Classification, clinical features, and diagnosis of inguinal and femoral hernias in adults

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INTRODUCTION

Hernias are among the oldest recorded afflictions of humankind. A hernia is defined as a protrusion, bulge, or projection of an organ or a part of an organ through the body wall that normally contains it. Collectively, inguinal and femoral hernias are known as groin hernias.

The epidemiology, pathogenesis, classification, clinical features, and diagnosis of inguinal and femoral hernias will be reviewed. The management of groin hernias (nonsurgical and surgical) is discussed elsewhere. (See "Overview of treatment for inguinal and femoral hernia in adults" and "Open surgical repair of inguinal and femoral hernia in adults" and "Laparoscopic inguinal and femoral hernia repair in adults" and "Robotic groin hernia repair".)

Inguinal hernias in children and abdominal wall hernias are reviewed separately. (See "Inguinal hernia in children" and "Overview of abdominal wall hernias in adults".)

EPIDEMIOLOGY

The lifetime prevalence of groin hernias is estimated to be 27 to 43 percent in males and 3 to 6 percent in females [1]. Groin hernias are the most common surgical condition encountered by primary care clinicians, with 1.6 million diagnosed annually and 500,000 undergoing operative repair in the United States [2]. Worldwide, 20 million groin hernia repairs are performed annually [1], and inguinal hernia repair is the most common of all abdominal wall hernia operations [3].

Risk factors — Well-documented risk factors for **primary** inguinal hernia include [4]:

- Male sex (increases risk by 8 to 10-fold) [5]
- Age (peak incidence between 0 to 5 and 75 to 80 years of age) [5]
- Family history of inguinal hernia in first-degree relatives [6,7]
- Impaired collagen metabolism
- History of prostatectomy, especially open (increases risk fourfold) [8]

In some studies, fewer inguinal hernias are detected in patients who are overweight or obese [9-12]. Mechanistically, obesity can both exacerbate hernia development by increasing abdominal pressure and alleviate it by blocking herniation/incarceration of the viscera with extra fat. Thus, whether obesity is truly protective of inguinal hernia development or obscures the diagnosis is unclear and deserves further investigation.

Well-documented risk factors for **recurrent** inguinal hernia include [13]:

- Female sex
- Direct, as opposed to indirect, hernia at the primary repair
- Surgeon low volume/inexperience [14]

Other risk factors, including chronic cough, chronic constipation, smoking [15], and contralateral groin hernia [16], are commonly cited but supported by less evidence. (See 'Acquired hernia' below.)

Females — Overall, groin hernia repairs are 8 to 10 times more common in males than in females [5]. Whereas males are 9 to 12 times more likely to develop an inguinal hernia, females are four times more likely to develop a femoral hernia [17]. This discrepancy can be explained anatomically by a greater distance between the pubic tubercle and the internal ring, a wider rectus muscle in females, and a wider internal ring in males [18].

Females manifest groin hernias at a later age. In one review, the median age at presentation was 60 to 79 for females compared with 50 to 69 for males [19].

Females have more emergency presentations due to a higher incidence of femoral hernias, which are more likely to incarcerate or strangulate [9,20,21]. Another explanation may be that females presenting with hernias are older and exhibit smaller hernia defects due to relatively smaller internal inguinal and femoral rings. In a study from the Swedish hernia registry,

emergency hernia repair was needed in 17 percent of females (53 percent femoral hernias) compared with 5 percent of males (7 percent femoral hernias) [21]. Bowel resection was required in 17 percent of females undergoing emergency groin hernia repair. (See 'Femoral hernia' below.)

In females, a retrospective review of data from the National Health and Nutrition Examination Survey (NHANES) also found that rural residence and greater height were independently associated with a higher incidence of acquired inguinal hernia in females [10]. In patients with low body mass index (BMI; <20 kg/m^2), there was a relative abundance of females, femoral hernias, and emergency presentations [10]. Although females accounted for only 8 percent of all groin hernias, they represented 30 percent of repairs in the low BMI group.

PATHOGENESIS

Groin hernias can be classified by etiology (congenital versus acquired). Congenital hernia is a result of abnormal development, whereas acquired hernia is due to alterations of otherwise normally developed tissues that lead to weakening or disruption. Males and females exhibit differences in the anatomic development of structures in the groin, which impacts the nature of the hernia each develops.

Congenital hernia — Congenital inguinal hernia is due to failure of the processus vaginalis to close. The processus vaginalis is an invagination of parietal peritoneum that precedes the migration and descent of the testicles in males. The same invagination occurs in females, and the portion of the processus vaginalis within the inguinal canal is called the "canal of Nuck," which usually obliterates around the eighth month of fetal life [22].

- In males, the gubernaculum (caudal genital ligament) normally migrates through the internal inguinal ring into the inguinal canal and through the external ring into the scrotum to allow descent of the testicle. Later in development, the upper portion of the gubernaculum degenerates and the lower portion remains as the scrotal ligament, securing the testicle to the lower part of the scrotum and limiting its mobility [23]. Once the testicle has descended, the internal ring normally closes. Failure of the internal ring to close combined with failure of obliteration of the processus vaginalis provides the necessary defect through which abdominal tissues can pass (eg, small bowel, cecum), which can occur during childhood or adulthood.

