Adult groin hernias

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Abstract

Inguinal hernias are common, affecting one in four men in their lifetime. They are much less common in women with a lifetime risk of about 3%. Consequently, inguinal hernia repair is one of the commonest operations with more than 20 million operations performed annually worldwide. Africans have a much higher incidence of hernias than Caucasians and this is thought to be because of the anatomical configuration of the African pelvis. Many hernias in poorer countries are not repaired, so that presentation as an emergency and indeed mortality due to complications are much more often seen than in more affluent societies.

Surgeons must be familiar with the anatomy of the groin from both the anterior and pro-peritoneal aspects. The anatomy of the inguinal region as seen from the posterior aspect has gained increasing importance, primarily because of the advent of laparoscopic repair but also because of the potential for pro-peritoneal repair using open techniques. Laparoscopic repair is recommended by the National Institute for Health and Clinical Excellence as one of the treatment options for inguinal hernia repair. Patients should be fully informed of all the risks and benefits associated with each of the three procedures offered (totally extraperitoneal, transabdominal preperitoneal or open).

Recurrence rates vary widely. In large series, recurrence rates well below 1% are described. However, in real-world practice, such rates are not achieved. A more realistic figure for 10-year recurrence of a hernia repair by a general surgeon is probably 3–5%. Chronic groin pain is much commoner after inguinal hernia repair than most surgeons acknowledge, probably being evident in one-third of cases.

Keywords Femoral hernia; hernia surgery; inguinal hernia; laparoscopy

Inguinal hernias are common, affecting one in four men in their lifetime. They are much less common in women with a lifetime risk of about 3%. Consequently, inguinal hernia repair is one of the commonest operations, accounting for 10–15% of all general surgical procedures. More than 20 million operations for groin hernias are performed annually worldwide. The prevalence of groin hernias in the population increases with age, rising from a little under 1% in the 45–64-year age group, to 1.5% of the over 75-year-old age group.

Africans have a much higher incidence of hernias than Caucasians. This is thought to be because of the anatomical configuration of the African pelvis, which is more oblique with a lower arch covering the inguinal canal. This results in a narrower origin of the internal oblique muscle. Consequently, the flap closure mechanism to protect against the development of hernia is less efficient. Many hernias in poorer countries are not repaired, so that presentation as an emergency and indeed mortality due to complications are much more often seen than in more affluent societies.

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The aetiology of inguinal hernia

The aetiology of inguinal hernia is multifactorial. It is commonly believed that indirect hernias in younger patients are caused by the failure of closure of the processus vaginalis. However, it has been shown that up to 30% of men without a clinically apparent inguinal hernia have a patent processus vaginalis.

Pathological changes in the abdominal wall connective tissue are thought to be the major factor in the aetiology of inguinal hernia. This would explain the recognized association of inguinal hernia with aortic aneurysms, as well as the increased incidence of inguinal hernia in osteogenesis imperfecta. There is evidence that the mature type 1 collagen in inguinal hernia patients is reduced and replaced by type 3 collagen with a resultant reduction in tensile strength and mechanical stability of the connective tissue.

Conditions such as chronic cough, constipation with straining, pregnancy, prostatic enlargement with urinary straining, and heavy lifting are not usually considered the primary cause of hernias, but in many cases may represent exacerbating or precipitating factors. Interestingly, studies suggest that the incidence of groin hernias in sedentary workers and workers who partake in heavy manual labour is similar, when other confounding factors are accounted for. Other contributory factors for inguinal hernia include smoking and obesity.

Anatomy

The inguinal canal could be considered as a three-dimensional cylinder stretching between the deep and superficial inguinal rings. The superior wall or roof is formed by the fibres of internal oblique and transversus abdominis which ultimately form the conjoined tendon. The conjoined tendon runs on the posterior wall of the medial part of the inguinal canal and additional support comes from the fascia transversalis. The anterior wall of the inguinal canal is formed by the aponeurosis of the external oblique and in the lateral part of the canal the aponeurosis of internal oblique. Inferiorly, the floor of the canal is formed by the inguinal ligament, the lacunar ligament in the medial third of the canal and the ilio-pubic tract more laterally.

