Overview of abdominal wall hernias in adults

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INTRODUCTION

A hernia is a protrusion, bulge, or projection of an organ or part of an organ through the body wall that normally contains it. Abdominal wall hernias are typically classified by location or etiology. Most abdominal wall hernias should be evaluated by a surgeon when identified. The nature of the repair depends upon the size and location of the hernia.

An overview of the classification, clinical features, and treatment options for most abdominal wall hernias will be presented here. More in-depth information for ventral/incisional hernias, inguinal and femoral hernias, parastomal hernias, and hernias related to peritoneal dialysis are discussed separately:

- (See "Clinical features, diagnosis, and prevention of incisional hernias" and "Management of ventral hernias".)
- (See "Classification, clinical features, and diagnosis of inguinal and femoral hernias in adults" and "Overview of treatment for inguinal and femoral hernia in adults".)
- (See "Spigelian hernias".)
- (See "Parastomal hernia".)
- (See "Abdominal wall hernia and dialysate leak in peritoneal dialysis patients".)

ANATOMY

The abdominal wall is comprised of a complex fusion of overlapping layers of muscles and connective tissues that contain and protect the intra-abdominal organs while facilitating movement and breathing [1].

The abdominal wall muscles form a roughly cylindrical cavity bound superiorly by the xiphoid process and costal margins and inferiorly by the pubic symphysis and iliac crests. The two central pillars of rectus abdominis muscles fuse at the midline to form the linea alba; laterally, they connect with a triple layer of flat muscles of external oblique, internal oblique, and transversus abdominis (also referred to as the oblique muscles) [2]. Each rectus muscle is enveloped by a rectus sheath comprised of fibers from the aponeurosis of the lateral flat muscles, the composition of which changes with location.

The muscles of the abdominal wall are supplied by intercostal and lumbar arteries and a deep circumflex branch of the iliac artery and are innervated by intercostal and lumbar nerves entering the abdominal wall between the transversus abdominis and internal oblique muscles.

Details of the anatomy of the abdominal wall are presented in another topic. (See "Anatomy of the abdominal wall".)

CLASSIFICATION

Abdominal wall hernias are most commonly classified by location (figure 1):

- Ventral hernia – Ventral hernias occur anteriorly and include primary ventral hernias (epigastric, umbilical, Spigelian), parastomal hernias, and most incisional hernias (ventral incisional hernias). (See "Clinical features, diagnosis, and prevention of incisional hernias".)
- Groin hernia – The groin is the region at the lower margin of the abdomen where the thigh meets the hip. Groin hernias are subclassified into inguinal and femoral hernias (figure 2). (See "Classification, clinical features, and diagnosis of inguinal and femoral hernias in adults".)
- Pelvic hernia – Pelvic hernias protrude through one of the pelvic foramina (sciatic and obturator hernia) or the pelvic floor (perineal hernias). (See 'Pelvic hernias' below.)
- Flank hernia – Flank hernias protrude through weakened areas of back musculature and include the superior and inferior lumbar triangle hernias (figure 3). (See 'Lumbar hernia' below.)

The European Hernia Society has proposed classification systems for ventral hernias [3] and groin hernias [4] based on the location and size of the defect. Adopting a unified classification

permits direct comparison of studies of hernia repairs.

Abdominal wall hernias can also be classified by etiology:

- Congenital hernia – The defect in the abdominal wall is present from birth. The most common congenital abdominal wall defects are omphalocele and gastroschisis. (See "Omphalocele: Prenatal diagnosis and pregnancy management" and "Gastroschisis".)
- Acquired hernia – The defect develops as the result of weakening or disruption of the fibromuscular tissues of the abdominal wall. Hernias that develop without a prior surgical incision are called primary hernias; those that develop after a surgical incision are incisional hernias. The pathogenesis of primary and incisional hernias differs. (See 'Pathogenesis' below.)

EPIDEMIOLOGY

Approximately five million Americans have an abdominal wall hernia, the majority of which are groin hernias. By one estimate, ventral hernia repairs comprise about one-third of all hernia repairs in the United States (US), and of all the ventral hernias that are repaired, about one-third are incisional and two-thirds are primary ventral hernias [5]. Abdominal wall hernia-related health care expenditure amounts to 2.5 to 3 billion dollars per year [1,6].

PATHOGENESIS

Most acquired hernias form when there is a loss of mechanical integrity of the abdominal wall muscles and tendons required to contain viscera and support the torso. Genetic or systemic extracellular matrix disorders may predispose patients to primary hernia formation, while defective wound healing following laparotomy and hernia repairs leads to incisional hernias [7]. (See "Basic principles of wound healing".)

From a biomechanical viewpoint, the abdominopelvic cavity is a cylinder enveloped by muscles, tendons, and bony structures. According to Pascal's principle, any pressure generated within the cavity is transmitted equally to the walls of that cavity. In response to increased abdominal pressure, the muscular abdominal wall contracts to generate counterpressure. In the event that intra-abdominal pressure exceeds abdominal wall pressure, the abdominal wall will rupture at its weakest point, causing herniation. And once a hernia has formed, it will continue to enlarge in size due to the increase in wall tension at that location according to the law of Laplace (the wall tension is greatest at the point of the largest radius and the thinnest wall) [1].

Additional etiologies and risk factors unique to individual hernias are presented below in their respective sections. (See 'Specific hernia sites' below.)

CLINICAL FEATURES

History — The clinical presentation of abdominal wall hernias can vary depending upon their location and size. Small hernias can be asymptomatic or present with varying degrees of pain and discomfort as the hernia contents protrude through the defect. Most often, the patient will complain of a bulge somewhere in the abdominal wall (figure 4). Coughing or straining may produce or aggravate pain or discomfort. Larger hernias can exert excessive pressure to the overlying skin leading to areas of erythema, ischemia, or ulceration.

The patient's history may identify risk factors associated with hernia formation. These are reviewed separately for the more common types of hernias in other topics. (See "Clinical features, diagnosis, and prevention of incisional hernias", section on 'Risk factors' and "Classification, clinical features, and diagnosis of inguinal and femoral hernias in adults", section on 'Risk factors' and "Parastomal hernia", section on 'Risk factors'.)

Although any abdominal wall hernia can present with complications due to incarceration of intestinal contents in the defect, femoral, obturator, and sciatic hernias frequently go unrecognized until they present as bowel obstruction due to incarceration. (See "Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults" and "Large bowel obstruction" and "Classification, clinical features, and diagnosis of inguinal and femoral hernias in adults", section on 'Complications'.)

Physical findings — The abdominal wall should be examined with the patient both standing and lying down. On examination of most patients, the hernia may be easy to identify, and the edges of the fascial defect can often be palpated. Supine examination will often allow the hernia contents to reduce so that the size of the hernia defect can be determined. The entire abdominal wall, particularly along the length of any incisions, should be palpated carefully to identify other coexistent hernia sites.

DIAGNOSIS

Most ventral and groin hernias can be readily diagnosed with a thorough abdominal and groin examination. However, very small hernias, hernias in patients with obesity, and certain types of hernias (eg, pelvic or lumbar hernias) require imaging studies to diagnose.

Diagnostic evaluation — Preoperative imaging may be necessary in patients with abdominal pain without a palpable hernia or in patients with obesity for measurement of the defect size when planning the surgical approach [8,9]. For such patients, abdominopelvic computed tomography (CT) is the best imaging modality to confirm the diagnosis and identify the contents contained within the hernia sac [10,11]. (See "Clinical features, diagnosis, and prevention of incisional hernias", section on 'CT imaging'.)

Differential diagnosis — Abdominal wall abnormalities that could mimic a hernia include [12]:

- Rectus abdominis diastasis (RAD) describes a condition in which an abnormally wide distance separates the two rectus muscles. When a patient with RAD raises their head while supine and begins to sit up, the increase in intra-abdominal pressure as the two rectus muscles contract can result in a diffuse fusiform bulge, often with a protrusion of abdominal contents into the thinned, bulged midline fascia, which can be seen as a prominent ridge extending from the xiphoid to the umbilicus (figure 5). However, there is no fascial defect and, therefore, no hernia. Ventral hernia can coexist with RAD, either primary (ie, epigastric or umbilical), or particularly if there has been a previous midline laparotomy (ie, incisional). Patients with acquired RAD typically have one of two profiles: middle-aged and older men with central obesity, or small, fit women who have carried a large fetus or twins to term. (See "Rectus abdominis diastasis".)

- Rectus sheath hematoma (RSH) is a rare clinical entity that results from accumulation of blood within the rectus sheath due to trauma, muscular strain, or in the setting of anticoagulation. RSH most often presents acutely with abdominal pain and a palpable abdominal mass. Due to the pattern of arterial blood supply to the rectus muscles, most RSHs occur in the lower abdomen. RSH can be distinguished from ventral hernia by CT imaging (image 1) and by the lack of a palpable fascial defect. (See "Spontaneous retroperitoneal hematoma and rectus sheath hematoma".)

- Abdominal wall cellulitis/abscess typically presents with focal tenderness, erythema, and fluctuance. It can occur postsurgery, post-trauma, spontaneously, or as an extension of an intra-abdominal process. A particularly morbid form of abdominal wall infection is necrotizing fasciitis, usually ascending from the lower genitourinary tract or the perianal area. (See "Cellulitis and skin abscess: Epidemiology, microbiology, clinical manifestations, and diagnosis" and "Necrotizing soft tissue infections".)

- Lipomas can develop within the soft tissue or muscles of the abdominal wall. Superficial or subcutaneous lipomas can be easily palpated as soft, painless subcutaneous nodules that are round, oval, or multilobulated, ranging from 1 to >10 cm in size. They typically occur at off-

midline locations. Deep subcutaneous or intramuscular lipomas are more difficult to distinguish from abdominal wall hernias or other abdominal wall lesions without imaging (CT, ultrasound [US], magnetic resonance imaging [MRI]). (See "Overview of benign lesions of the skin", section on 'Lipoma'.)