- In females, migration of the gubernaculum does not take place [24]. The upper portion of the gubernaculum in females forms the suspensory ligament of the ovary; the lower portion of the gubernaculum is bent into an angular form. Cephalic to the bend, it becomes the round ligament of the ovary (ie, ligamentum ovarii proprium) and, caudal to it, the round ligament of

the uterus (ie, ligamentum teres uteri). Thus, the inguinal component of the gubernaculum remains in females as the round ligament, whereas it degenerates in males. The round ligament runs through the internal ring, through the inguinal canal, and ends in the fat of the labium majora or terminates just outside the external ring without attachment or extension to the labium [24,25]. The internal ring is narrower in females and may explain the lower incidence of indirect inguinal hernia in females (see 'Epidemiology' above). The ligamentous structure found within the inguinal hernia sac in female patients is often erroneously identified as the round ligament. However, detailed anatomic examination identifies this structure as the suspensory ligament of the ovary [25], which helps explain the occasional presence of the fallopian tube or ovary in the hernia sac in female patients [26,27].

Acquired hernia — Acquired hernias are due to a weakening or disruption of the fibromuscular tissues of the body wall allowing intra-abdominal contents to protrude through the acquired defect. Acquired groin hernias can develop as a result of inherent connective tissue abnormalities, chronic abdominal wall injury, or possibly drug effects [28].

Tissues of the groin may disrupt as a result of inborn or acquired biochemical or metabolic processes that weaken connective tissue due to disturbed collagen metabolism [29-31]. A tendency toward hernia formation may be evident in the patient or family history [6,32]. Aortic aneurysmal disease, which is linked to connective tissue abnormalities, is also associated with groin hernia [33-40]. Although rare, a number of inborn errors of metabolism, such as abnormalities in collagen type I and III synthesis, can be the underlying cause for the development of hernias [41]. Weakening of the tissues may also result from pharmacologic effects. Chronic glucocorticoid administration is associated with thinning of skin and weakening of the soft tissues that may predispose to hernia development. Other factors that affect the integrity of connective tissue include older age [9,10] and smoking [15,42].

Chronic overstretching of the musculoaponeurotic structures due to increased intra-abdominal pressure or abdominal wall injury is another factor contributing to acquired hernia. Elevations in intra-abdominal pressure can also result from chronic cough, constipation, strenuous exercise/activity, and pregnancy. Direct hernias occur with unusual frequency in athletic individuals [43-45]. The relationship between inguinal hernias and intermittent straining or heavy lifting is not clear; some studies suggest that the incidence of hernia is no higher in professions performing heavy manual labor than in sedentary professions, while others have come to the opposite conclusion [12,46-48]. Pectineus muscle atrophy with age may contribute to femoral hernia formation. The higher incidence of femoral hernia in females may relate to comparatively less baseline muscle bulk compared with males or a weakening of the musculature from childbirth. However, in one small study, multiple deliveries were not found to be significantly associated with the development of hernia in females [12].

CLASSIFICATION

Groin hernias can also be classified according to the anatomic location of the abdominal wall defect. Several such classification schemes for groin hernias exist [28,49,50], but the simplest and most useful system separates groin hernias into indirect and direct inguinal hernias and femoral hernias. Approximately 96 percent of groin hernias are inguinal and 4 percent are femoral [51].

Indirect inguinal hernia — Indirect inguinal hernias are the most common type of hernia in both males and females [19,20,52]. In the Swedish registry, indirect inguinal hernia accounted for 49 percent of repairs in females and 54 percent in males [20]. Indirect inguinal hernias are classified as lateral hernias in the European Hernia Society groin hernia classification system [50].

Indirect hernias protrude at the internal inguinal ring, which is the site where the spermatic cord in males and the round ligament in females exit the abdomen (figure 1). The origin of the hernia sac is located lateral to the inferior epigastric artery. Indirect hernias develop more frequently on the right in both male and females, which is thought to be due, in males, to a later descent of the right testicle and, in females, to the asymmetry of the female pelvis. (See 'Congenital hernia' above.)

Most indirect inguinal hernias in adults are congenital, even though they may not be clinically apparent in the neonatal period or childhood. A shutter mechanism, which is postulated to close the internal inguinal ring to a slit, may be dysfunctional in patients with a patent processus vaginalis [53-55]. Increases in intra-abdominal pressure in association with reduced muscle tone or other connective tissue abnormalities can then force abdominal contents through the widened internal ring into the inguinal canal, resulting in a clinically detectable hernia.

Direct inguinal hernia — Direct inguinal hernia accounts for 30 to 40 percent of groin hernias in males [20] but approximately 14 to 21 percent of groin hernias in females [19,20,52].

Direct inguinal hernias protrude medial to the inferior epigastric vessels within Hesselbach's triangle, which is formed by the inguinal ligament (Poupart's ligament) inferiorly, the inferior epigastric vessels laterally, and the rectus abdominis muscle medially (figure 1). Direct hernias are classified as medial hernias in the European Hernia Society groin hernia classification system [50].

