Inguinal hernia

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Inguinal hernia, often referred to as a ‘rupture’ by patients, is the most common hernia in men and is around 10 times more common in men than in women. There are two basic types that are fundamentally di ff erent in anatomy , causation and complications. However, they are anatomically very close to each other, the surgical repair techniques are very similar and ultimate reinforcement of the weakened anatomy is identical, so they are often referred to together as inguinal hernia. Inguinal hernia /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF - Congenital inguinal hernias are of the indirect type, whereas the acquired hernias may be either indirect or direct. - Anatomy of the inguinal canal As the testis descends from the abdominal cavity to the scrotum it passes through a defect in the transversalis fascia called the deep inguinal ring, just deep to the abdominal muscles. This ring lies midway between the anterior superior iliac spine and the pubic tubercle, approximately 2–3 /uni00A0 cm above and marginally lateral to the femoral artery pulse in the groin. The inferior epigastric vessels lie just medial to the deep inguinal ring, passing from the iliac vessels to rectus abdominis. Muscle fibres from the innermost two layers of the lateral abdominal wall, the transversus muscle and the internal oblique muscle, arch over the deep inguinal ring from lateral to medial before descending to become attached to the pubic tubercle. These two muscles fuse and become tendinous, forming the conjoint tendon. Below this arch there is no muscle but only transversalis fascia and external oblique aponeurosis, resulting in an area of weakness (Figure 64.10). The testis proceeds medially and downwards along the inguinal canal. Anterior to the canal is the aponeurosis of the external oblique muscle, the fibres of which run downwards and medially . T he testis finally emerges through an inverted V-shaped defect in the aponeurosis, the superficial inguinal ring, and descends into the scrotum.

Epigastric Umbilical Spigelian Inguinal Femoral Obturator Figure 64.9 Diagram to show the sites of abdominal wall hernias: common in red and rare in black. Incisional and parastomal hernias can be found at various sites. Types – indirect (lateral, or oblique) or direct (medial) Origin – congenital or acquired Anatomy – inguinal canal Diagnosis – usually clinical but radiological in special circumstances Surgery – open or minimally invasive (laparoscopic/robot assisted) Superior lumbar Inferior lumbar Gluteal Sciatic

The inguinal canal is roofed by the conjoint tendon; its pos terior wall is transversalis fascia, the anterior wall is the exter nal oblique aponeurosis and the floor is the free inferior edge of the external oblique aponeurosis, rolled inwards thickened to become the inguinal (Poupart’s) ligament. The inguinal canal in males contains the testicular artery , veins, lymphatics and the vas deferens all covered in cremasteric muscle. In females, the round ligament descends through the canal to end in the labia majora. Three important nerves, the ilioinguinal, the ilio hypogastric and the genital branch of the genitofemoral nerve, also pass through the canal. As the testis descends, a tube of peritoneum is pulled with the testis and wraps around it ultimately to form the tunica vag inalis. This peritoneal tube should obliterate, possibly under hormonal control, b ut it commonly

fails to do so completely . As a result, bo wel within the peritoneal cavity can pass inside the tube towards the scrotum. Inguinal hernias in neonates and Francois Poupart , 1661–1709, physician and anatomist, Hôtel Dieu, Reims, France 1561 by Gabrielle Fallopius , 1523–1563, Professor of Anatomy , Padua, Italy . Franz Kaspar Hesselbach , 1759–1816, surgeon and anatomist, Würzbur patients, the muscles around the deep inguinal ring can prevent a hernia from developing until later in life, when, under the constant positive abdominal pressure, the deep inguinal ring and muscles are stretched and a hernia becomes apparent. As the hernia increases in size, the contents are directed down into the scrotum. These hernias can become massive and may be referred to as a scrotal hernia. An indirect hernia is lateral because its origin is lateral to the inferior epigastric vessels. It is also oblique as the hernia passes obliquely from lateral to medial through the abdominal muscle layers. An indirect hernia can pass all the way down to the scrotum, following the line of the processus vaginalis, while this is not possible with a direct hernia. The second type of inguinal hernia, referred to as direct or medial, is always acquired. It is a result of stretching and weakening of the abdominal wall just medial to the inferior epigastric vessels, an area known as Hesselbach’s triangle, the - three sides of which are the inferior epigastric vessels laterally , - the lateral edge of rectus abdominis muscle medially and the inguinal ligament below (the iliopubic tract) (Figure 64.11). This area is weak because the abdominal wall at this point con - sists of only transversalis fascia covered by the external oblique aponeurosis. A direct medial hernia is more likely in elderly patients. It is broadly based and therefore unlikely to strangulate. The - bladder can be pulled into a direct her nia (Figure 64.12). Inguinal hernias are sometimes referred to as ‘sliding’ in type. These are acquired indirect hernias arising at the deep inguinal ring lateral to the inferior epigastric vessels. Retro - - peritoneal fatty tissue is pushed downwards along the inguinal canal. As more tissue enters the hernia, peritoneum is pulled with it, thus creating a sac. However, the sac has formed sec - ondarily , distinguishing it from a classic indirect hernia. On the left side, sigmoid colon may descend into a sliding hernia and , described the inguinal ligament in 1705 although it had been described in g, Germany.