In males the inguinal canal contains the spermatic cord and its coverings, as well as the ilioinguinal nerve. The cord (but not the ilioinguinal nerve) is covered by the internal spermatic fascia, which is derived from the transversalis fascia. Superficial to this, the cord is covered by cremasteric fascia, derived from the internal oblique muscle layer. As the cord exits the superficial ring, it picks up a third layer derived from the external oblique, the external spermatic fascia. In females the round ligament and the ilioinguinal nerve form the canal contents. The ilioinguinal nerve passes through the superficial ring to descend into the groin.

The superficial inguinal ring (which is actually a V-shaped cleft) is formed where the fibres of the external oblique split at the pubic tubercle to permit egress of the spermatic cord. The deep inguinal ring is about 1–1.5 cm above the inguinal

ligament. Its medial boundary is identified by the position of the inferior epigastric vessels. The superficial landmark for the inferior epigastric vessels is the mid inguinal point. This is a point midway between the top of the symphysis pubis and the anterior superior iliac spine.

As well as the ilioinguinal nerve, two further nerves are seen within the inguinal canal. The genital branch of the genitofemoral nerve travels within the inguinal canal and supplies the cremaster muscle and the scrotal skin. The iliohypogastric nerve is not often seen at inguinal hernia surgery. It is the superior branch of the anterior ramus of the spinal nerve L1 (the inferior branch is the ilioinguinal nerve). The iliohypogastric nerve emerges from the upper border of the lateral aspect of psoas and perforates the posterior part of transversus abdominus near the crest of the ileum.

The femoral ring lies below the inguinal ligament and lateral to the pubic bone. It is bounded anteriorly by the inguinal ligament and posteriorly by the pectineus muscle covered by its fascia. Medially, the crescentic lacunar ligament forms a rigid edge and laterally there is a fibrous septum between the femoral ring and the femoral vein. Importantly, therefore, the femoral ring is bounded by rigid structures on three of four sides and this explains the greater likelihood of strangulation with femoral hernias.

The anatomy of the inguinal region as seen from the posterior aspect has gained increasing importance. This is primarily because of the advent of laparoscopic repair but also because of the potential for pro-peritoneal repair using open techniques such as the Kugel patch or Stoppa repairs.

The myopectineal orifice is the window through which inguinal and femoral hernias may occur. It is divided by the ilio-pubic tract representing a thickening of the fascia transversalis. Superiorly, the medial boundary is the edge of the rectus abdominis muscle and just lateral to this is the potential direct space. The inferior epigastric vessels run on the posterior aspect of the conjoined tendon and immediately lateral to them is the internal ring. The vas enters the internal or deep inguinal ring from the medial aspect and the spermatic vessels enter from the lateral aspect. A triangle formed between these two structures is known at laparoscopic surgery as the triangle of doom, because dissection in this region may injure the external iliac vessels. Lateral to the spermatic vessels and below the ilio-pubic tract there are a number of important cutaneous nerve branches which can be injured; this area is known as the triangle of pain.

Presenting symptoms

The typical history is of a swelling in the groin, which may reduce spontaneously, require manual reduction or be irreducible. Some patients have groin pain, but there is no obvious swelling. A hernia that is irreducible is termed 'incarcerated', whereas if the contents are ischaemic, it is 'strangulated'.

How to examine for a hernia

Examination should commence with the patient supine, looking for any obvious swelling at rest or on coughing. If the hernia is not obvious at this point, the patient should be examined standing. The origin of any identified swelling from the superficial layer of the abdominal wall should be identified. Inguinal hernias arise above and classically medial to the pubic tubercle; however, if the hernia is large the anatomy can be distorted and the superficial ring expanded.

