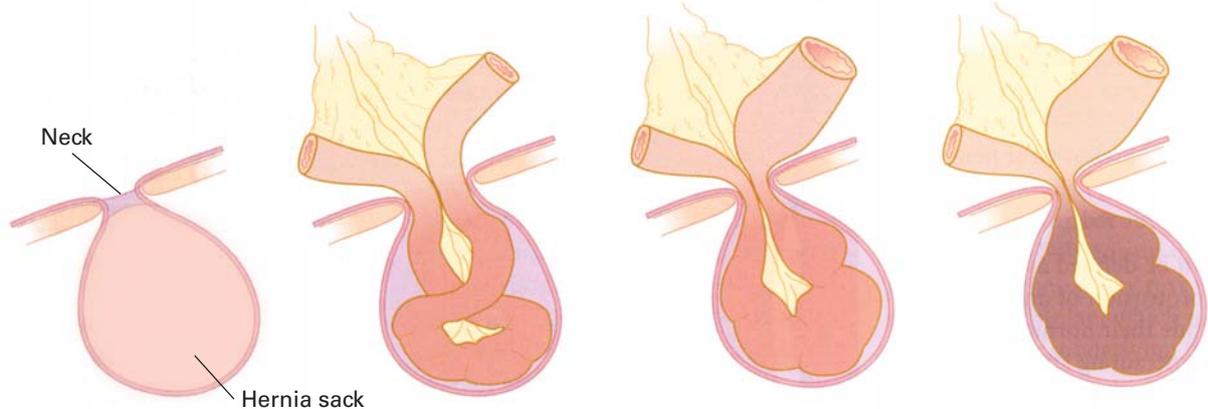


Figure 2a Hernia. The narrow point of a hernia where the hernial sac passes through the abdominal wall is known as the neck of the sac. This is usually the site of any strangulation.

Figure 2b Irreducible or incarcerated hernia. When the hernia contents cannot be returned to the abdominal cavity and the hernial sac cannot be reduced either due to adhesions of the contents to the sac or due to swelling of the tissues in the sac.

Figure 2c Obstructed hernia. When a loop of bowel within the hernia is obstructed. Note that the bowel leading into the hernia is dilated but the bowel leading from the hernia is collapsed.

Figure 2d Strangulated hernia. When the blood supply to the contents of a hernia is compromised. When a loop of gut is strangulated, there will also be intestinal obstruction, then infarction, then perforation of the bowel.

Figure 2 Complications of hernias

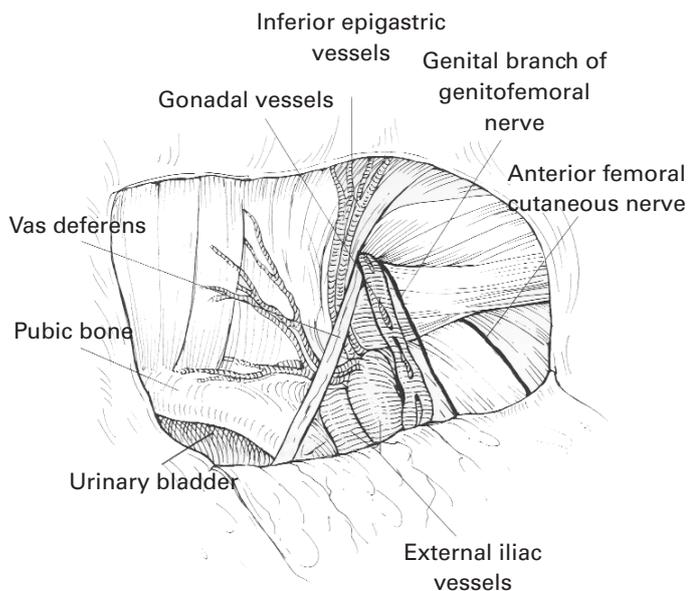


Figure 3 Laparoscopic view of the right inguinal region, with the peritoneum incised. The vessels and nerves and the vas are all at risk of injury by inappropriately placed staples, particularly in the 'triangle of doom' (vas medially, gonadal vessels and genitofemoral nerve laterally)