ring Iliacus Inferior epigastric vessels Femoral nerve External inguinal Femoral artery ring Femoral vein Sac of femoral Pubic tubercle hernia Sac of indirect inguinal hernia Sac of direct

inguinal hernia Figure 64.10 The close relationships of direct inguinal, indirect ingui nal and femoral hernias. (a) Figure 64.11 (a) Laparoscopic view of the left inguinal region with hernia defects highlighted: yellow, Hesselbach’s triangle (medial or direct inguinal); blue, lateral or indirect inguinal; green, femoral. (b) Diagrammatic representation of

(b) Inferior epigastric vessels Laparoscopic instrument Testicular Line of the vessels inguinal ligament Arch of the pubic bone Vas deferens (a) .

the caecum may do so on the left. Surgeons need extra caution during repair because the bowel may form part of the sac itself and can be damaged during the dissection. Occasionally , both lateral and medial hernias are present in the same patient (pantaloon hernia). Classification Many ways to classify inguinal (and femoral) hernias have been described. The European Hernia Society has recently suggested a simplified system of: /uni25CF primary or recurrent (P or R); /uni25CF lateral, medial or femoral (L, M or F); /uni25CF defect size in fingerbreadths (assumed to be 1.5 /uni00A0 cm), with three sizes of one fingerbreadth or less, between one and three fingerbreadths and three or more fingerbreadths. A primary indirect inguinal hernia with a 3-cm defect size would be PL2. Diagnosis of an inguinal hernia In most cases, the diagnosis of an inguinal hernia is simple. Often the hernia will reduce on lying and reappear on stand ing. With the patient lying down, the patient is asked to reduce the hernia if it has not spontaneously reduced. If the patient cannot then

the surgeon gently attempts to reduce the hernia. Once reduced, the surgeon identifies the bony landmarks of the anter osuperior iliac spine and pubic tubercle, from which the location of the deep inguinal ring can be found just above the midpoint of the inguinal ligament. Gentle pressure is applied at this point and the patient asked to cough. If the hernia is controlled with pressure on the deep inguinal ring then it is likely to be indirect/lateral; if the hernia appears medial to this point despite local pressure, then it is direct/ medial. Other examination techniques have been suggested but even experienced surgeons find it di ffi cult to distinguish lateral and medial hernias with certainty (Figure 64.13 Diagnostic difficulties Confirmation of the diagnosis may not be possible when the patient describes an intermittent swelling but nothing is found history alone but re-examination at a later date or investigation by ultrasound scan may be requested. If an inguinal hernia becomes ir reducible and tense there may be no cough impulse. Di ff erential diagnosis would include a groin lymph node mass, psoas abscess, subcutaneous soft tis - sue mass (e.g. lipoma) or an abdominal mass. Such cases may r equire investigation by either ultrasonography or CT . Large scrotal hernias may be misdiagnosed as a hydrocele or other testicular swelling. The surgeon should be able to iden - tify the upper limit of a swelling that arises from within the scrotum, but a large scrotal hernia has no upper limit because it extends back along the inguinal canal to the peritoneal cavity . In cases of doubt, ultrasonography or CT should establish the diagnosis. As inguinal hernia is so common, less experienced clini - cians might suggest this diagnosis w hen referring cases of fem - oral hernia or Spigelian hernia. A saphena varix may present as a groin swelling that increases in size on standing and with a definite cough impulse and be misdiagnosed as a hernia, par - ticularly in pregnant women. It is essential in men to e xamine the scrotal contents to exclude other pathologies and to check that the patient has both testes. It is also important to examine the opposite side because contralateral her nia is common. A patient with a single hernia has a 50% lifetime risk of developing a hernia on the other side. Some surgeons have suggested that patients should be o ff ered bilateral repair, especially if laparoscopic surgery is planned, but this is not widespread practice at present. -).