Direct inguinal hernias occur as a result of a weakness in the floor of the inguinal canal. This weakness appears to be due to connective tissue abnormalities in many cases, although some

may occur due to deficiencies in the abdominal musculature resulting from chronic overstretching or injury. (See 'Acquired hernia' above.)

Femoral hernia — Femoral hernias account for <10 percent of all groin hernias and only 2 to 4 percent of all groin hernia repairs [21,56]. Femoral hernias represent 20 to 31 percent of repairs in females [10,19,21,57] compared with only 1 percent in males [20,21]. Femoral hernias occur later in life than inguinal hernias [19,58]. Over the age of 70, femoral hernias represent 52 percent of repairs in females and 7 percent of repairs in males [58].

Femoral hernias are located inferior to the inguinal ligament and protrude through the femoral ring, which is medial to the femoral vein and lateral to the lacunar ligament (figure 1) [59]. The femoral ring can widen and become patulous with aging and following injury.

Although femoral hernias are the least common type of hernia, 40 percent present as emergencies with incarceration or strangulation [10,32].

COMPLICATIONS

Incarceration refers to trapping of hernia contents within the hernia sac such that reducing them back into the abdomen or pelvis is not possible. Reduced venous and lymphatic flow leads to swelling of the incarcerated tissue, which can be bowel (small, large, appendix), omentum, bladder or ovary, or other structures. As edema accumulates, venous and, ultimately, arterial flow to the contents of the hernia sac can become compromised, resulting in ischemia and necrosis of the hernia contents, which is referred to as strangulation.

The risk of incarceration and strangulation is overall low, estimated between 0.3 and 3 percent per year [60-64]. In two trials that compared elective repair of inguinal hernias with watchful waiting (control), strangulation occurred in the control groups at rates of 1.8 per thousand (0.18 percent) and 7.9 per thousand (0.79 percent) occurrences per patient-year [63,64]. Risk factors associated with incarceration and the need for emergency hernia surgery include female sex [21,65], femoral hernia [21,65], and hernia-related hospitalization within the previous year [66].

Other complications of a groin hernia happen more gradually. These include hernia enlargement or increasing pain from a hernia that is untreated [67].

CLINICAL FEATURES

Groin hernias have a variety of clinical presentations ranging from a bulge in the groin region on routine physical examination (with or without pain) to life-threatening complications.

Incarcerated or strangulated hernias can present as acute mechanical intestinal obstruction without obvious symptoms or signs of a groin hernia, particularly in patients with obesity. (See "Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults".)

Symptoms — The most common symptom associated with hernia is a heaviness or dull discomfort in the groin, which may or may not be associated with a visible bulge. Groin hernias in females can also result in vague pelvic discomfort.

Groin discomfort is most pronounced when intra-abdominal pressure is increased, such as with heavy lifting, straining, or prolonged standing. Very little pressure is needed to create the discomfort, which resolves when the patient stops straining or lies down. This pain is due to constriction of the contents of the hernia (eg, bowel, fat) at the neck of the hernia sac. Typically, discomfort is more pronounced at the end of the day or after prolonged standing. Thus, patients who work in manual or physically active professions will notice the discomfort more frequently than sedentary workers [12,46,48]. Pain with standing or straining may also arise from stretching of the ilioinguinal nerve, which is typically described as a radiating "twinge" when the nerve is stretched with prompt dissipation of the pain when the stretch is released.

Moderate-to-severe pain with hernias is unusual and, when present, should raise the possibility of incarceration or strangulation. Strangulated hernias may manifest with symptoms of bowel obstruction, including nausea, vomiting, abdominal pain and bloating, and possibly systemic symptoms if strangulation and bowel necrosis have occurred. (See 'Complications' above.)

However, results of patient-reported symptoms and outcomes in groin hernia surgery are heterogeneous and inconsistently reported [68,69].

Physical findings — The most common physical finding in adults is a bulge in the groin (figure 2). Patients will frequently be aware of the bulge and bring it to the attention of the examiner. In many cases, it is easier and more reliable to demonstrate a hernia bulge with the patient standing, although some hernias, particularly strangulated hernias, can be appreciated while the patient is supine. Two-thirds of groin hernias are located on the right side [52,57,70-73].

Examination for hernia is best done with the patient standing and the clinician seated in front of the patient. Observation of the groin will occasionally reveal an obvious bulge. This can be confirmed as a hernia by placing the hand over the bulge and asking the patient to cough or perform a Valsalva maneuver. When coughing, hernias produce a distinct, soft impulse that increases the protrusion. The sensation is distinct from the firmer impulse that is felt when the intact abdominal wall is tensed with coughing.

If a visible or palpable hernia is not evident, additional maneuvers may be performed in male or female patients to detect the hernia:

- Male patients – Many groin hernias in males are obvious on physical examination. Smaller hernias can be identified by invaginating some of the redundant scrotal skin into the inguinal canal, traversing as best as possible the external ring. When the patient is instructed to cough or Valsalva, occult hernias may be felt extending into the canal and touching the tip of the finger [74]. Using the index finger, the examiner places the finger at the base of the scrotum, gently pushing and directing the finger toward the pubic tubercle. The finger will rest adjacent to the spermatic cord, and the fingertip will be just within the external ring. There will always be some degree of pressure against the finger with this maneuver, but a true hernia can typically be felt as a "silky" impulse tapping against the finger when the patient coughs or strains.