- Scar endometriosis can occur as a palpable abdominal wall mass at a previous caesarean incision. Patients often report cyclic pain during menses. (See "Endometriosis in adults: Pathogenesis, epidemiology, and clinical impact".)

- Urachal anomalies arise from incomplete obliteration of the embryonic connection between the urinary bladder and the umbilicus (figure 6). Urachal anomalies can become infected or develop into neoplasm. (See "Care of the umbilicus and management of umbilical disorders in children", section on 'Urachal anomalies'.)

- Neurofibromas are benign neoplasms composed of Schwann cells and collagen fibers. They can be solitary (sporadic) or plexiform (neurofibromatosis 1 or 2). (See "Neurofibromatosis type 1 (NF1): Pathogenesis, clinical features, and diagnosis".)

- Desmoid tumors are benign, slowly growing fibroblastic neoplasms that can arise from the abdominal muscular aponeurosis. Desmoid tumors are characterized by slow growth and minimal pain and no metastatic potential but a propensity for local recurrence even after complete surgical resection and are associated with familial adenomatous polyposis (FAP). They can be distinguished from abdominal wall hernias by imaging (US, CT, or MRI). (See "Desmoid tumors: Epidemiology, molecular pathogenesis, clinical presentation, and diagnosis".)

  Likewise, abdominal wall sarcomas and metastatic deposits, typically from melanoma, lung, renal, and ovarian cancer, can also present as an abdominal wall mass. (See "Clinical presentation, diagnostic evaluation, and staging of soft tissue sarcoma".)

- Seromas, suture granulomas, and surgical implants (eg, penile prosthetic reservoir, vascular graft, peritoneal dialysis catheter) can result from previous surgical procedures.

The differential diagnosis of abdominal wall hernia also includes any intra-abdominal pathology that could cause abdominal pain and discomfort. Most nonhernia pathologies are accompanied by additional symptoms and signs (eg, gastrointestinal symptoms). The differential diagnosis of acute abdominal pain and chronic abdominal wall pain is exhaustive and reviewed elsewhere. (See "Causes of abdominal pain in adults" and "Anterior cutaneous nerve entrapment syndrome".)

SPECIFIC HERNIA SITES

Primary ventral hernias — Primary ventral hernias include epigastric, umbilical, and Spigelian hernias. Epigastric and umbilical hernias are common primary ventral hernias, while Spigelian hernias are rare. (See 'Spigelian hernia' below.)

Of the more than 600,000 ventral hernias repaired in the United States annually, 75 percent are primary ventral hernias such as umbilical or epigastric hernias [13]. In a 2014 systematic review and meta-analysis of both trials and cohort studies, mesh repairs were associated with a small reduction in recurrence rates compared with suture repairs but also an increased risk of seroma and surgical site infection [13].

Thus, we suggest mesh reinforcement if a primary ventral hernia defect is larger than 1 cm in diameter; the rationale and techniques are discussed in another topic. (See "Management of ventral hernias", section on 'Surgical management of ventral hernias'.)

Epigastric hernia — Epigastric hernias are defects centered in the abdominal midline between the umbilicus and the xiphoid process (figure 7) [8]. They represent 1.6 to 3.6 percent of all abdominal wall hernias and 0.5 to 5 percent of all operated abdominal wall hernias [14].

The pathogenesis of epigastric hernia has been attributed to congenitally weakened linea alba from a lack of decussating midline fibers, forceful diaphragmatic contraction transmitted to the midline abdominal wall by tendinous insertions, and perforation of the linea alba by vascular lacunae [15]. Risk factors include extensive physical training or coughing (from lung diseases), obesity, smoking, chronic steroid use, diabetes, old age, and male sex. Epigastric hernias are two to three times more common in men and are most commonly diagnosed between the ages of 20 and 50 [15].

Epigastric hernia can be asymptomatic, but most patients present because of a small, slightly uncomfortable lump between the umbilicus and the xiphoid. The defects are often no more than 1 cm in diameter [14]. Up to 20 percent of epigastric hernias are multiple. Bowel incarceration or strangulation is rare. Epigastric hernias that involve a peritoneal sac (true hernias) usually contain only omentum, and only rarely small intestine. Epigastric hernias can also occur with only protrusion of extraperitoneal fat through the linea alba without a peritoneal sac (false hernia); such hernias can be difficult to identify laparoscopically. For patients with a history of prior abdominal surgery (eg, laparoscopic cholecystectomy), an epigastric hernia may be an incisional (ie, trocar-site) hernia.

Epigastric hernias can be small (<1 cm), medium (1 to 4 cm), or large (>4 cm) [8]. Repair of an epigastric hernia is reserved for symptomatic patients and most often can be performed as a day surgery procedure under local anesthesia. For open repair, a small midline or transverse incision is made overlying the hernia. The hernia contents are either reduced or resected, and the defect is closed with interrupted sutures or mesh [2]. As for all ventral hernias, we suggest mesh reinforcement if the hernia is incisional and/or if the defect is larger than 1 cm in diameter. Recurrence after epigastric hernia repair is rare. (See "Management of ventral hernias", section on 'Surgical management of ventral hernias'.)

Umbilical hernia — Umbilical hernia (also referred to as periumbilical hernia) is a primary ventral hernia located in the center of the umbilical ring [8]. In adults, umbilical hernias are most often acquired due to increased intra-abdominal pressure brought on by obesity, abdominal distension, ascites, or pregnancy. Anatomically speaking, certain configurations of the umbilical ring may also predispose to hernia formation [16].

Umbilical hernias are common. They have been found in 23 to 50 percent of individuals screened by physical examination or ultrasound [17]. They occur more commonly in females than in males with a 3:1 ratio. In men, umbilical hernias most often present incarcerated, whereas females, particularly those close to their ideal body weight, are more likely to have an easily reducible mass. Typically, omentum or preperitoneal fat is contained within the hernia sac. Omental strangulation within a hernia can cause chronic abdominal wall pain. On the other hand, if a knuckle of bowel becomes incarcerated, bowel obstruction or bowel ischemia can develop. (See 'Richter hernia' below.)

Umbilical hernia can usually be diagnosed with palpation of a soft mass either at, slightly above, slightly below, or to one side or another of the umbilicus (picture 1). Tenderness can be elicited with pressure and palpation but is often absent without provocation. Larger umbilical hernias may be associated with skin erythema, ulceration, or ischemia.

Umbilical hernias that are so small and asymptomatic that the patient is not even aware of their presence do not require repair and can be observed. In a study of 789 patients with umbilical/epigastric hernia who were followed for five years, 16 percent required elective repair, but only 4 percent required emergency surgery [18].

Umbilical hernias can be small (<1 cm), medium (1 to 4 cm), or large (>4 cm) [8]. The treatment of symptomatic umbilical hernias is surgical and can be performed open or laparoscopically, depending upon the size of the hernia and other patient characteristics (see "Management of ventral hernias", section on 'Primary ventral hernia <1 cm' and "Management of ventral hernias", section on 'Ventral hernias between 1 and 10 cm'):

- For open repair, a vertical or curvilinear incision can be made over or adjacent to the hernia sac; the hernia sac is then identified and dissected to its fascial attachments. Once the fascia has been cleared, the hernia sac can either be inverted or excised and the fascia subsequently closed with a nonabsorbable suture (figure 8). If the defect is large or if the fascial edges cannot be approximated without tension, mesh should be used. The mesh can be placed deep to (sublay or underlay) or over the fascia (onlay) and should be sutured circumferentially to the surrounding fascia to prevent migration. A variety of flat meshes and mesh plugs have been designed for this purpose [19]. An effort should be made to tack the skin of the umbilicus to the fascia to recreate a cosmetically appealing umbilicus. As with all ventral hernias, we suggest mesh reinforcement for all incisional hernias and those primary hernias that are larger than 1 cm in diameter. (See "Management of ventral hernias", section on 'Surgical management of ventral hernias'.)

- Laparoscopic repair of small, readily identifiable primary midline ventral hernias (ie, epigastric and umbilical) in thin patients is generally not necessary and is often more invasive than open repair. Circumstances in which a laparoscopic repair may be advantageous include larger hernia defect (>4 cm), suspicion of multiple defects, and obesity [2]. In addition, laparoscopy may be used to assess the viability of an incarcerated loop of intestine (eg, spontaneously reduced Richter hernia). Laparoscopically, umbilical hernias are repaired the same way as other ventral hernias; the technique is described separately. (See "Laparoscopic ventral hernia repair".)

Recurrence rates range from 0 to 3 percent after a mesh repair to up to 14 percent after a sutured repair [19,20].

Umbilical hernias frequently coexist with rectus abdominis diastasis (RAD) as the two entities share many of the same risk factors (eg, obesity). Surgeons evaluating patients for an umbilical hernia should note the presence and degree of any RAD. And because suturing together a thinned-out linea alba will likely result in higher recurrence rates, we suggest mesh repair of a primary ventral hernia (epigastric or umbilical) that is within or at the terminus of an RAD [2].

Umbilical hernias have been detected in up to 90 percent of pregnant women. Generally speaking, a watchful waiting approach is recommended for asymptomatic patients until the postpartum period. Symptomatic patients and those with an incarcerated hernia require individualized treatment. (See "Management of ventral hernias", section on 'Pregnancy'.)

Cirrhotic patients are prone to developing umbilical hernias due to increased intra-abdominal pressure (from ascites) and impaired healing (due to poor synthetic function and nutrition).

However, the indications, optimal timing, and approach for umbilical hernia repair in cirrhotic patients are controversial and discussed elsewhere. (See "Management of ventral hernias", section on 'Cirrhosis'.)

Congenital umbilical hernias in children are discussed separately. (See "Care of the umbilicus and management of umbilical disorders in children".)