Figure 64.12 A cystogram showing that part of the urinary bladder has descended into a left direct inguinal hernia (arrows). Figure 64.13 Oblique left inguinal hernia that became apparent when the patient coughed and persisted until it was reduced when he lay down.

Most cases require no diagnostic tests but ultrasonography , CT and MRI are occasionally used and show excellent anatomical detail but may miss groin hernias because they tend to reduce spontaneously in supine patients. Management of inguinal hernia It is safe to recommend no active treatment in cases of early asymptomatic direct hernia, particularly in elderly patients who do not wish for surgical intervention. These patients should be warned to seek early advice if the hernia increases in size or becomes symptomatic. Surgical trusses are not recommended. Elective surgery for inguinal hernia can be undertaken under local, regional or general anaesthesia with minimal risk, even in high-risk patients. Herniotomy In children who have lateral hernias with a persistent processus vaginalis, it is su ffi cient just to excise and close the sac. This is called a herniotomy (see Chapter 18). In adult surgery , herniotomy alone has a high recurrence rate and some form of muscle-strengthening repair (herniorrhaphy) is recommended. Open suture repair In 1890, Edoardo Bassini described a suture repair for inguinal hernia that remained the basis of open repair for over 100 years (Figure 64.14). The surgeon enters the inguinal canal by opening its anterior wall, the external oblique aponeurosis. The spermatic cord is dissected free and the presence of a lateral or

a medial hernia is confirmed. The sac of a lateral hernia is separated from the cord, opened and any contents reduced. The sac is then sutured closed at its neck and excess sac removed. If there is a medial hernia then the sac is inverted and the transversalis fascia is suture plicated. Sutures are now placed between the conjoint tendon above and the inguinal ligament below , extending from the pubic tubercle to the deep inguinal ring. The posterior wall of the inguinal canal is thus strengthened. Over 150 modifications to Bassini's operation have been described with little or no benefit except for the Shouldice modification. In this operation, the transversalis fascia is opened by a central incision fr om the deep inguinal ring to the pubic tubercle and then closed to create a two-layered pos terior wall (double breasting). The external oblique is closed in a similar fashion. Expert centres have reported lifetime failure rates of less than 2% after Shouldice repair but it is a techni cally demanding operation that, in most hands, gives r similar to those of a Bassini repair. Today , when a Bassini-type operation is done, most sur geons use a continuous, non-absorbable nylon or polypropyl ene sutur e that is darned between the conjoint tendon and inguinal ligament (Maloney). This operation gives excellent Edoardo Bassini , 1844–1924, Professor of Surgery , Padua, Italy . Edward Earle Shouldice , 1890–1965, surgeon, Thornhill, Ont, Canada, established the Shouldice Hernia Hospital in 1945. Sir Astley Paston Cooper , 1768–1841, surgeon, Guy's Hospital, London, UK. George Edward Maloney , 1912–1997, born Dunedin, New Zealand, surgeon, the Radcli ff e Infirmary , Oxford, UK. Mohan P Desarda , contemporary , Poona, India. Irving Lichtenstein , 1920–2000, surgeon, Beverley Hills, CA, USA. results and is the most common operation performed in coun - tries where mesh is too expensive. Desarda has described an operation where a 1- to 2-cm strip of external oblique aponeurosis lying over the inguinal canal is isolated from the main muscle, but left attached both medially and laterally . It is then sutured to the conjoint tendon and inguinal lig ament, reinforcing the posterior wall of the inguinal canal. As the abdominal muscles contract, this strip of aponeurosis tightens to add further physiological support to the posterior wall. This operation is currently seen as equivalent to Shouldice repair. Open flat mesh repair Synthetic mesh has been used since the 1950s to reinforce hernia repair, and in the 1980s Lichtenstein described a tension-free, simple, flat, polypropylene mesh repair for inguinal hernia (Figure 64.15). The initial part of the operation is identical to Bassini's. Once the hernia sac has been removed and any medial defect closed, a piece of mesh measuring 8 /uni00A0×/uni00A0 15 /uni00A0 cm is - placed over the posterior wall, behind the spermatic cord, and is slit to wrap around the spermatic cord at the deep inguinal ring. Loose sutures hold the mesh to the inguinal ligament and - conjoint tendon. Two major advantages are claimed: lower esults hernia recurrence rates and accelerated postoperative recov - ery . Randomised trials show that hernia recurrence within the - first 2 years is lower but acute pain scores are similar. Recent - research comparing Lichtenstein's re pair with laparoscopic surgery has identified chronic pain as the most common complication of open flat mesh repair with rates reported as