- Female patients – Groin hernias in females often do not have a visible bulge. Moreover, the examination used in a male (ie, invagination of scrotal skin) is not possible in females. In females, the layers of the abdominal wall absorb the hernia impulse, making the external ring difficult to locate. Ultrasound or other imaging tests may be needed to detect hernias in female patients. (See 'Identifying occult hernia' below.)

The femoral region should also be examined with particular attention to the area medial to the femoral canal. The space is found by identifying the femoral artery pulsation caudal to the inguinal ligament in the upper portion of the thigh and moving medial from it toward the pubic tubercle. Femoral hernias may be difficult to clinically differentiate from inguinal hernias preoperatively on physical examination when located overlying the inguinal ligament or superior to it. (See 'Differentiating inguinal from femoral hernia' below.)

On physical examination, an incarcerated or strangulated hernia may be painful to palpation. The patient may also be febrile, and erythema of groin skin may be apparent. Generalized peritonitis typically does not occur, since the ischemic or necrotic tissue is trapped within the hernia sac. However, if a strangulated segment of bowel is reduced (spontaneously or unwittingly), generalized peritoneal signs may be present. The clinical manifestations of bowel obstruction or perforation are discussed in detail elsewhere. (See "Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults" and "Overview of gastrointestinal tract perforation".)

DIAGNOSIS

In the majority of cases, a diagnosis of inguinal or femoral hernia can be made based upon history and physical examination, without the need for further studies [4]. Although the data are limited, one study reported a sensitivity of 75 percent and specificity of 96 percent for a diagnosis of inguinal hernia on physical examination by surgeons [75]. Diagnosis may be more difficult in females and those with obesity, for whom additional diagnostic evaluation may be necessary.

DIAGNOSTIC EVALUATION

When the diagnosis is not apparent, imaging can help to identify occult hernia, differentiate inguinal from femoral hernia, and distinguish hernia from other clinical entities [76-80]. Imaging is also important for evaluating patients for hernia-related complications.

In the absence of suspected intra-abdominal complications, we suggest groin ultrasound (US) as the initial diagnostic modality [81]. Pelvic US is noninvasive and inexpensive and overall has a high sensitivity and specificity for hernia (confirmed by surgery), particularly in the presence of a palpable mass [82], distinguishing hernia from other inguinal and scrotal pathologies [76,80].

Other modalities, including computed tomography (CT), magnetic resonance imaging (MRI), and herniography (peritoneography), may be useful under specific clinical circumstances [81,83] but may be associated with varying degrees of accuracy [84]. (See 'Identifying occult hernia' below and 'Differentiating inguinal from femoral hernia' below and 'Evaluating hernia complications' below and 'Differential diagnosis' below.)

Identifying occult hernia — US is the best initial imaging modality for identifying occult inguinal hernia in patients with suggestive symptoms but no detectable hernia on physical examination [82,85]. US increases the sensitivity of detecting an occult hernia from 80 percent with physical examination alone to 96 percent [86].

Other experts consider US operator dependent and instead prefer cross-sectional imaging [87]. If that is the local practice, and when groin US is negative or nondiagnostic, MRI with Valsalva maneuver may be performed to establish a diagnosis. Besides groin hernia, MRI can also diagnose other conditions that could cause groin pain, such as adductor tendonitis, pubic osteitis, hip arthrosis, bursitis iliopectinea, and endometriosis [88,89]. CT with Valsalva is another option when MRI is not available [90]. Herniography is now rarely performed because it is invasive and can only diagnose hernia. (See 'Differential diagnosis' below.)

Differentiating inguinal from femoral hernia — Distinguishing inguinal from femoral hernia can be difficult, particularly in patients with obesity, but has clinical implications. Watchful

waiting may be an option for asymptomatic or minimally symptomatic inguinal hernia but is not recommended for femoral hernia due to the high risk for complications. This issue is discussed in detail elsewhere. (See "Overview of treatment for inguinal and femoral hernia in adults", section on 'Inguinal hernia'.)

For most groin hernias, the location will be obvious on physical examination: femoral hernias most commonly present inferior to the inguinal ligament and medial to the femoral artery, while inguinal hernias present superior to the inguinal ligament. However, when the clinical examination is uncertain, we perform groin ultrasound to differentiate inguinal from femoral hernia [91].

If US is negative or nondiagnostic, CT of the groin region can help further differentiate femoral from inguinal hernias. Sufficiently thin slices using multidetector CT may allow localization of the hernia sac (image 1). If the hernia sac extends medial to the pubic tubercle on CT [92], a diagnosis of inguinal hernia (image 2 and image 3) can be made with certainty, but a hernia sac located lateral to the pubic tubercle associated with venous compression suggests a diagnosis of femoral hernia (image 4). A study that evaluated the CT appearance of 215 patients with groin hernia found that the combination of a localized sac and venous compression was more often associated with femoral hernia compared with inguinal hernia (100 versus 1 percent) [93].