An indirect hernia will traverse the deep ring and as it enlarges, may reach the scrotum. A direct hernia traverses the posterior wall of the inguinal canal medial to the inferior epigastric vessels and displaces the cord. It is neither reliable, nor necessary to distinguish between these two types of hernia. The traditional teaching that indirect hernias can be controlled by pressure at the deep ring should no longer be taught. Femoral hernias appear below and lateral to the pubic tubercle.

If a hernia is present it should be gently reduced by taxis, taking care not to perform reduction en-mass. In large, long-standing hernias the patient is often better at effecting reduction than the surgeon.

If the swelling cannot easily be reduced it is important to determine that it is indeed a hernia and not a swelling arising from the contents of the scrotum or the spermatic cord. The testes should therefore be examined as a routine at assessment of inguinal hernias. Swellings arising from within the scrotum include hydrocoele, testicular tumour, varicocoele and hydrocoeles of the cord. An ectopic testis may easily be mistaken for a hernia. A saphena varix is a soft swelling arising from the junction of the femoral and long saphenous veins. The unwary examiner may mistake it for a hernia. Finally, a nodal mass may be confused with an irreducible femoral hernia. In these circumstances ultrasound can be useful in establishing a diagnosis.

The contralateral side should also be examined.

There are a number of classifications for inguinal hernia. We prefer the Kingsnorth classification (Box 1).

Imaging

Imaging of the groin is rarely necessary to diagnose an inguinal hernia.

Herniography can be performed by injecting water-soluble contrast into the peritoneal cavity and while it is highly reliable it has been largely superseded by non-invasive investigation including ultrasound and dynamic magnetic resonance imaging (MRI). MRI is of most use in looking for other causes of groin pain in patients suspected of having a painful hernia but without an obvious swelling.

Kingsnorth classification of inguinal hernia

H1 Reduces spontaneously on lying down
H2 Reduces completely with manual pressure
H3 Inguino-scrotal but reducible with manual manipulation
H4 Irreducible inguino-scrotal

H3 and H4 hernias can be subdivided according to the distance of the hernia sac below the pubic tubercle (10, 20, 30 cm).

Box 1

Indication for surgery

Traditional teaching dictated that all hernias should be repaired to prevent hernia-related complications unless the patient has significant co-morbidity.

One-third of patients will be asymptomatic at presentation. The risk of incarceration is lower than previously thought with a risk in the region of four per 1000 patients with a groin hernia per year. Incarceration is more likely in patients older than 60 years, in femoral hernias and in the first 3 months after presentation of the hernia. Approximately 20% of asymptomatic or minimally symptomatic hernias will become symptomatic and require repair. Around 1% will present with incarceration requiring emergency surgery.

The question of whether a watch-and-wait policy is appropriate following informed consent is controversial, though two controlled trials have suggested it is safe. In selected patients under 50 years old, who have an American Society of Anesthesiologists (ASA) class of 1 or 2 and a hernia for more than 3 months, it is certainly an option.

Anaesthesia for hernia repair

Tension-free hernia repair can easily be performed as a day case under local anaesthesia once the technique has been learned. This has significant advantages. In particular, the patient can be guaranteed a journey home without pain. Retention of urine is rare in patients who have hernia repair under local anaesthesia. The use of local anaesthesia diminishes the need for potent opiate analgesia postoperatively. This in turn reduces the incidence of postoperative nausea and vomiting, which may prevent day case surgery when general anaesthesia is used.

Despite this, in the UK many hernia repairs are still performed under general anaesthesia. This is largely a question of custom and practice.

Local anaesthesia is generally not suitable for H4 hernias and repair of very large H3 hernias under local anaesthesia can be challenging. However, these hernias can, if necessary, be repaired under spinal anaesthesia.