B F A D G E C A Figure 64.14 Inguinal canal anatomy as shown in Bassini's original diagram

(1890). A, subcutaneous fat; B, external oblique aponeurosis (opened); C, inferior epigastric vessels; D, Poupart’s (inguinal) liga

ment; E, spermatic cord retracted; F , the conjoint tendon (triple layer of lesser oblique, transversus abdominis and Cooper’s (cremasteric) fascia); G, transversalis fascia.

high as 20%. Nevertheless, today , Lichtenstein’s repair is the most common operation for inguinal hernia in resource-rich countries. Open plug/device/complex mesh repair Shaped mesh plugs have been developed in an attempt to improve on simple flat mesh repair. They are simple to insert and require little if any fixation. However, they can become solid (meshoma) and migrate/erode into adjacent structures such as the urinary bladder. Other meshes have been designed to be placed beneath the transversalis fascia. There is little evidence that any of these techniques are superior to Lichten stein’s operation and use is not recommended in the 2018 European Hernia Society groin hernia guidelines. Open preperitoneal repair The preperitoneal approach was first described by Annandale in 1880, but was largely discarded until the 1950s when Stoppa described it with mesh reconstruction through a midline incision. It is useful when multiple attempts at open standard surgery have failed and the hernia(s) keeps recurring. It has been largely superseded by the totally extraperitoneal laparo scopic approach, which is modelled on Stoppa’s operation. Laparoscopic inguinal hernia repair Two techniques are described and have been extensively stud ied: the totally extraperitoneal (TEP) and the transabdominal preperitoneal (TAPP) approach. In both, the aim of surgery is to reduce the hernia and hernia sac from within the abdomen and place a 10 /uni00A0×/uni00A0 15 /uni00A0 cm mesh (or larger) in the pr eperitoneal plane, just deep to the abdominal wall extending medially Thomas Annandale , 1838–1907, Regius Professor of Surgery , Edinburgh, UK. Rene Stoppa , 1921–2006, surgeon, Amiens, France. into the retropubic space and at least 5 /uni00A0 cm lateral to the deep inguinal ring (Figure 64.16). The mesh covers Hesselbach’s triangle, the deep inguinal ring and the femoral canal. In TEP , the surgeon develops the extraperitoneal plane just deep to the abdominal muscles, taking care not to enter the peritoneal cavity . In TAPP , the surgeon enters the peritoneal cavity first and incises the peritoneum above the hernia defect to open up the extraperitoneal space as in TEP . Compared with an open approach, the laparoscopic approach is associated with reduced pain both immediately s later, more rapid return to full after surgery and up to 5 year - activity and a reduced incidence of wound complications such as infection, bleeding and seroma. Laparoscopic surgery is of particular benefit in bilateral hernias and in patients with hernia recurrence after open surgery . The proportion of cases performed laparoscopically is slowly rising, but there is a long learning curve. The increasing use of robot-assisted laparoscopic inguinal hernia surgery is evident. To date, little additional patient ben - efit has been noted, although the enhanced surgical view of the gonomic comfort for the surgeon are compel - robot and the er - ling reasons to utilise this

platform. The cost of using a robot for simple inguinal repair r emains hard to justify . Tailored approach - A number of surgical approaches and operations are available, as noted in Summary box 64.9. No one operation suits all hernias. Taking into account the surgeon’s skills, equipment available, patient type and hernia characteristics will aid a preoperative discussion as to which repair is best, or indeed whether no operation at all is the best management plan.