MRI appears to differentiate inguinal from femoral hernia with a sensitivity and specificity of more than 95 percent, which is superior to CT [75]. However, cost and lack of uniform availability limit the practicality of MRI.

Evaluating hernia complications — For patients who present with nausea, vomiting, and abdominal distention associated with a history of groin pain or mass, bowel obstruction due to bowel incarceration (image 5) or strangulation should be suspected. For most patients with incarcerated hernia and/or strangulation, clinical examination alone is sufficient to establish a diagnosis; additional imaging is generally not necessary and may delay surgical exploration and repair [94].

For patients with clinical features of bowel obstruction in whom the diagnosis of groin hernia is not clear and who do not have indications for immediate surgical exploration, CT is generally more useful than ultrasound. Although obtaining CT scan may not alter the management plan for exploration and repair, it may add valuable information concerning the organs involved or the extent of bowel strangulation. Features on CT associated with bowel obstruction are discussed in detail elsewhere. (See "Etiologies, clinical manifestations, and diagnosis of mechanical small bowel obstruction in adults", section on 'Abdominal CT'.)

DIFFERENTIAL DIAGNOSIS

The differential diagnosis of inguinal hernia includes any pathology that can produce pain or a mass within the groin region, including soft tissues, lymphoid tissue, bony structures, associated vessels, or structures associated with male or female reproduction (table 1).

For most patients, groin hernia can be distinguished from other inguinal and scrotal pathologies on physical examination, but when this is not the case, ultrasound is usually the initial imaging modality [95]. (See 'Diagnostic evaluation' above.)

- Acute and nonacute scrotal pathologies can produce groin mass and/or groin pain and may appear similar to groin hernia. The pain associated with testicular pathologies is more likely to be localized to the scrotum instead of the inguinal or femoral region. (See "Acute scrotal pain in adults: Evaluation and management of major causes" and "Nonacute scrotal conditions in adults".)
  - Acute scrotum (see "Acute scrotal pain in adults: Evaluation and management of major causes"):
    - Testicular torsion
    - Epididymitis
  - Nonacute scrotal conditions (see "Nonacute scrotal conditions in adults"):
    - Hydrocele
    - Varicocele
    - Spermatocele
    - Epididymal cyst
    - Testicular tumor
- In females, a clinical diagnosis of inguinal hernia during pregnancy can be challenging; not every groin bulge during pregnancy is a hernia. Round ligament varicosities may first appear during pregnancy and can be easily mistaken for a hernia [96,97].
- Orthopedic causes of groin pain include osteitis pubis, sports hernia, adductor muscle strain, lumbar radiculopathy, and hip problems. A groin bulge will be absent, but the nature of the groin pain may raise the question of occult hernia. If ultrasound is unrevealing, magnetic resonance imaging (MRI) is useful for differentiating inguinal hernia from musculoskeletal causes of groin pain [75]. The evaluation of these conditions is discussed in detail elsewhere. (See "Musculoskeletal examination of the hip and groin".)

The term "sports hernia" refers to groin pain related to athletic participation but is not necessarily associated with an anatomic hernia. Sports hernia is discussed elsewhere. (See "Sports-related groin pain (sports 'hernia')".)

- Aneurysms and pseudoaneurysms of the iliac or common femoral arteries present as a mass in the pelvic or groin region, respectively; however, these are pulsatile, are rarely confused as a hernia, and can be easily identified on ultrasound. On occasion, a thrombosed aneurysm may present as a nonpulsatile mass, or a vascular infection will present with overlying erythema, mimicking strangulated hernia. (See "Iliac artery aneurysm" and "Overview of infected (mycotic) arterial aneurysm".)

- Skin and soft tissue conditions, especially when inflamed, can produce pain and a mass in the groin region that could mimic a hernia. These include sebaceous cyst, cellulitis/skin abscess, or enlarged lymph nodes. A groin ultrasound can localize the pathology to the skin and soft tissue, rather than the much deeper inguinal or femoral canal.

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: Groin hernia in adults".)

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 topics (see "Patient education: Groin hernias (The Basics)").

SUMMARY AND RECOMMENDATIONS

- **Epidemiology** – The lifetime prevalence of groin hernias is between 27 and 43 percent in males and 3 and 6 percent in females. However, while males are 9 to 12 times more likely to develop an inguinal hernia, females are four times more likely to develop a femoral hernia. Forty percent of femoral hernias present as emergencies with incarceration or strangulation. (See 'Epidemiology' above.)

- **Pathogenesis** – Congenital hernias are due to lack of closure of the processus vaginalis. Acquired hernias are due to a weakening or disruption of the fibromuscular tissues of the groin. (See 'Pathogenesis' above.)

- **Classification** – Groin hernias are classified by anatomic location as inguinal or femoral. Inguinal hernias are further divided into indirect and direct. The sac of indirect hernia protrudes lateral to the epigastric vessels, whereas direct hernias protrude medial to the epigastric vessels through Hesselbach's triangle (figure 1). Femoral hernias protrude through the femoral canal. (See 'Classification' above.)