Our technique for hernia repair under local anaesthesia requires preparation of a total of 60 ml of local anaesthetic. We use a mixture of 30 ml of 0.5% lidocaine with adrenaline and 0.25% levobupivacaine. The operative anatomy is identified and the proposed incision, which should run from just lateral to the position of the deep ring to just medial to the position of the superficial ring about 1.5–2 cm above the inguinal ligament, is marked. The proposed skin incision is infiltrated intra-dermally and subcutaneously with about 15 ml of local anaesthesia. A further injection of 5–10 ml of local anaesthetic is placed 1–2 cm above the anterior superior iliac spine immediately deep to the external oblique. The external oblique can be felt easily if the needle is blunted slightly before insertion of this local anaesthetic. Further infiltration into the inguinal canal with 10 ml of local anaesthetic completes the block. This is performed before the surgical team scrubs.

However, we also infiltrate local anaesthetic during the procedure. The two critical points are the mobilization of the cord medially and at the deep ring; traction on the peritoneum can be painful and cause profound nausea.

Techniques of repair

Tension-free repair

Lichtenstein et al were the first to popularize the use of mesh in hernia repair in 1989 on the grounds that sutured repairs led to unavoidable tension on the suture line. It is an easily taught technique with reproducible results in the hands of general surgeons.

An oblique groin incision is made above and parallel to the inguinal ligament along the line already infiltrated with local anaesthesia (it is useful to mark the skin). Further dissection is facilitated by placing a small retractor in the wound and using it to elevate the tissues under slight tension. The external oblique is opened in line with the skin incision to the superficial ring and the contents of the inguinal canal are separated from it. The spermatic cord is mobilized using the avascular plane between the pubic tubercle and the cord. The inguinal ligament is defined inferiorly, and the conjoined tendon dissected to the line of fusion with the external oblique superiorly (Figure 1).

A hernia ring or similar retractor is placed around the cord and a retractor held at the medial side of the wound. The cremaster fibres are incised longitudinally to expose the cord. An indirect hernia sac will be identified in the anteromedial aspect of the cord. The sac is separated from the cord and is opened to inspect and reduce the contents. The sac is traditionally transfixed at the level of the deep ring and the redundant peritoneum is excised. Many surgeons simply invert the sac at the deep ring. A large inguino-scrotal sac can be transected and the distal portion left in situ. The sac margins may bleed, so careful haemostasis must be achieved by overrunning with a suture or use of diathermy. A direct sac is invaginated by a running suture to flatten the posterior wall. If there is a sliding hernia, the bowel should not be dissected off the sac. Rather, a purse string suture should be used to close the sac before it is reduced.

A mesh is then trimmed to fit between the inguinal ligament and the reflected external oblique. The medial corner of the mesh should overlap the pubic tubercle by 2 cm. The mesh is sutured

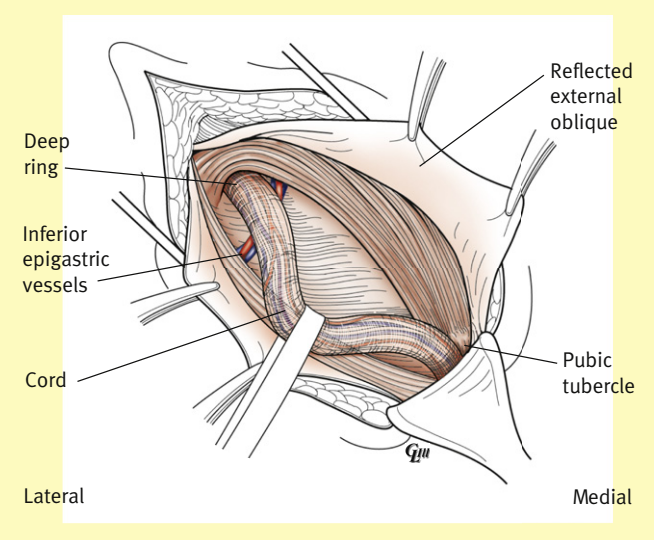

Figure 1 Mobilization of the spermatic cord.