Spigelian hernia — A Spigelian hernia occurs through a defect in the Spigelian aponeurosis, which is the aponeurosis of the transverse abdominal muscle bounded by the linea semilunaris laterally and the lateral edge of the rectus muscle medially. The typical location is in the "Spigelian hernia belt," a transverse 6-cm-wide zone around the level of the arcuate line [21]. The arcuate line is the caudalmost extent of the posterior rectus sheath.

As the hernia develops, preperitoneal fat emerges through the defect, bringing an extension of the peritoneum with it through the Spigelian fascia. The hernia is nevertheless covered by the intact external oblique aponeurosis (figure 9). For this reason, almost all Spigelian hernias are interparietal in nature, and only rarely will the hernia sac lie in the subcutaneous tissues anterior to the external oblique fascia. A large Spigelian hernia is most often found lateral and inferior to its defect in the space directly posterior to the external oblique muscle; the hernia cannot develop medially due to the intact rectus muscle and sheath.

The patient most often presents with a swelling in the mid to lower abdomen, just lateral to the rectus muscle. The patient may also complain of a sharp pain or tenderness at this site. Suspected Spigelian hernias can be diagnosed by abdominopelvic computed tomography (CT) or ultrasound (image 2) [22,23]. (See "Spigelian hernias", section on 'Diagnosis'.)

Surgical repair is generally recommended once a Spigelian hernia is diagnosed. Surgery is usually performed under general anesthesia with either open or laparoscopic techniques. (See "Spigelian hernias", section on 'Treatment' and "Spigelian hernias", section on 'Minimally invasive Spigelian hernia repair' and "Spigelian hernias", section on 'Open Spigelian hernia repair'.)

Ventral incisional hernia — Incisional hernias, by definition, develop where an incision has been made at a previous abdominal procedure. Since most abdominal incisions are made in the anterior abdominal wall, most incisional hernias are ventral hernias. The epidemiology, risk factors, clinical features, diagnosis, and management of incisional hernia are reviewed elsewhere in dedicated topics. (See "Clinical features, diagnosis, and prevention of incisional hernias" and "Management of ventral hernias" and "Laparoscopic ventral hernia repair".)

Inguinal and femoral hernia — Groin hernias, including inguinal and femoral hernias, are the most common abdominal wall hernias. Issues related to these types of hernias are discussed in detail elsewhere. (See "Classification, clinical features, and diagnosis of inguinal and femoral hernias in adults" and "Overview of treatment for inguinal and femoral hernia in adults".)

Pelvic hernias — Pelvic hernias, including obturator, perineal, and sciatic hernias, are abdominal wall hernias that are rare and difficult to diagnose by physical examination. Abdominopelvic CT should be performed in patients who have suggestive symptoms. Symptomatic hernias require surgical repair.

Obturator hernia — Obturator hernias are the protrusion of the abdominal contents through the obturator foramen. The obturator foramen is located on the anterolateral aspect of the pelvic wall, formed by the rami of the ischium and pubis. It is oval in shape and mostly covered by a fibro-osseous membrane. The only opening is in a small area anterosuperiorly, where the obturator nerve, artery, and vein traverse to enter the obturator canal en route to supply/innervate the obturator or adductor region of the thigh (medial upper third of the thigh).

Weakness of the obturator membrane may result in enlargement of the obturator canal with a defect that is usually anterior and medial to the obturator neurovascular bundle [24]. Preperitoneal fat and lymphatic tissue in the obturator canal normally form a cushion around the neurovascular bundle that prevents herniation. Thus, obturator hernia usually occurs in the setting of cachexia, emaciation, or profound weight loss (body mass index between 13 and 19 kg/m^2) [25]. Additionally, a distorted pelvic stance due to hip or spinal arthritis, malunited femoral neck fracture, and spinal deformities can also contribute to obturator hernia formation.

Obturator hernia is a very rare type of abdominal wall hernia, which represents <1 percent of all abdominal wall hernias. It occurs predominantly in thin, older female patients between the ages of 70 and 90 and is more prevalent in Asian countries than Western ones. Right-sided obturator hernias are twice as common as left-sided ones as the left obturator foramen may be covered by the sigmoid colon [26].

Obturator hernia forms in three anatomical stages: a pilot tag of preperitoneal fat first enters the pelvic orifice of the obturator canal; this is followed by formation of a peritoneal dimple, which progresses to form a peritoneal sac; and in the final stage, abdominal viscera enter the sac, causing symptoms [26]. The hernia sac usually contains small bowel (particularly ileum; 41 to 100 percent partially resulting in Richter-type hernias) but may contain large bowel, omentum, fallopian tube, or appendix. In >90 percent of cases, the diagnosis is made

intraoperatively during exploration for bowel obstruction [24]. Many of the patients have a history of previous attacks of small bowel obstruction that have resolved due to spontaneous reduction of an existing obturator hernia.

Clinically, patients with an obturator hernia may present with obturator neuralgia (groin pain radiating medially to the knee) due to compression of the obturator nerve. Obturator neuralgia is classically diagnosed by one or both signs [26]:

- The Howship-Romberg sign is characterized by pain, hyper/hypoesthesia, or cramps extending from the inguinal crease to the anteromedial aspect of the ipsilateral thigh radiating down to the knee. The pain is exacerbated by coughing, extension, adduction, and medial rotation of the thigh and relieved by flexion. It can be caused by compression of the cutaneous branch of the obturator nerve by a hernia in the obturator canal.

- The Hannington-Kiff sign is characterized by the loss of the thigh adductor reflex in the presence of a positive patellar reflex. It is caused by obturator nerve compression leading to adductor muscle weakness. The adductor reflex can be elicited by percussion on the adductor tendon 5 cm above the medial femoral condyle with the index finger placed across the adductors. A loss of adductor reflex is evidenced by slight or no muscle contraction compared with the contralateral side.

Obturator hernia can also present as a palpable proximal thigh mass between pectineus and adductor longus muscles, or ecchymosis of the thigh (if bowel necrosis has occurred). Obturator hernias may be initially confused with femoral hernias but can also occur in conjunction with femoral hernia. When a clinical diagnosis is uncertain, CT, ultrasound, or magnetic resonance imaging (MRI) can be used for confirmation [27].

The treatment of obturator hernia is surgical repair. Patients with an incarcerated obturator hernia causing small bowel obstruction require urgent surgical repair to avoid strangulation/bowel gangrene. Nonstrangulated obturator hernias should also be repaired to prevent future complications.

Obturator hernias can be repaired via transperitoneal (open or laparoscopic), obturator, or inguinal approaches. Given the rarity of the condition, the optimal approach is not known and probably depends on patient condition and surgeon experience. For patients with bowel obstruction, a transperitoneal approach is preferred. For patients without a bowel obstruction, some favor a posterior preperitoneal approach, which provides direct access to the hernia while avoiding intra-abdominal adhesions.

Reduction of the hernia may require incision of the obturator membrane. This should be done at the lower margin of the obturator canal downward and medially avoiding injury to the nerve and blood vessels positioned just lateral to the sac in 50 percent of patients and medially, anterior, or posterior in the rest [25].

If the hernia orifice is smaller than 1 cm in diameter, simple suture repair may be attempted. Defects larger than 1 cm in diameter require reinforcement with prosthetic materials or an omental patch (for contaminated cases) [26]. The contralateral obturator canal should also be examined and possibly reinforced to prevent future herniation.

The morbidity and mortality rates associated with surgical repair were 38 percent and 12 to 70 percent, respectively [26]. The recurrence rate is about 10 percent after primary (suture) repair.

Perineal hernia — Perineal hernias are the protrusion of intraperitoneal or extraperitoneal contents into the perineum through a congenital or acquired defect in the pelvic floor [28].

Congenital perineal hernias are rare. Acquired perineal hernias can be primary or secondary. Primary acquired perineal hernias typically occur in older, multiparous women. Secondarily acquired perineal hernias are incisional hernias associated with extensive pelvic operations such as abdominoperineal resection (APR), pelvic exenteration, radical prostatectomy, and radical cystectomy. Perineal hernias occurring after APR are most common and reviewed separately. (See "Prevention and management of perineal complications following an abdominal perineal resection", section on 'Perineal hernia'.)

Clinically, perineal hernias present as a unilateral bulge in the area of the labia, perineal regions, or gluteal regions. They are classified as anterior or posterior relative to the transverse perinei muscle [24]. The hernia may be detected on bimanual rectal-vaginal examination and can be confirmed on ultrasound or pelvic CT. Pain in the perineal area, intestinal obstruction, topical skin erosion, and difficulty with urination necessitate the surgical repair of a perineal hernia.

Perineal hernias can be repaired through transabdominal, perineal, or combined abdominoperineal approaches [29]. Transabdominal repair can be accomplished open or laparoscopically [30]. The hernia defect may be closed primarily by direct suturing or reinforced with autogenous tissues (eg, uterus) or prosthetic materials. A 2017 systematic review showed that more repairs are being done using prosthetic mesh or flap reconstruction, rather than direct suture repair [31]. A 2023 systematic review associated synthetic mesh repair with a lower recurrence rate than other techniques, especially through an abdominal approach [32]. However, the quality of evidence is very low, as most studies included were small case series.

Sciatic hernia — Sciatic hernias are the protrusion of the abdominal contents through the greater or lesser sciatic foramen. Hernias that pass through the greater sciatic foramen above the pyriformis muscle (suprapiriform hernia) are more common than hernias that pass below the pyriformis muscle (infrapiriform hernia) and those passing through the lesser sciatic foramen (spinotuberous hernia) (figure 10). Suprapiriform hernias follow the trajectory of the superior gluteal artery and nerve [1].

Conditions that may predispose to sciatic hernia include coexisting hernia, malignancy, pelvic abnormalities (eg, congenital, post-traumatic), and pelvic surgery [33]. In one review, the contents of the hernia sac were (in order of frequency) ovary, ureter, small intestine, colon, neoplasm, omentum, or bladder [33].