Figure 64.15 Lichtenstein’s repair. Figure 64.16 Right medial/direct inguinal hernia: laparoscopic view. Note the inferior epigastric vessels (red arrow) and contents of the spermatic cord passing through the deep ring (yellow arrow).

Operations for inguinal hernia /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF /uni25CF Emergency inguinal hernia surgery Approximately 5% of inguinal hernias present as an irre ducible, painful lump that may progress to strangulation and possible bowel infarction. Time is critical in the presence of ischaemic bowel. The principles of surgery are the same as in an elective setting. Open or laparoscopic surgery is possib depending on the local facilities, the surgeon’s skills and the patient’s characteristics. Approximately 20% of patients who present as an emergency require bowel resection. This may require conversion to a midline laparotomy , which adds signifi cantly to postoperative morbidity and mortality . Surgical site infection may complicate emergency cases but, unless there is significant infection/contamination, use of synthetic mesh is acceptable as long as the operation is covered by appropriate antibiotics. Complications of inguinal hernia surgery Despite inguinal hernia repair being a common procedure, postoperative complications are common. Immediate complications include bleeding or haematoma (usually from subcutaneous vessels but occasionally from accidental damage to the inferior epigastric or iliac vessels). Urinary retention may require catheterisation. Infusion of local anaesthetic may lead to femoral nerve blockade that will resolve over some hours. Within the first week, pain, bruising and swelling are com mon while seroma formation and wound infection are less frequent. Seroma is due to an inflammatory response to dissec tion, sutures or mesh and is more common if the peritoneal sac is left in situ . In most cases the fluid resolves spontaneously but may require aspiration. After laparoscopic surgery , a seroma may be misdiagnosed as an early recurrence. Despite the potential of bacterial contamination of a groin incision and use of mesh, routine use of antibiotics is not recommended in recent guidelines. In the longer term, hernia recurrence and chronic pain are the main concerns. No operation can be guaranteed to be recurrence free and good centres aim for a 5-year recurrence than suture repairs, but there is no di ff erence between the var - ious mesh repairs and no di ff erence between open and lapa - roscopic sur gery . There is very strong evidence that specialist hernia surgeons have lower recurrence rates and chronic pain rates whatever technique the y use. Chronic pain, defined as pain persisting for more than 3 /uni00A0 months after surgery , is common after all forms of surgery and possibly a ff ects as many as 20% of patients after groin her - nia repair. It is less common and less se vere after laparoscopic surgery . Di ff erent types of pain have been described but the most severe is neuralgic pain due to nerv e irritation. This may be the result of nerve injury at the time of operation or chronic irritation of nerves by suture material or mesh. Chronic pain has become one of the main areas of focus when comparing inguinal hernia outcomes. Patients at higher risk of chronic pain include females, the young, those with a painful hernia, those with a chronic pain syndrome, those with an exaggerated response to a heat stimulus and those with certain psychologi - cal tendencies. In addition, the handling of the nerves at open surgery is thought to be important. The variation of anatomy of the

three nerves should be considered during the dissec - tion, keeping nerves contained within their connective tissue surroundings w hen possible. In laparoscopic surgery , placing - sutures or staples/tacks into the retroperitoneal area should be avoided for fear of causing nerve injury . If a nerve requires to be sacrificed, this should be done as proximally as practicable and the nerve end buried within the muscle belly . le Rarely , damage to the testicular artery can lead to testicu - lar infarction, perhaps the most serious complication of ingui - nal hernia surgery in a young man. There is no evidence that hernia surgery has an e ff ect on male fertility despite extensive - study in this area. Summary box 64.10 Complications /uni25CF /uni25CF /uni25CF

Herniotomy Open suture repair Bassini Shouldice Desarda Maloney darn Open /f_l at mesh repair Lichtenstein (Open complex mesh repair – not recommended Mesh plugs Hernia systems) Open preperitoneal repair Transinguinal, Stoppa repair Laparoscopic/robot-assisted repair TEP TAPP Early: pain, bleeding/haematoma, urinary retention Medium: seroma, wound infection Late: chronic pain, testicular atrophy

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