- **Clinical features** – The clinical presentation of groin hernias can range from a groin bulge to life-threatening complications (ie, incarceration or strangulation).

  - **Symptoms** – The most common symptom is a heaviness or dull sense of discomfort with straining or lifting, which is relieved once the pressure is removed. Incarcerated or strangulated groin hernias may present with nausea, vomiting, or abdominal pain. (See 'Symptoms' above.)

  - **Physical findings** – The most common physical finding in adults is a bulge in the groin best felt with the patient standing while coughing or straining (figure 2). Inguinal hernias are felt above the inguinal ligament and femoral hernias below the inguinal ligament medial to the femoral arterial impulse. (See 'Physical findings' above.)

- **Diagnosis** – Most groin hernias are diagnosed on physical examination (sensitivity 75 percent; specificity 96 percent). Diagnosis may be more difficult in females and those with obesity, for whom imaging studies may be necessary. (See 'Diagnosis' above.)

- **Imaging**

  - **To identify an occult hernia** – Groin ultrasound (US) is the preferred initial modality. Magnetic resonance imaging (MRI) or computed tomography (CT) with Valsalva may be pursued with negative or nondiagnostic US. (See 'Identifying occult hernia' above.)

- **To differentiate inguinal from femoral hernia** – US or CT can be performed. (See 'Differentiating inguinal from femoral hernia' above.)
- **To evaluate for incarceration or strangulation** – CT is preferred. (See 'Evaluating hernia complications' above.)

- **Differential diagnosis** – The differential diagnosis of groin hernia includes any pathology that can produce pain or a mass in the groin region (table 1). US can distinguish groin hernia from masses originating from the testicle, fluid-filled masses (hydrocele), skin or soft tissue mass (sebaceous cyst, abscess), and dilated vessels (varicocele, venous aneurysm, arterial aneurysm). MRI can diagnose musculoskeletal causes of groin pain. (See 'Differential diagnosis' above.)

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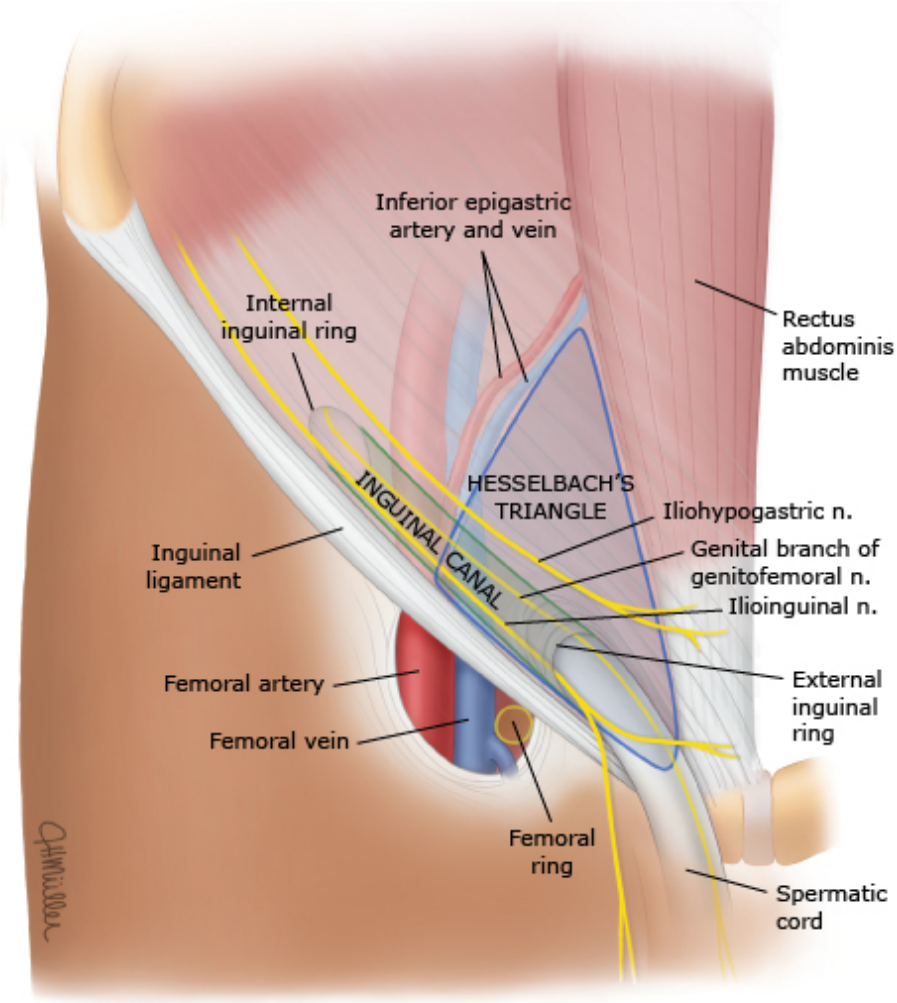
Topic 3686 Version 38.0