Clinically, these unusual hernias may present as a buttock mass, with abdominal pain, or as sciatica. Intestinal obstruction, urinary sepsis due to herniation of the ureter, and gluteal sepsis have also been reported. In one report, an unrecognized sciatic hernia was the cause of chronic pelvic pain in 1.8 percent of 1100 women [34]. A definitive diagnosis can be made with pelvic CT or MRI.

Surgical repair consists of reduction of the hernia contents and closure of the defect with or without prosthetic material and can be accomplished using an abdominal approach (typically laparoscopic) for strangulated hernias, a transgluteal approach for nonstrangulated hernias, or a combined approach.

Lumbar hernia — Lumbar hernias are the protrusion of intraperitoneal or extraperitoneal contents into a nonanatomic location through fascial defects in the posterior-lateral abdominal wall [1].

The lumbar region is bordered superiorly by the 12th rib, medially by the erector spinae muscle, inferiorly by the crest of the iliac bone, and laterally by the posterior border of the external oblique muscle [35,36]. Primary or congenital lumbar hernias arise in one of two possible triangular defects in the lumbar region (figure 3) [35]:

- The superior lumbar triangle (Grynfeltt) (image 3) is an inverted triangle bordered by the 12th rib superiorly, internal oblique laterally (anteriorly), and quadratus lumborum medially (posteriorly). The floor is the transversalis fascia and the aponeurosis of the transversus abdominis muscle. The roof is the external oblique and latissimus dorsi muscles.

- The inferior triangle (Petit) is a smaller upright triangle located between the posterior border of the external oblique muscle laterally (anteriorly), the lateral border of the latissimus dorsi muscle medially (posteriorly), and the iliac crest inferiorly (image 4). The floor is composed

of lumbodorsal fascia, continuous with the aponeurosis of the internal oblique and transversus abdominis muscles.

Twenty percent of lumbar hernias are congenital; 80 percent are acquired [37], which can either be primary (spontaneous) or secondary to trauma or surgery such as nephrectomy, adrenalectomy, hepatic resection, and abdominal aortic aneurysm repair (image 5). Post-traumatic and postincisional lumbar hernias are larger and more diffuse than primary lumbar hernias, may not observe the triangular boundaries outlined above, and are therefore often referred to as flank hernias [35].

Secondary lumbar or flank hernia forms due to multiple factors. Damage to the nerves that innervate the abdominal wall leads to muscle atrophy, weakness, bulging, and eventually hernia. Trauma or surgery can exacerbate inherent weaknesses of the abdominal wall by avulsing muscle and tendon from their bony attachments [38]. The apparent hernia can also be an area of diastasis, in which the muscular aponeurosis has been weakened.

Clinically, the most common presentation of a lumbar hernia is a palpable posterolateral mass that increases in size with coughing and strenuous activity [39]. The mass is usually reducible and disappears when the patient assumes a decubitus position [38]. The risk of bowel incarceration is low (<10 percent) because of the wide neck at the hernia orifice and the location of the hernia within the abdominal wall [40,41]. Lumbar hernias can also present as vague back pain, bowel obstruction, urinary obstruction, pelvic mass, or, rarely, as a retroperitoneal or gluteal abscess. Abdominopelvic CT is the preferred imaging modality for confirming the diagnosis.

Surgical repairs can be performed via an open approach or minimally invasive approach (laparoscopic or robotic). Imaging (typically with CT) is critical in determining the size and location of the hernia defect and aiding in selection of the proper technique. Invariably, repair requires the use of mesh. While small fascial defects can be repaired laparoscopically with intraperitoneal mesh (IPOM), preperitoneal/retromuscular mesh placement is preferred for larger hernias, which can be accomplished via open or robotic approach.

In one review, the authors preferred the open technique in patients with large (>15 cm) hernias, significant loss of domain, thin atrophic skin, or large dystrophic scars for ease of managing the skin and soft tissue. They used the robotic approach in patients with smaller hernias and/or high risks of wound complications (eg, obese, active smoker, poorly controlled diabetes) [36]. It should be noted that this approach to lumbar hernia repair was described in a review article, and the authors have not published patient outcomes validating this approach.

Before placing the mesh (typically midweight polypropylene), the preperitoneal plane should be developed in all directions for a minimum of 5 cm, which typically extends to the psoas muscle and tendon posteriorly, iliac crest inferiorly, underneath the costal margin superiorly to exposed diaphragmatic muscle fibers, and the lateral border of the rectus muscle medially. When fixing the mesh to the iliac crest, the authors used bone anchors with permanent sutures. When fixing the mesh to the rib, they placed slowly absorbable sutures directly through the cartilaginous edge of the rib [36].

Parastomal hernia — Parastomal hernias are incisional hernias that occur due to and alongside a surgically created stoma (ileostomy, colostomy). Given that a stoma is in essence a deliberately created hernia to exteriorize the bowel, the risk for parastomal hernia is very high. The diagnosis and management of parastomal hernias are discussed separately. (See "Parastomal hernia" and "Ileostomy or colostomy care and complications" and "Overview of surgical ostomy for fecal diversion".)

RICHTER HERNIA

A Richter hernia is defined by incarceration of only part of the bowel wall in the hernia defect (image 6) [42]. It can form anywhere a defect is large enough for the bowel to enter but small enough to prevent herniation of an entire loop of bowel. The most common site of Richter hernia is at the femoral canal (36 to 88 percent), where the hernia can be easily mistaken for an enlarged lymph node. Other sites include the inguinal ring (12 to 36 percent), incisional hernia defects (4 to 25 percent), including laparoscopic port sites (0.23 to 3.5 percent), and the obturator canal. While distal ileum is most commonly entrapped in a Richter hernia, practically any portion of the intestinal tract can be involved.

Patients may present initially with only local inflammation at the site of the hernia (figure 11). Focal strangulation of a portion of the bowel wall can progress to ischemia and gangrene, with or without overt signs of intestinal obstruction. Compared with other strangulated hernias, bowel involved in Richter hernias progresses to gangrene more rapidly because the antimesenteric border of the intestine that is typically trapped in a Richter hernia has the poorest collateral blood supply. Approximately 5 to 15 percent of strangulated hernias are Richter hernias. When it perforates into the hernia sac, a Richter-type hernia can also present in a delayed fashion as an enterocutaneous fistula.

The diagnosis of a Richter hernia can be difficult [43]; imaging studies such as abdominopelvic computed tomography (CT) scan may be required. Once diagnosed, attempts at manual reduction should be avoided before the viability of the incarcerated intestine can be ascertained.

For Richter hernias of the groin (femoral, inguinal), a preperitoneal repair is preferred. If the intestine has been reduced at induction of general anesthesia, the peritoneum then can be incised to inspect the intestine. If the involved area of the intestine does not exceed 50 percent of the circumference of the bowel, an alternative to bowel resection is invagination without opening the intestine. In cases where bowel resection is required due to extensive intestinal necrosis/gangrene, conversion to a transperitoneal approach is preferred as performing a bowel resection through a small Richter hernia defect is difficult, and converting to a laparotomy also permits inspection of the remaining bowel.

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Ventral hernia".)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Basics topic (see "Patient education: Abdominal wall hernias (The Basics)" and "Patient education: Abdominal wall hernia repair (The Basics)" and "Patient education: Abdominal wall hernia repair – Discharge instructions (The Basics)")

SUMMARY AND RECOMMENDATIONS

- **Definition** – An abdominal wall hernia is a protrusion, bulge, or projection of an organ or part of an organ through the abdominal wall. It is typically classified according to location and

etiology. (See 'Introduction' above and 'Classification' above.)

- **Clinical features** – Although abdominal wall hernias can go unnoticed, patients usually complain of a bulge with or without pain or discomfort. Complicated hernias present with incarceration and/or strangulation of contents in the hernia sac, which can cause bowel obstruction. Large hernias may cause erythema, ischemia, or ulceration of the overlying skin. (See 'Clinical features' above.)

- **Diagnosis** – Most ventral and groin hernias can be readily diagnosed with a thorough abdominal and groin examination. Very small hernias, hernias in patients with obesity, and certain types of hernias (eg, pelvic and lumbar) require imaging studies to diagnose. Abdominal and/or pelvic computed tomography is the preferred imaging study to diagnose all abdominal wall hernias. (See 'Diagnosis' above.)

- **Specific hernias** – Specific hernia sites have characteristic features and require distinctive management, which are summarized above or in separate topic reviews:

  - Epigastric hernia (see 'Epigastric hernia' above and "Management of ventral hernias", section on 'Surgical management of ventral hernias')

  - Umbilical hernia (see 'Umbilical hernia' above and "Management of ventral hernias", section on 'Surgical management of ventral hernias')

  - Spigelian hernia (see 'Spigelian hernia' above and "Spigelian hernias")

  - Ventral incisional hernia (see "Clinical features, diagnosis, and prevention of incisional hernias" and "Management of ventral hernias" and "Laparoscopic ventral hernia repair")

  - Inguinal and femoral hernia (see "Classification, clinical features, and diagnosis of inguinal and femoral hernias in adults" and "Overview of treatment for inguinal and femoral hernia in adults")

  - Obturator hernia (see 'Obturator hernia' above)

  - Perineal hernia (see 'Perineal hernia' above)

  - Sciatic hernia (see 'Sciatic hernia' above)

  - Lumbar hernia (see 'Lumbar hernia' above)

  - Parastomal hernia (see "Parastomal hernia")

- **Richter hernia** – A Richter hernia is defined by incarceration of only part of the bowel wall in the hernia defect. The femoral canal is the most common site for Richter hernia; other sites include the inguinal ring, incisional hernia defects, and the obturator canal. Bowel involved in Richter hernias may not be completely obstructed but can rapidly become gangrenous. (See 'Richter hernia' above.)

  Thus, Richter hernias require urgent surgical repair. In cases where bowel resection is required due to extensive intestinal necrosis/gangrene, we suggest converting to a laparotomy, rather than working through the Richter defect (**Grade 2C**). Converting to a laparotomy also permits inspection of the remaining bowel.