in place with a non-absorbable suture, beginning at the most medial aspect of the inguinal ligament. Sutures must never be placed in the periosteum. This suture is then continued laterally along the inguinal ligament to just beyond the deep ring. A slit is then made in the lateral end of the mesh creating a wider tail above the cord and a narrow one below the cord (usually one-third below and two-thirds above). The upper edge of the mesh is sutured to the internal oblique aponeurosis with about four interrupted sutures. The lower edge of the upper lateral tail is sutured to the inguinal ligament to create a 'new deep ring'. The mesh is trimmed on the lateral side, leaving 3–4 cm lateral to the deep ring and these ends are tucked beneath the external oblique aponeurosis (Figure 2). It is important that the mesh is applied loosely to create a tension free repair. The external oblique aponeurosis is then closed with a continuous suture. Standard wound closure, usually with a subcuticular skin suture completes the operation.

Laparoscopic repair

Laparoscopic hernia repair was first described in 1992. It allows hernias to be repaired without opening the anterior abdominal wall. As in an open repair, a mesh is used to cover the hernia defect once the sac has been dealt with. There are two main approaches. The transabdominal pre-peritoneal (TAPP) repair involves entry into the peritoneal cavity via the umbilical scar. Two further trocars are place above and slightly medial to the anterior superior iliac spines to allow access for dissecting instruments and the stapler. A transverse incision is made in the peritoneum above the hernia defect and dissection continues bluntly, separating the peritoneum from the anterior abdominal wall, usually with inversion of the hernia sac. In larger hernias the sac can be divided (Figure 3). The 'triangle of doom' is the anatomic area between the spermatic vessels and the vas deferens (Figure 4). Underneath the peritoneum in this area lie the external iliac artery and vein therefore extreme caution must be taken during dissection. The pro-peritoneal space is dissected to allow placement of a prosthetic mesh to cover the entire myopectineal orifice. This dissection must involve complete mobilization of the vas and gonadal vessels.

The placement of staples lateral to the internal ring or on iliopsoas should be avoided to reduce the risk of neurovascular damage. The peritoneum is then closed over the mesh to prevent

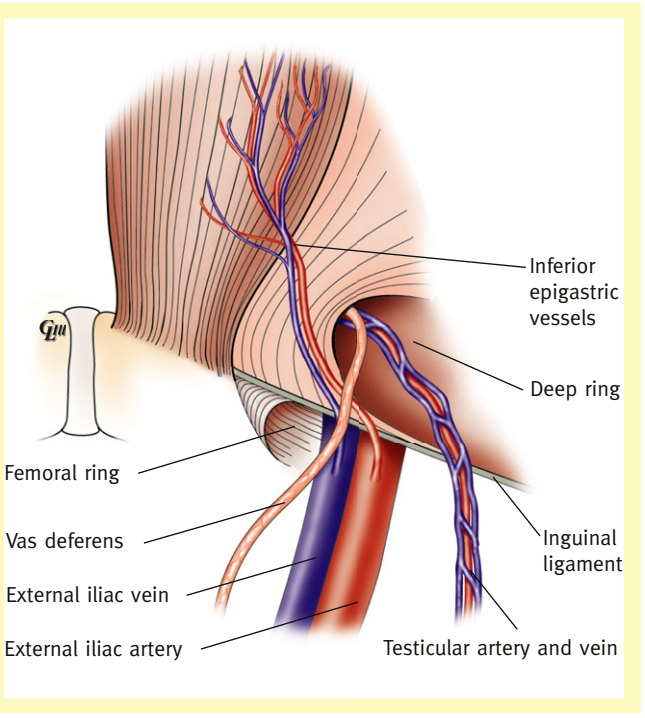

Figure 3 Pre-peritoneal view of the deep ring, as seen at laparoscopy.