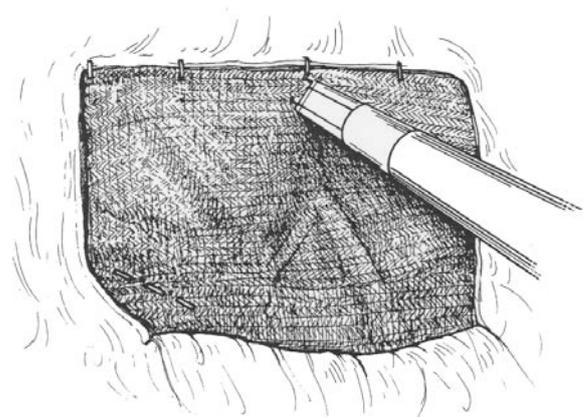


Figure 4 Mesh stapled in place. Inferiorly staples are placed in the pubic bone, but not more laterally in the 'triangle of doom'

The cumulative probability of strangulation of an inguinal hernia has been estimated to be 4.5% after two years and this complication carries a significant morbidity and mortality, particularly in the elderly (Gallegos et al 1991).

How should the hernia be repaired?

Two advances have revolutionised hernia surgery in the last 20 years: the introduction and widespread use of mesh, and the development of laparoscopic hernia repair (Figures 3 and 4).

Open mesh repair

Lichtenstein and colleagues described an open mesh repair in 1987 (Lichtenstein 1987, Kurzer et al 2003) (see figure 5). Instead of suturing the defect, non-absorbable mesh was used to cover the posterior wall of the inguinal canal thus creating a 'tension-free' repair. The operation has proved to be straightforward and rapid to perform and the excellent results have been reproduced by other surgeons. It can be carried out using local anaesthetic.

Other methods apart from flat mesh have been tried. Using a mesh plug or cone to fill the hernia defect has achieved popularity because of its ease and generally good results, though plug repairs have been associated with high incidences of postoperative pain. They also add expense and complexity, with the accompanying risk of increased complications such as plug migration.

Laparoscopic repair

Laparoscopic inguinal hernia repair was first described by Ger in 1982 but was not seen as a viable alternative to open repair until prosthetic mesh started to be used in the early 1990s. It has been advocated by enthusiasts as the method of choice for inguinal hernia repair (Bittner et al 2002), but its routine use for all inguinal hernias is controversial (Beattie et al 2000) and currently a subject of intense debate. It requires an obligatory general anaesthetic.

Techniques of laparoscopic repair

The two techniques of laparoscopic repair are transabdominal preperitoneal (TAPP) or totally

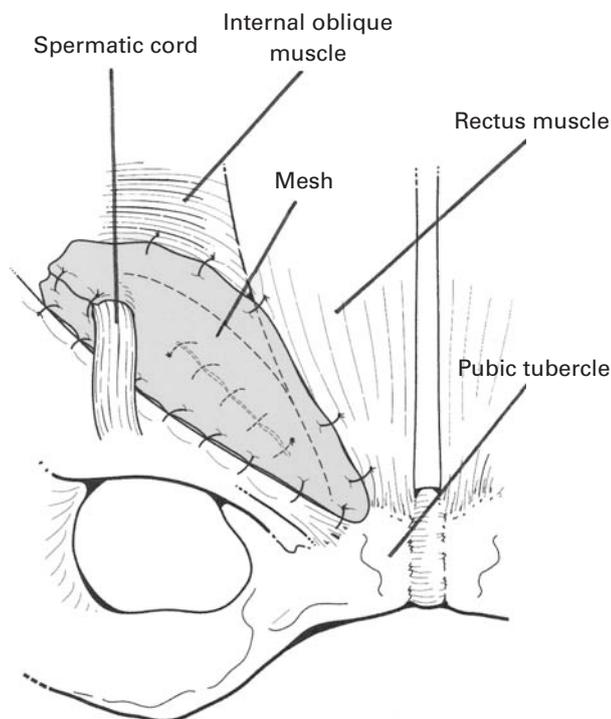


Figure 5 Right inguinal hernia repaired with onlay mesh. The suture line where a direct hernia has been inverted is visible through the mesh