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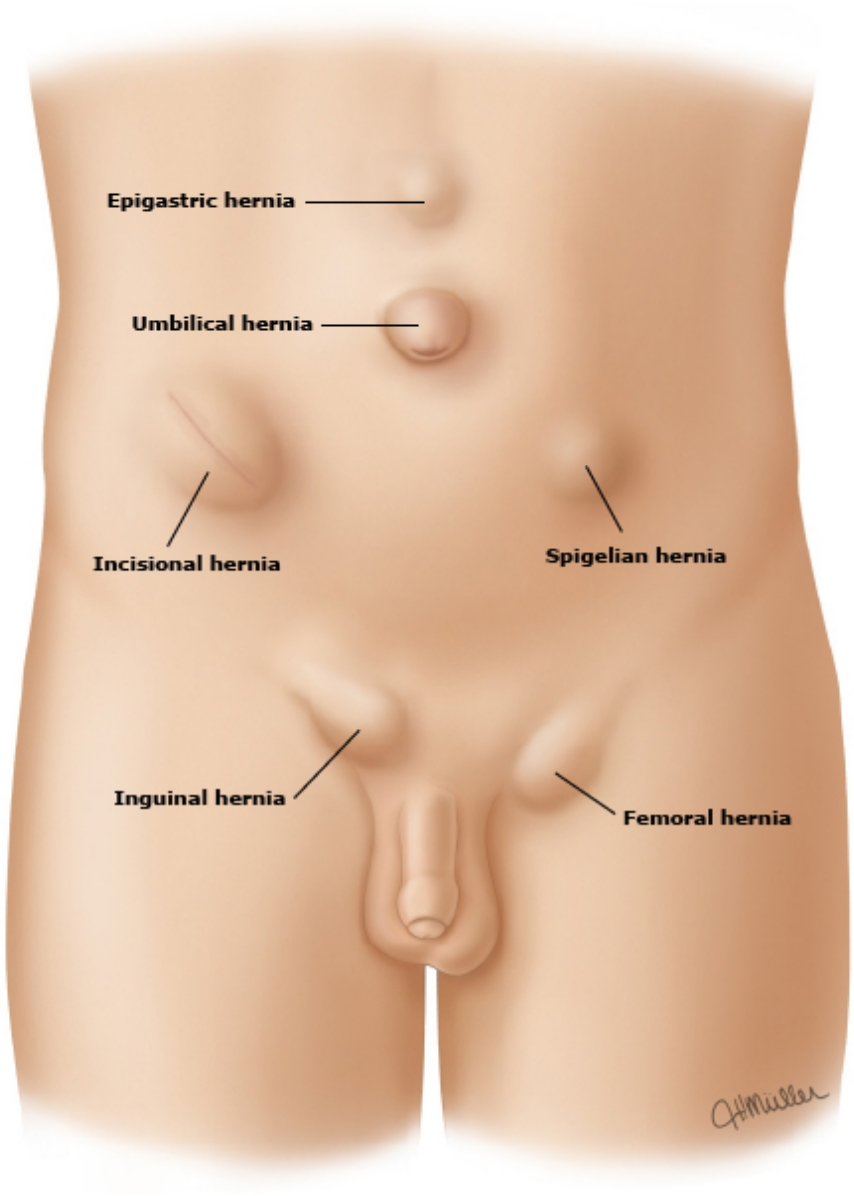
Topic 3688 Version 35.0

GRAPHICS

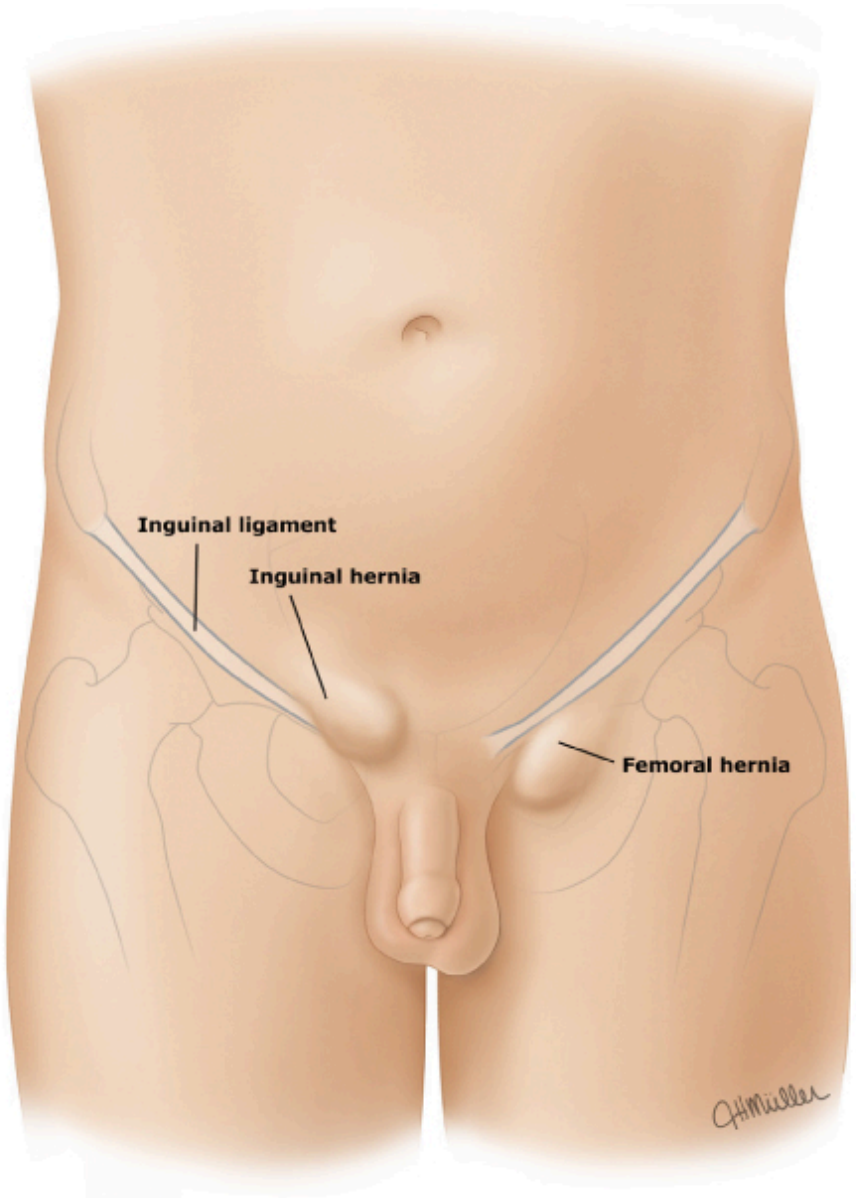
Figure 1: **Abdominal wall hernias**



Abdominal wall hernias include incisional hernias, which occur along incisions from a prior surgery; umbilical hernias; epigastric hernias, which occur between the umbilicus and xiphoid; Spigelian hernias located near the semilunar line in the lower abdomen; lumbar hernias in the flank (not shown); and groin hernias (inguinal and femoral hernias).

Graphic 52358 Version 5.0

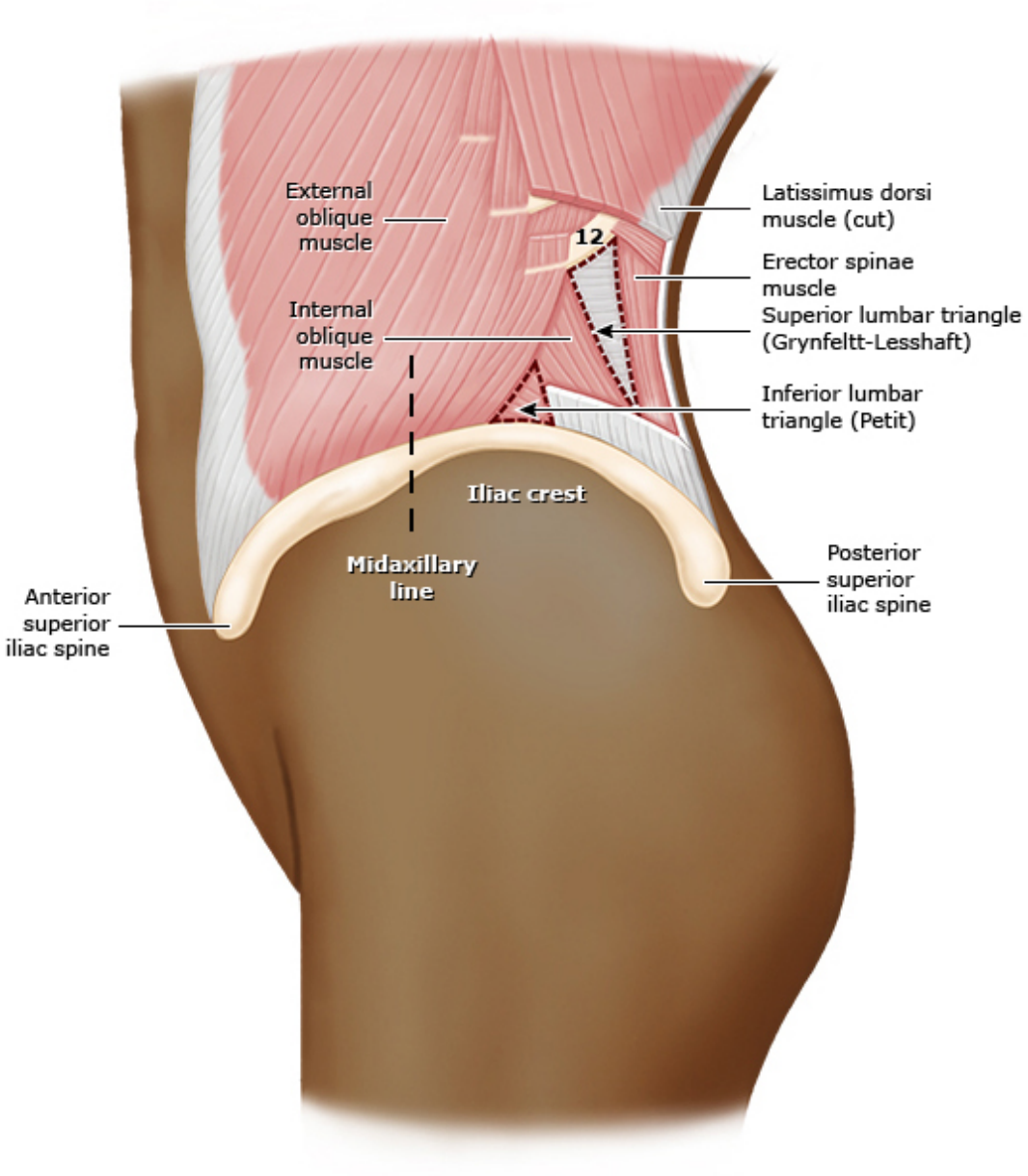
Figure 2: **Groin hernias**



Inguinal hernias typically present above the inguinal ligament and extend below it. Femoral hernias typically present below the inguinal ligament.