GRAPHICS

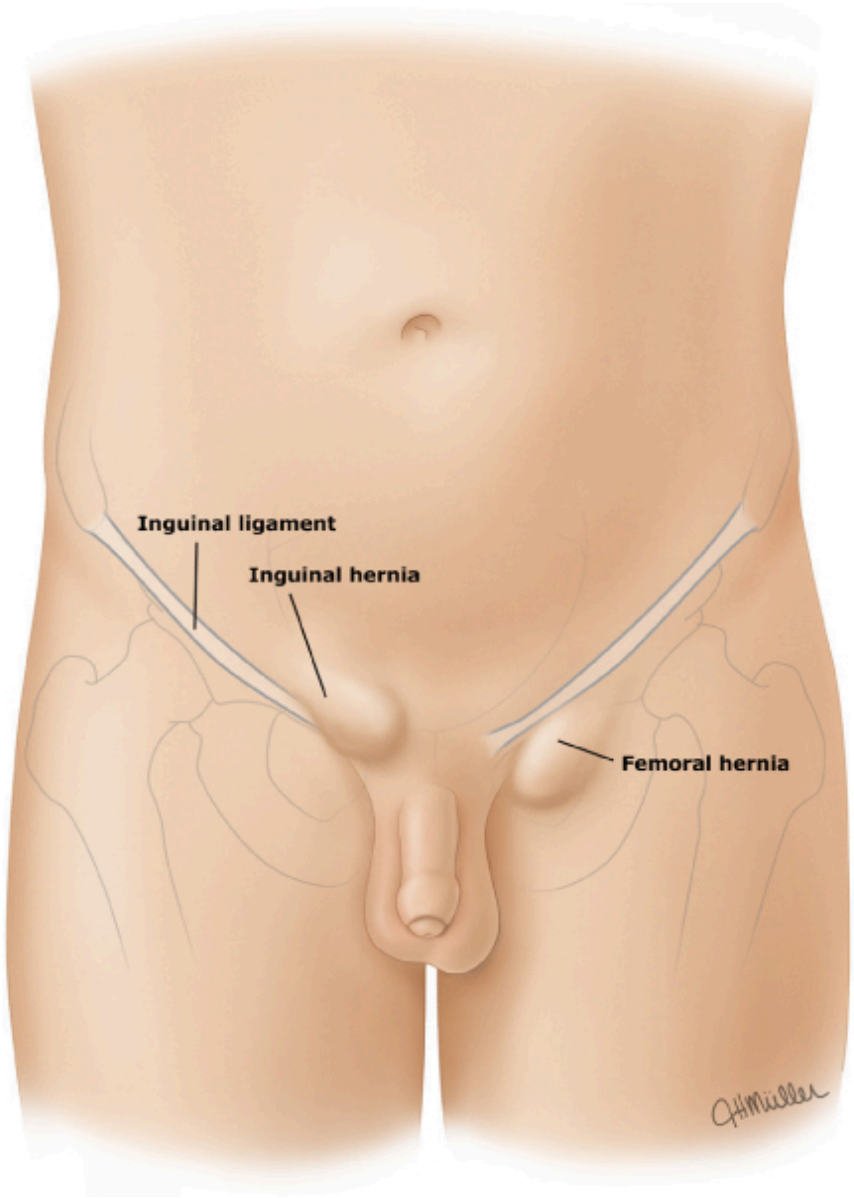
Figure 1: **Groin hernia anatomy**



Indirect inguinal hernias develop at the internal inguinal ring and are lateral to the inferior epigastric artery. Direct inguinal hernias occur through Hesselbach's triangle (outlined in blue) formed by the inguinal ligament inferiorly, the inferior epigastric vessels laterally, and the rectus abdominis muscle medially. Femoral hernias develop in the empty space at the medial aspect of the femoral canal, inferior to the inguinal ligament.