extraperitoneal (TEP). Both methods place mesh against the inside of the abdominal wall in the inguinal or inguino-femoral region, covering the hole or hernia defect from behind.

In the TAPP repair the instruments first enter the peritoneal cavity. The peritoneal lining of the abdominal cavity covering the inguinal region is then incised in order to gain access to the extraperitoneal space. The mesh is attached to suitable points with staples (see figure 4) and the area is then covered again with peritoneum to prevent the mesh from coming in contact with bowel.

In the TEP repair the entire dissection is done in the extraperitoneal space without the need to enter the peritoneal cavity. Both methods place mesh in the same place eventually.

The TAPP repair carries a theoretical risk of damage to internal organs, bowel and bladder, but →

at present is used more widely in the UK because the inside of peritoneal cavity is more familiar to general surgeons and large series of TAPP repairs have been reported with good results (Bittner et al 2002).

The TEP repair is said to be more difficult. However, because the peritoneal cavity is not entered the risk of visceral injury is much reduced. The use of a balloon can greatly facilitate dissection in the extraperitoneal plane, particularly useful for surgeons on the early part of their learning curve, although when combined

with disposable instruments it does add significantly to the cost of the procedure. Fixing the mesh in place with staples and inadvertently trapping nerves may give rise to long term postoperative pain. Using larger pieces of mesh, held in place by intra-abdominal pressure and no fixation has been advocated but can be associated with an increased risk of recurrence. Fibrin glue has been used though at present it is experimental and expensive.

Results of operation – outcomes to assess

Traditionally, whether or not the hernia recurred and the incidence of standard short term complications such as bleeding (haematoma) or infection, were the only outcomes of interest to surgeons. However mesh repairs, correctly performed, have a very low incidence of recurrence, so that other outcome measures (see Table 2) are currently used to assess the effectiveness of groin inguinal hernia surgery repair. ➔

- Incidence of long term pain.
- Persistent numbness.
- Length of hospital stay.
- Time to return to normal activities and time to return to work.
- Cost effectiveness.

Table 2 Outcome measures for inguinal hernia repair

Open	Laparoscopic
	Advantages
<ul style="list-style-type: none"> ■ Easy to learn ■ Minimal risk of major complications ■ Good results obtainable by 'non-experts' ■ Ideal for day surgery, especially under LA ■ Suitable for almost all inguinal hernias 	<ul style="list-style-type: none"> ■ Less postoperative discomfort ■ Quicker return to normal activities ■ Diagnose occult contralateral hernia ■ Indicated for recurrent and bilateral hernia
	Disadvantages
<ul style="list-style-type: none"> ■ More postoperative discomfort than laparoscopic repair ■ More long-term discomfort than laparoscopic repair ■ Longer to return to normal activities 	<ul style="list-style-type: none"> ■ Requires GA ■ Not suitable for elderly or if co-morbidity ■ Not suitable if previous abdominal surgery ■ Long or steep learning curve ■ Needs high level of technical expertise for good results ■ Potential for serious bowel or bladder injury ■ Greater costs than open repair ■ ? future surgery if pre-peritoneal mesh

Table 3 Advantages and disadvantages of open versus laparoscopic repair

Open repair – mesh versus non-mesh

The EU Hernia Trialists Collaboration meta-analysis of 2002 reported on 20 randomised trials (EU Hernia Trialists Collaboration 2002a). Compared with sutured repair, patients having a mesh repair had a shorter hospital stay, a faster return to normal activities and a lower incidence of persisting pain. Open mesh repair was also associated with a 50–70 % reduction in the risk of recurrence. Nationwide surveys of surgical practice reveal that the open mesh technique has become the procedure of choice for primary inguinal hernia repair (Bay-Nielsen & Kehlet 2001, Hair et al 2002).