Graphic 73484 Version 2.0

Figure 3: **Lumbar triangles**

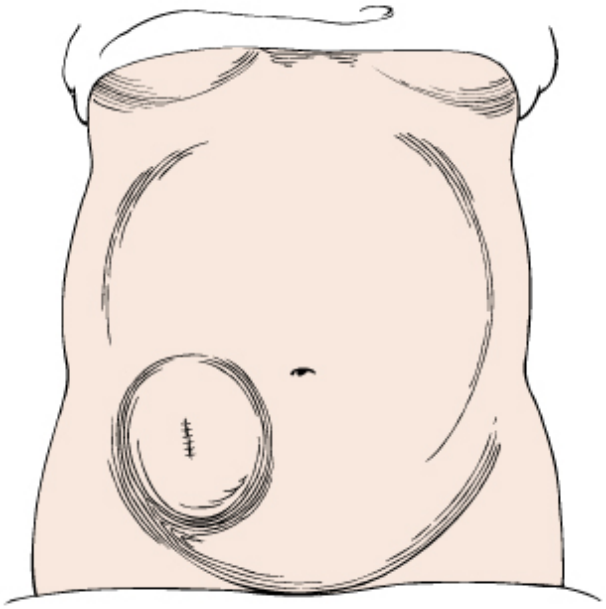


The superior lumbar triangle (Grynfeltt) is an inverted triangle. The base is the twelfth rib, the posterior border is the erector spinae, the anterior border is the posterior margin of the external oblique, and the apex is the iliac crest inferiorly.

The inferior triangle (Petit) is located between the external oblique, the latissimus dorsi, and the iliac crest.

Graphic 81616 Version 6.0

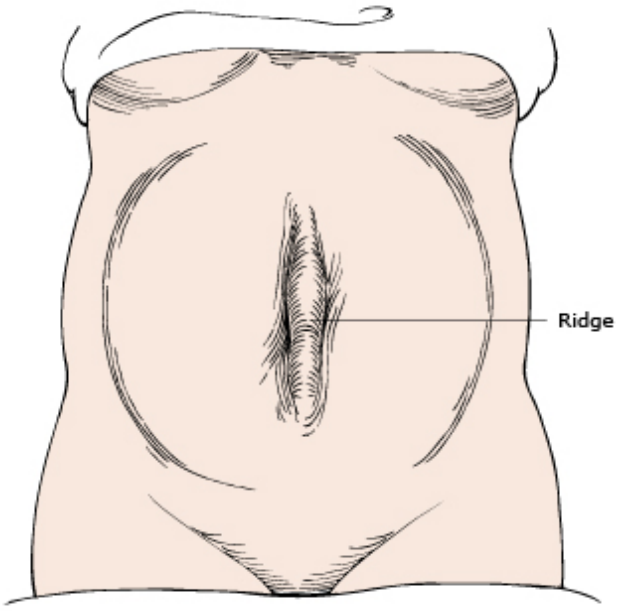
Figure 4: **Incisional hernia**



An incisional hernia occurs when bowel protrudes through a defect or weakness resulting from a surgical incision. It appears as a bulge near a surgical scar on the abdomen.

Graphic 66840 Version 1.0

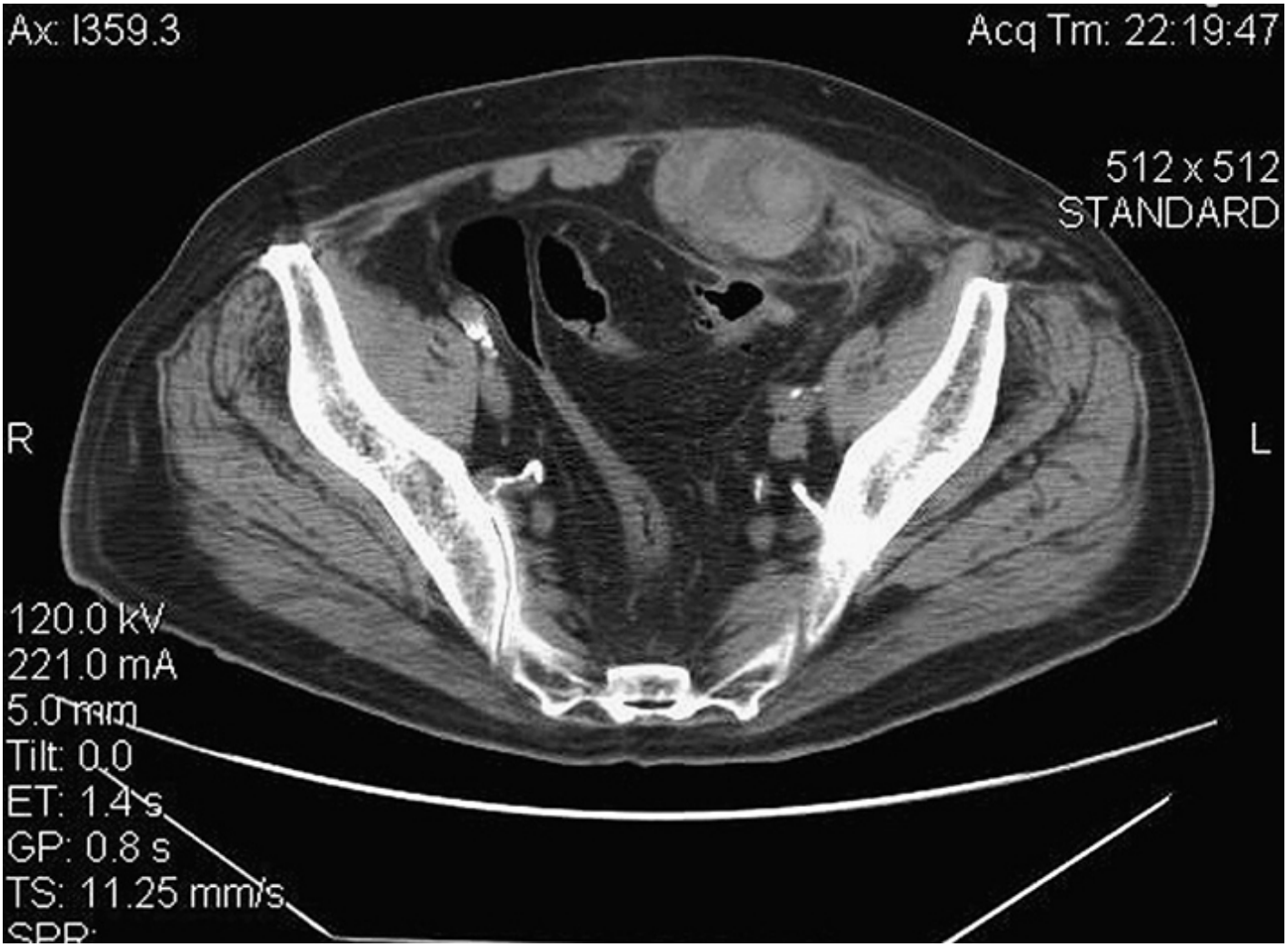
Figure 5: **Diastasis recti**



Diastasis recti occurs when bowel protrudes through a separation between the two rectus abdominis muscles. It appears as a midline ridge. The bulge may appear only when client raises head or coughs. The condition is of little significance.

Graphic 69049 Version 2.0

Image 1: **CT image of type I rectus sheath hematoma**



CT scan of the pelvis demonstrating a left-sided type I RSH measuring 4.2 x 4.4 x 11 cm in a 78-year-old man under anticoagulation therapy.

CT: computed tomography; RSH: rectus sheath hematoma.