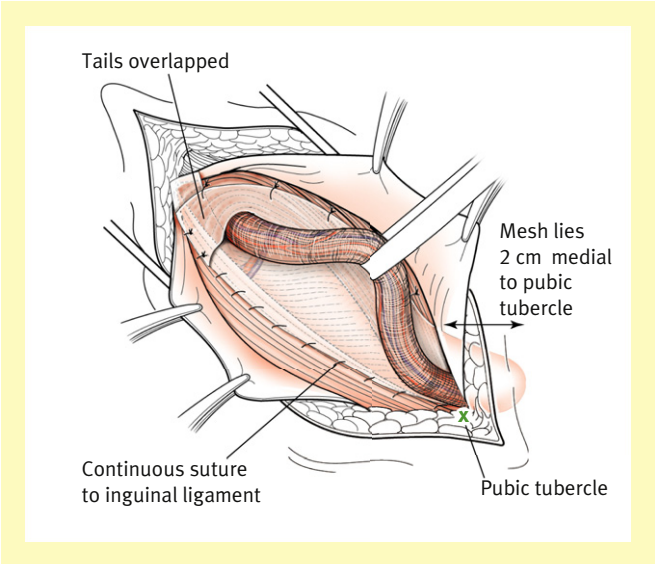

Figure 2 Positioning and suturing of the mesh.

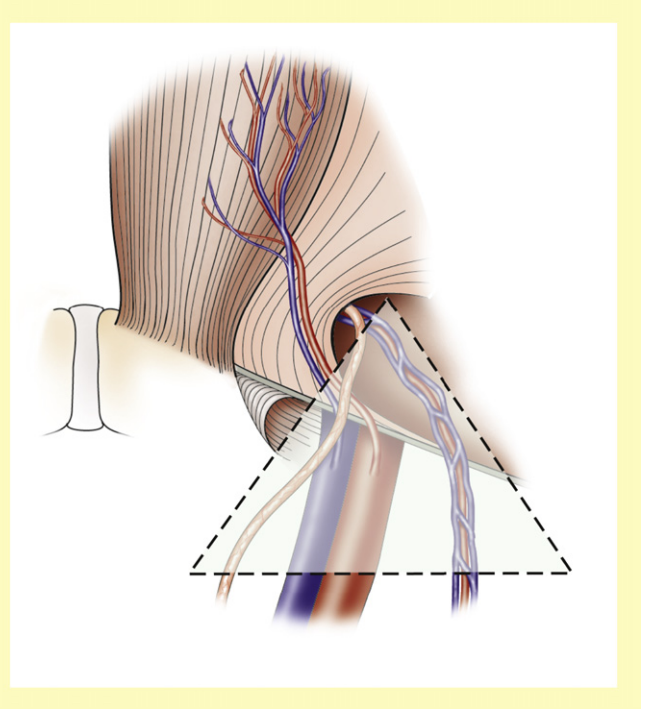

Figure 4 The 'triangle of doom'.

adhesions between the mesh and the bowel. This approach allows bilateral repair to be carried out if necessary.

In the totally extraperitoneal (TEP) repair, insufflation, repair and mesh placement are all performed in the pro-peritoneal plane. This approach is technically more challenging, but avoids entering the peritoneal cavity. However, there is no difference between the two techniques in relation to duration of operation, time to return to normal activities or recurrence rates.

Femoral hernia repair

Low approach (Lockwood): this approach is commonly used for elective operations. The hernia sac is exposed through a 3–4 cm incision in the groin crease below the medial half of the inguinal ligament. The sac is dissected free, remembering the position of the femoral vein nearby.

The sac is opened to inspect the contents and is then emptied, transfixed and excised. The defect is closed by approximating the inguinal and pectineal ligaments with a non-absorbable suture for 1 cm laterally. Care must be taken not to constrict the femoral vein, which lies laterally. Some surgeons reflect the pectineal fascia to reinforce the repair. Alternatively, the femoral canal may be plugged with rolled, umbrella or preformed plug mesh, secured with 3–4 interrupted non-absorbable sutures.

Transinguinal approach (Lothiessen): in this repair, the floor of the inguinal canal (transversalis fascia) is opened to allow reduction of the sac. The inguinal and pectineal ligaments are then approximated to close the femoral defect. A concurrent inguinal hernia may be repaired at the same time. This approach predisposes the patient to the development of a direct inguinal hernia and is rarely used.