Laparoscopic versus open repair

A large number of randomised controlled trials comparing open with laparoscopic inguinal herniae repair have been published. Table 3 outlines the advantages and disadvantages of these two techniques. Two recent meta-analyses (EU Hernia Trialists Collaboration 2002b, Memon et al 2003) concluded that return to normal activity was faster and the incidence of long term discomfort and numbness was less after laparoscopic repair although operating time was longer. Laparoscopic repair was associated with fewer postoperative complications although the number of serious visceral or vascular injuries was greater.

NICE guidelines suggest open tension-free mesh repair for primary one sided inguinal hernias, with laparoscopic repair reserved for bilateral or recurrent hernias (National Institute for Clinical Excellence and Technology Appraisal Guidance 2001). These guidelines have been challenged by experienced laparoscopic surgeons (Bailey 2005).

Choice of anaesthetic for inguinal hernia repair

At present laparoscopic repair requires a general anaesthetic (GA). For open repair either GA or local anaesthesia (LA) is appropriate. Regional anaesthesia is occasionally used if the patient is considered unfit for GA and the surgeon is not comfortable doing the procedure under LA.

However it is not ideal for day case surgery and cannot be recommended for routine use because prolonged motor block will delay discharge from hospital in a large number of cases and there is a high incidence of urinary retention. LA has considerable advantages over GA in terms of reduced cardiac, CNS and respiratory complications, while the incidence of urinary retention after LA hernia repair is negligible (Kark et al 1998, Nordin et al 2003). This makes LA particularly appropriate for elderly patients and those with co-existing disease.

In addition Song et al (2000) report that LA results in less postoperative pain and the shortest admission time of all anaesthetic methods. These features combined with the absence of postoperative nausea and vomiting, excessive drowsiness or urinary retention make LA ideal for day case surgery. However the technique is more demanding of the surgeon, requiring patience, gentle handling of tissues and familiarity with the anatomy (see Figure 6). It is also difficult to teach trainees hernia repair if LA is used. A poorly administered LA, with excess inappropriate sedation is worse than a well administered GA in terms of patient safety and effectiveness. A comparison between LA and GA is made in Table 5.

The Royal College of Surgeons has recommended that >50% inguinal hernias should be repaired as day cases. At present about 30% of inguinal hernia repairs in the UK are done in this way, though in dedicated consultant led units this figure can reach over 80% (Kingsnorth et al 2003).

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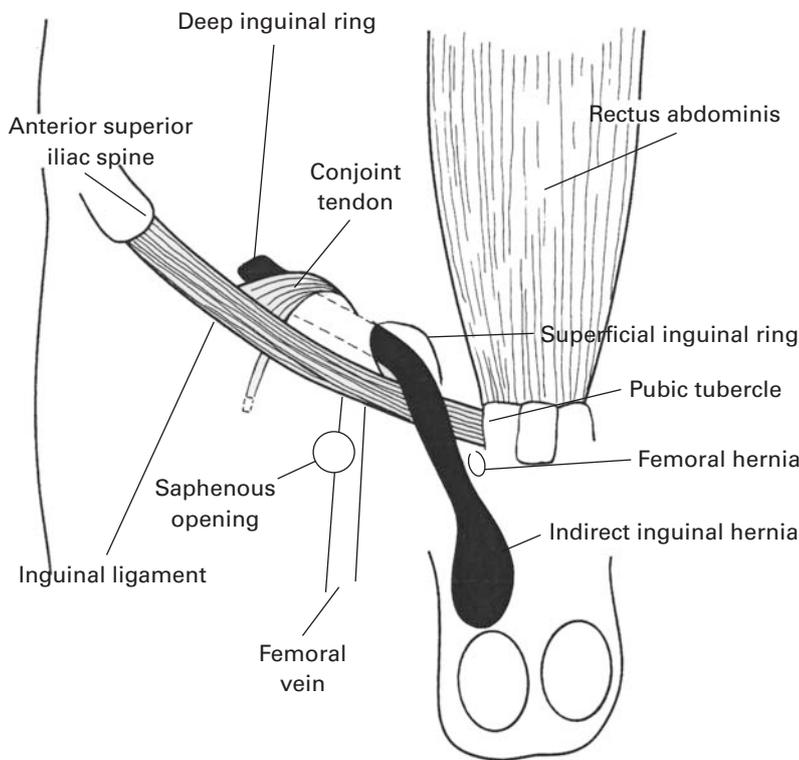