Graphic 103798 Version 2.0

Figure 6: **Anomalies of the urachus**

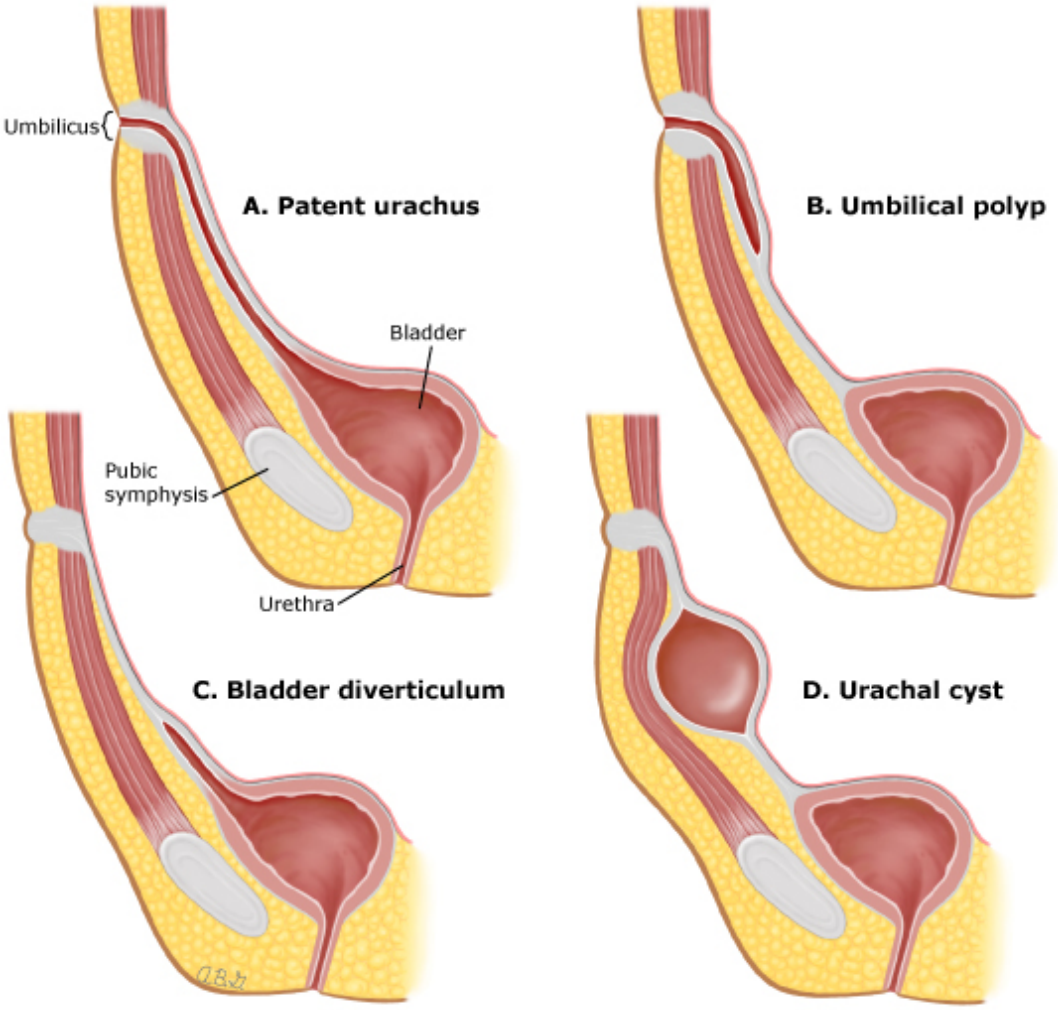


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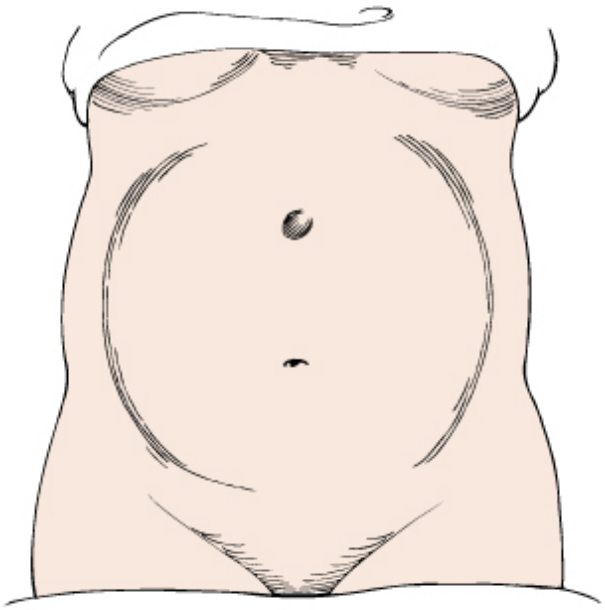
Figure 7: **Epigastric hernia**



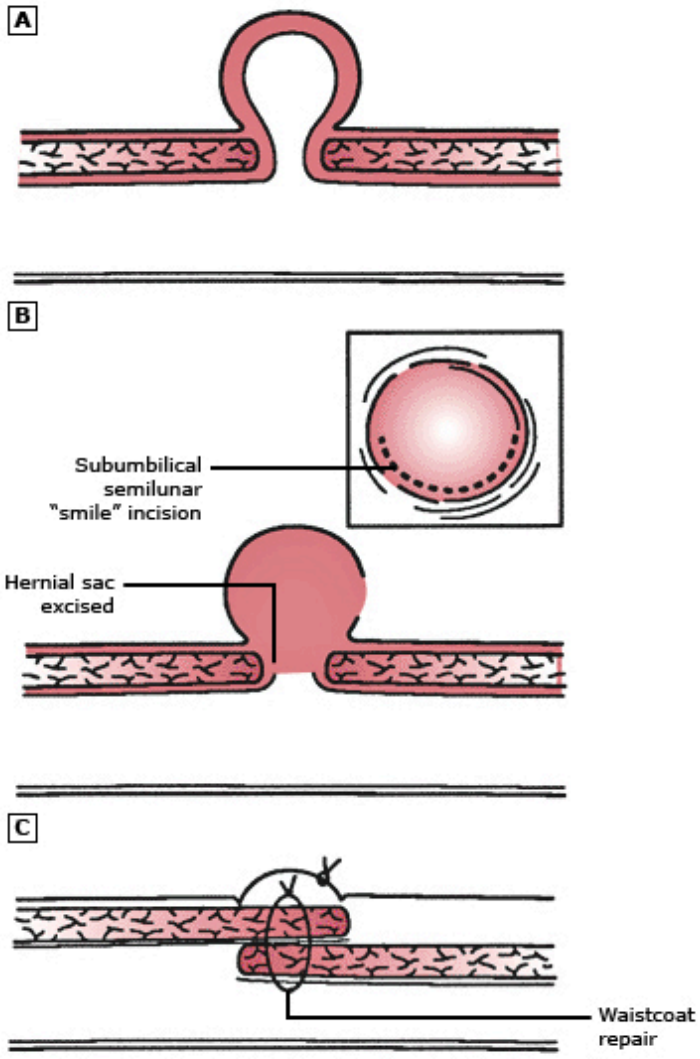
An epigastric hernia occurs when bowel protrudes through a weakness in the linea alba. The small bulge appears midline between the xiphoid process and the umbilicus. It may be discovered only on palpation.

Graphic 72710 Version 1.0

Picture 1: **Umbilical hernia**

Graphic 72970 Version 2.0

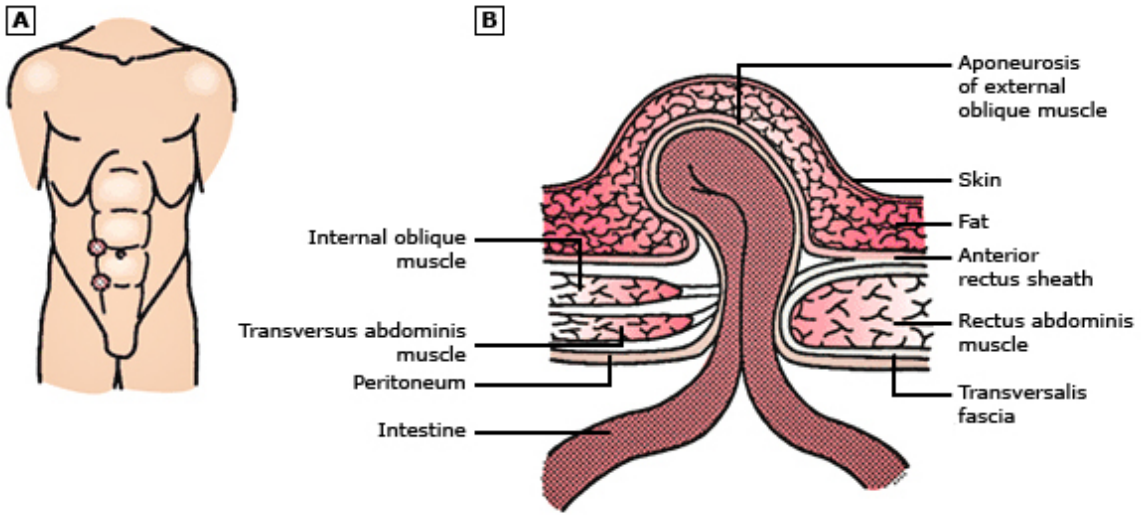
Figure 8: **Umbilical hernia repair**



Repair of an umbilical hernia. A) Diagram of longitudinal section through the hernia. B) Subumbilical "smile" incision. The hernial sac is excised. C) Waistcoat type of closure.

Graphic 53945 Version 1.0

Figure 9: **Spigelian hernia**



Spigelian hernia. A) Usual site of occurrence. B) Transverse section of abdominal wall showing site of defect.