High/pre-peritoneal approach: this is commonly used for strangulated hernias as it provides good access for assessment of bowel viability and resection if necessary. The abdominal incision can be midline (Henry), pararectus (McEvedy), Pfannenstiel or transverse suprainguinal (Nyhus).

Once learned, this technique often becomes the preferred option for surgeons, as it affords excellent exposure of the femoral canal.

After division of the fascial layers, the transversalis fascia must be opened to enter the correct pro-peritoneal plane, reflecting the inferior epigastric vessels forward. The sac is exposed when the peritoneum is reflected from the posterior lower abdominal wall. If there is difficulty reducing the sac, the peritoneal cavity can be entered above the incarcerated hernia.

In cases where there is no contamination, we usually place a mesh over the femoral canal.

Repair of recurrent inguinal hernias

Recurrent inguinal hernias can be challenging, and should not be operated on by inexperienced surgeons. Orchidectomy is rarely required. It is wise to choose a different surgical approach than the method of primary repair. If an open repair has failed, then laparoscopic or open pro-peritoneal techniques are suitable. If the initial surgery was laparoscopic, it seems sensible to consider an anterior repair.

Repair of strangulated hernias

Emergency surgery for strangulation is much more difficult than elective inguinal hernia surgery. It is important that the patient is adequately and promptly resuscitated and broad-spectrum antibiotics should be administered as soon as possible.

It is important to remember that strangulated inguinal and femoral hernias can result in severe sepsis and the death of the patient.

The technique of dissection is similar to elective surgery. However, ischaemic contents of the sac, such as bowel or omentum, will often need to be resected. Laparotomy is occasionally necessary to achieve this safely. In the presence of severe contamination, insertion of a synthetic mesh may be unwise, even with broad-spectrum antibiotic cover. The options are to repair the hernia using an absorbable mesh (with likely recurrence), to use a biological (collagen) mesh, with the attendant costs, or our preferred option, to perform an anatomical repair such as the Shouldice procedure, which does not require mesh.

Complications of hernia repair

Most hernia repairs are uncomplicated. However, patients should be warned preoperatively that numbness below the wound, sometimes extending into the scrotum, is normal.

Recurrence rates vary widely. In large series, recurrence rates well below 1% are described. However, in real-world practice, such rates are not achieved. A more realistic figure for 10-year recurrence of a hernia repair by a general surgeon is probably 3–5%.

Urinary retention is a common complication of inguinal hernia surgery, though less so after repair under local anaesthesia.

Chronic groin pain is much commoner after inguinal hernia repair than most surgeons acknowledge, probably being evident in one-third of cases. This most often takes the form of a mild ache, but severe neuralgia may prove disabling.

Haematoma and/or seroma occur in 1–2 % of cases. Testicular atrophy is a rare complication, caused by ischaemic orchitis.

Wound infection is rare; antibiotics are not usually necessary at the time of repair. If a patient who has had an inguinal hernia repair presents a few weeks after surgery with recent onset of swelling and pain, infection must be excluded urgently. If infection involves the synthetic mesh, this may need to be removed. Mesh removal is a challenging procedure often requiring orchidectomy.

Conclusion

Inguinal hernias are common, and in many parts of the world represent a major health challenge. Small asymptomatic hernias do not always need to be repaired.

Hernias are primarily caused by a structural weakness in the fascial collagen layers. Additional factors such as obesity and smoking may contribute. Increased abdominal pressure may precipitate the appearance of a hernia, but is rarely, if ever, the main cause.

Surgeons must be familiar with the anatomy of the groin from both the anterior and pro-peritoneal aspects.

Inguinal hernia surgery requires attention to detail if good results are to be obtained. Recurrence rates 'in the wild' are not

at the level achieved in major hernia centres. Chronic pain is a common (though usually mild) long-term complication of hernia surgery. ◆

FURTHER READING

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