Figure 6 Anatomy of the groin – anterior view

Long term discomfort following inguinal hernia repair

There is evidence that up to 20% of patients will have some degree of discomfort (often mild) one year or more after inguinal hernia repair (Bay-Nielsen et al 2004). In the majority of patients this will subside with time but in up to 6% of patients this pain may be severe and affect the patient's quality of life. The aetiology of this pain is unclear and is probably multifactorial.

Mesh as a biomaterial

A number of prosthetic materials are available for hernia repair. Polypropylene, distributed under various trade names, is favoured in the USA, the UK and most of Europe and, at present, fulfils most of the criteria for the ideal mesh. However it does stimulate inflammation and promote scar tissue formation (which is part of the reason for its effectiveness). There is a possible (unproven) association of mesh with long term pain after inguinal hernia repair and it has been suggested by Post et al (2004) that lightweight large pore mesh may reduce this because it stimulates less inflammatory reaction and less scar tissue formation. ➔

Open tension-free mesh	Laparoscopic
<ul style="list-style-type: none"> ■ Easier for surgeons to learn and to teach ■ Low risk of major complications ■ Acceptable results obtainable by trainee surgeons ■ Suitable for almost all inguinal hernias ■ Cost-effective ■ More postoperative discomfort than laparoscopic repair ■ Longer to return to normal activities 	<ul style="list-style-type: none"> ■ Technically difficult ■ Potential for serious bowel, bladder or blood vessel injury ■ Long learning curve ■ Requires general anaesthesia ■ TAPP not suitable if previous abdominal surgery ■ Greater costs than open repair ■ Indicated for recurrent and bilateral hernia (NICE guidelines) ■ May diagnose unsuspected hernia on the opposite side ■ Less postoperative discomfort than open repair ■ Quicker return to normal activities

Table 4 Comparison of surgical techniques for the repair of inguinal herniae

There is a possible link between mesh and long term pain

Local Anaesthesia (LA)

- Most cost-effective method – shortest time to discharge
- No CVS, CNS or respiratory problems
- Good for elderly or unwell
- No urinary retention or postoperative nausea and vomiting
- Low immediate postoperative pain
- Ideal for day case surgery
- Not suitable for strangulated or incarcerated hernias
- Not suitable for very obese or excessively anxious patients
- Procedure may take longer than under GA
- More technically demanding than GA repair
- Difficult to teach hernia repair under LA

General Anaesthesia (GA)

- Costlier than LA; equipment, preoperative investigations, staffing levels
- Not suitable for elderly, unwell patients
- Incidence of urinary retention and postoperative nausea and vomiting
- May need postoperative opioids
- If day case then more likely to need unplanned overnight stay
- Indicated for repair of strangulated or irreducible hernia
- Best for obese or anxious patient
- Short 'on-table' time; longer time in operating room and hospital
- Hernia repair can be carried out by surgeons in training
- Easy to learn and teach hernia repair

Table 5 Comparison of local and general anaesthesia for open inguinal hernia repair

Mesh for everyone?