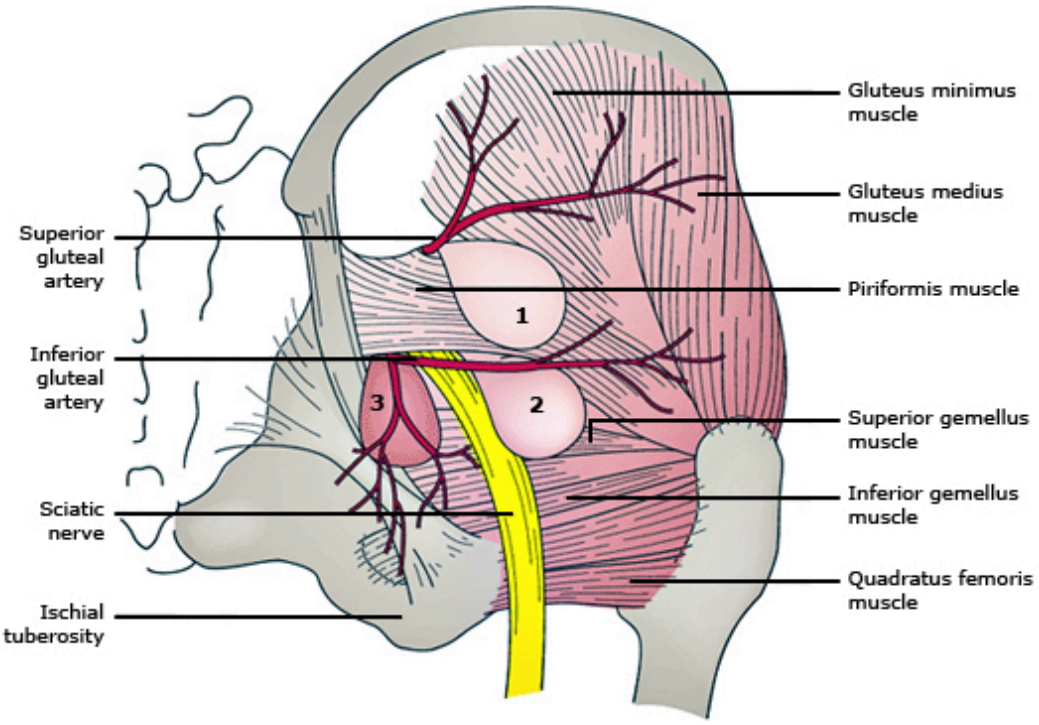
Graphic 55169 Version 1.0

Image 2: **Spigelian hernia**

Herniation of fat through a defect in the aponeurosis between the left rectus abdominis (arrow) and the aponeurosis of the left transversus abdominis and internal oblique muscles. The lateral margin of the hernia sac is the external oblique muscle and fascia (arrowhead).

Graphic 63214 Version 3.0

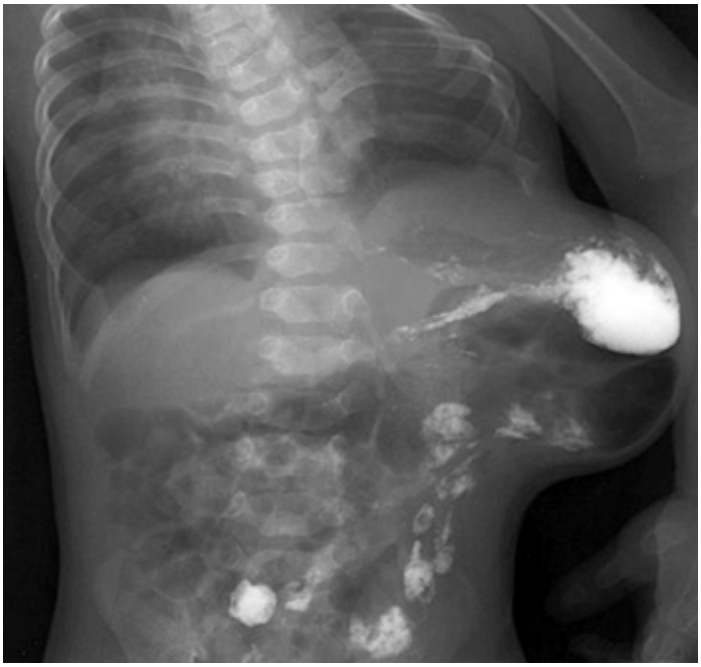
Figure 10: **Gluteal and sciatic hernias**



Sciatic hernias are rare. The hernia can pass through the greater sciatic foramen above (1) or below (2) the piriformis muscle or through the lesser sciatic foramen medial to the sciatic nerve (3).

Graphic 53186 Version 5.0

Image 3: **Lumbar hernia through the superior triangle**



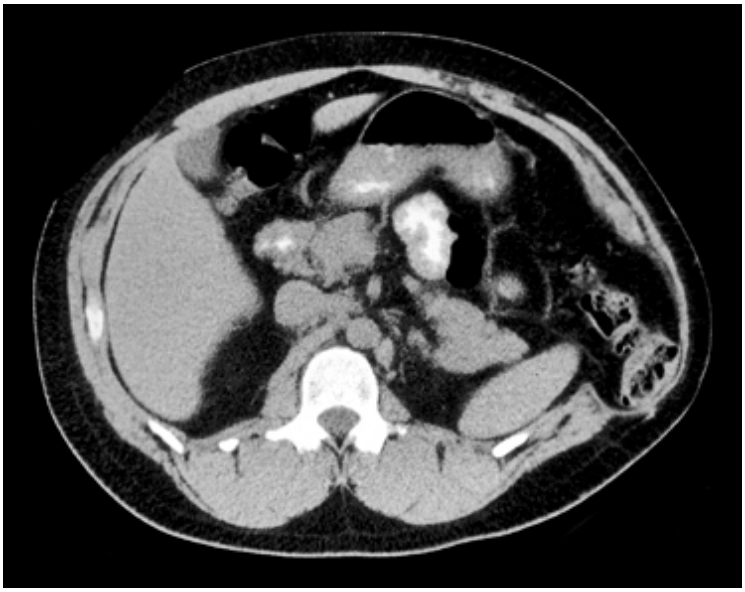
Note the multiple bony anomalies.

Graphic 65959 Version 2.0

Image 4: **Lumbar hernia through the inferior triangle**

Graphic 71107 Version 2.0

Image 5: **CT lumbar hernia**

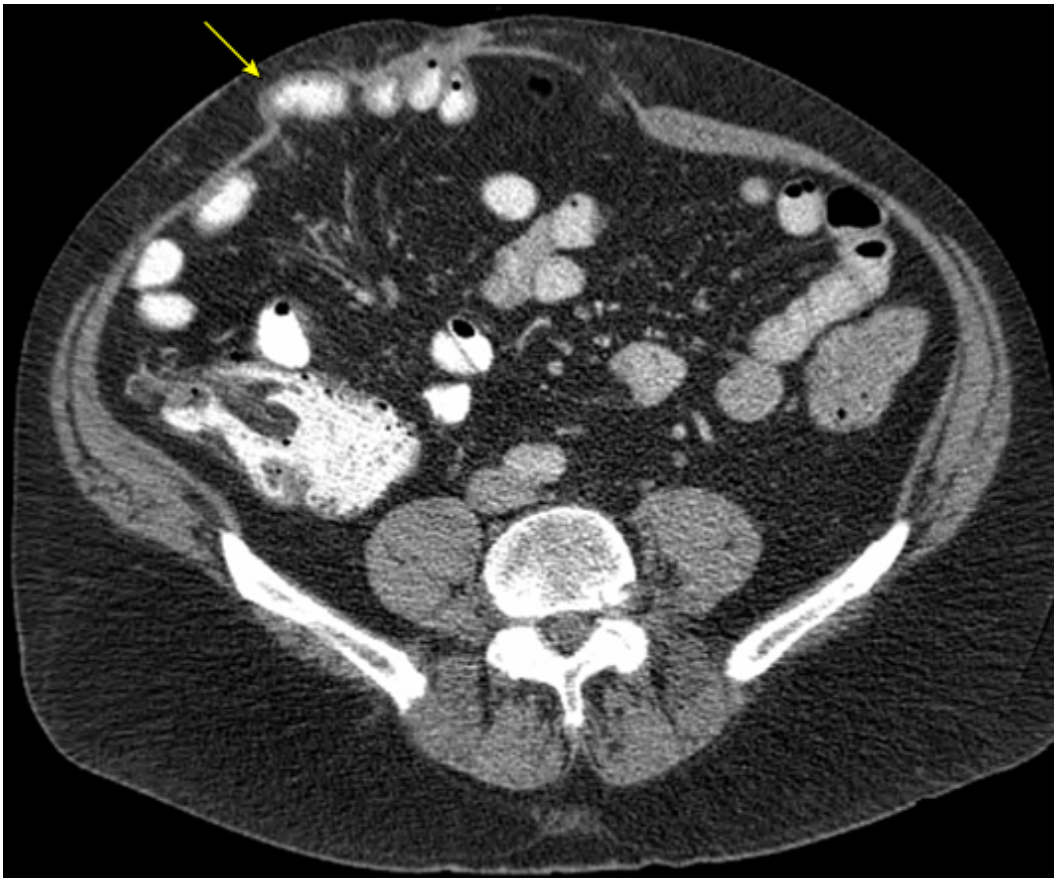


Computed tomogram of a left-sided lumbar hernia following nephrectomy for renal cell cancer.

CT: computed tomography.

Graphic 76449 Version 5.0

Image 6: **Richter hernia on computed tomography**

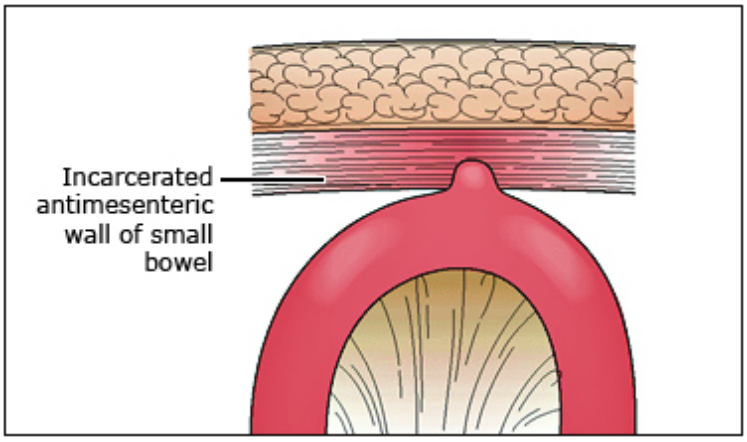


The CT scan shows a Richter hernia with a knuckle of part of the small bowel protruding into a hernia of the anterior abdominal wall.

CT: computed tomography.

Graphic 88742 Version 3.0

Figure 11: **Richter hernia**



Schematic diagram showing a Richter hernia, in which the antimesenteric border, but not the whole wall, of the bowel is incarcerated.

Graphic 58994 Version 4.0