Prosthetic mesh has made such a difference to the results of inguinal hernia repair that the temptation is to advocate its universal use. Some surgeons have expressed concern over possible long term complications, hence there is a tendency not to use it in the young – although there is no consensus regarding minimum age.

Return to work and normal activities after inguinal hernia repair

Patients should be advised clearly, both verbally and with written instructions, that an early return to normal activities and work not only has no adverse consequences but is positively beneficial. The majority of patients should be able to return to normal activities between one and two weeks after open or laparoscopic repair. Failure to do so may relate to pain and wound problems, but may equally well be a result of conflicting GP advice and inadequate preoperative counselling (Bay-Nielsen 2004).

Prophylaxis for venous thromboembolism and infection?

There is little objective evidence in the literature regarding the use of thromboprophylaxis following inguinal hernia repair and this is reflected in the variation and inconsistency of practice among UK surgeons (Smith 2007). Patients should undergo risk assessment and management should follow local guidelines for surgical patients. Mechanical methods such as graded compression stockings, calf muscle pumps and early mobilisation are to be preferred over formal anticoagulation, because of the high incidence of haematoma formation in the surgical wound. ➔

Early return to normal activities and work has no adverse consequences



Figure 7 Ten minutes postoperative (general anaesthesia)

Open repair under local anaesthesia is well tolerated by higher risk groups

Perioperative antibiotics?

Early fears of an increase in infection rate associated with mesh have proved unfounded. There is conflicting evidence that prophylactic antibiotics reduce the incidence of wound infection. A single shot of a broad-spectrum intravenous antibiotic is recommended for higher risk patients (for example, diabetic, elderly, obese or immunocompromised) and for recurrent or complex herniae.

Cost of inguinal hernia repair and day case surgery

Debate surrounds the cost of open and laparoscopic repairs. Direct hospital costs relate to time in the operating room, time in hospital, the use of specialised equipment (disposable or increased sterilisation costs for re-usable) and an obligatory need for GA. Laparoscopic hernia repair in the UK has an additional NHS cost of £91 over open repair (NICE 2004) yet this is based on the cost of hernia repairs undertaken in 2001-2. Reusable laparoscopic equipment is estimated by NICE to cost about £170 per procedure compared with £790 for disposable equipment. The cost effectiveness of laparoscopic surgery is also influenced by the number of laparoscopic procedures a surgeon performs annually and the surgeon's experience.

It is now widely recognised that an increasing proportion of inguinal hernia repairs should be carried out as day cases. Cooke et al (2004, p5) state that: *'Day surgery provides a high quality, patient-centred treatment that is safe, efficient and effective [and] is accompanied by ... a lower incidence of hospital-acquired infection and an*



Figure 8 Ten minutes postoperative (local anaesthesia)

earlier return to normal activity compared with inpatient treatment.¹

Conclusion

Hernia repair is a common surgical procedure in the day case setting. A hernia is a protrusion of an organ or part of an organ through the wall of its containing cavity into an abnormal position. The majority of groin hernias are inguinal and the patient usually presents with a groin swelling associated with pain or discomfort. The aetiology of hernias is multifactorial and treatment usually surgical. The widespread introduction of surgical mesh to support repairs and the development of laparoscopic surgical techniques have

revolutionised hernia repairs in the last 20 years. Laparoscopic techniques reduce postoperative discomfort, but require general anaesthesia and surgical experience (Figure 7). Open tension-free mesh repairs have a low morbidity and mortality and is a suitable technique for most groin hernias. Open repair under local anaesthesia is well tolerated by higher risk groups such as the elderly and is an ideal day case procedure (Figure 8).

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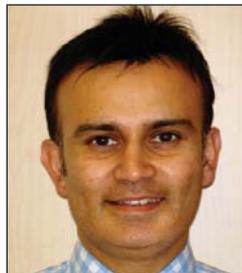
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