Graphic 61841 Version 5.0

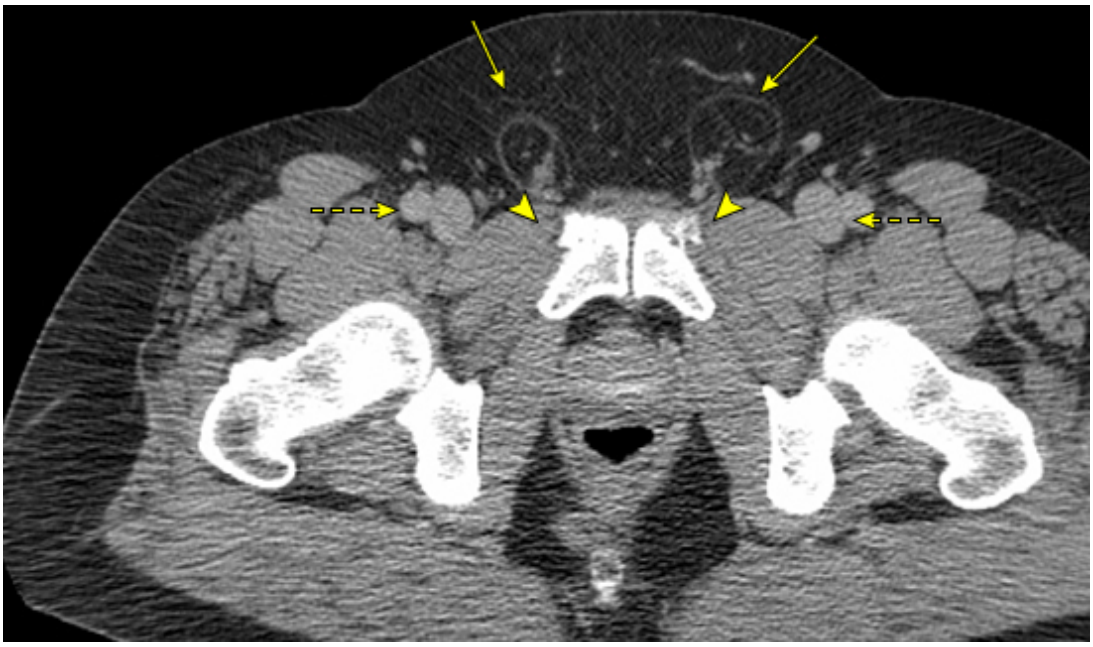
Figure 2: **Groin hernias**



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

Image 1: **Bilateral inguinal hernias**

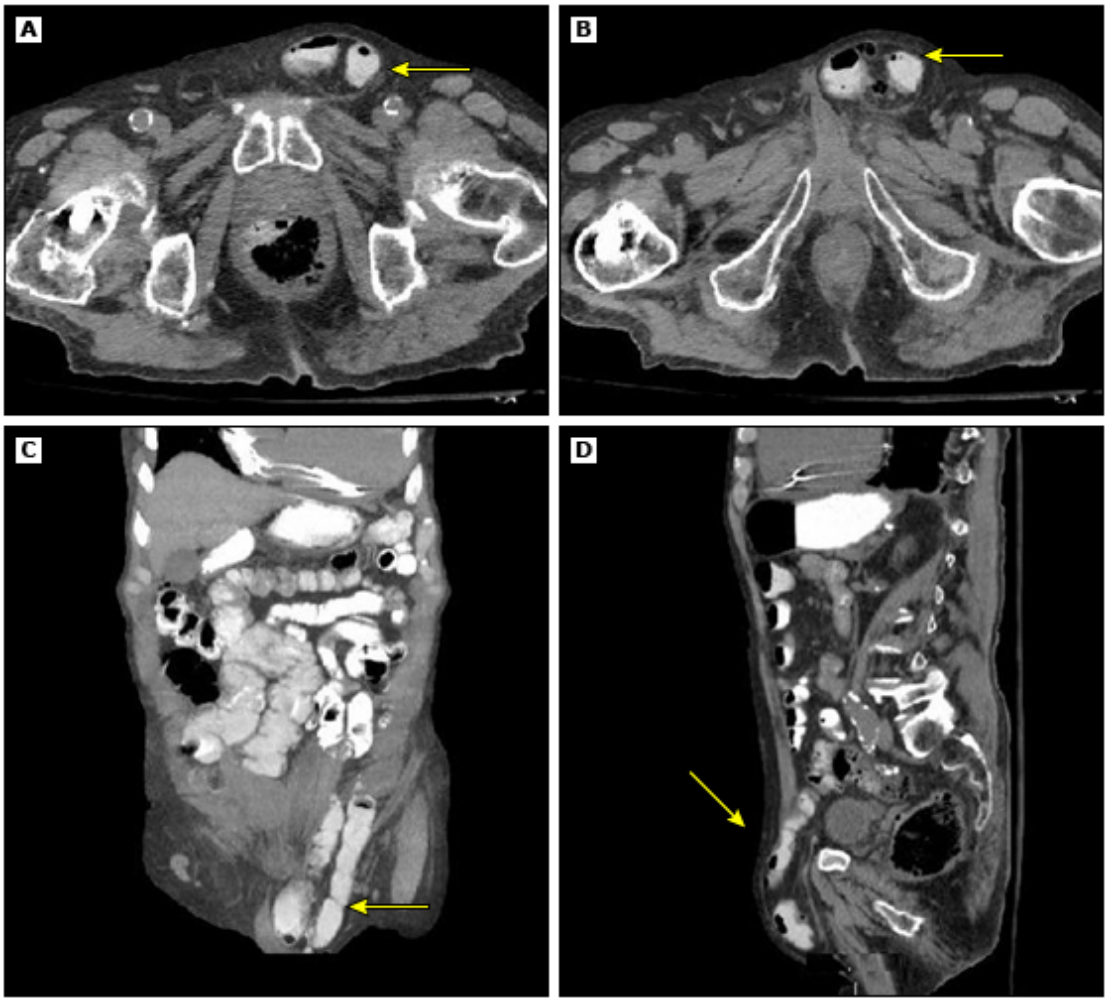


The CT scan of the pelvis through the femoral heads shows bilateral fat containing inguinal hernias (arrows) extending medial to the pubic tubercle (arrowheads) and associated with noncompressed femoral veins (dashed arrows).

CT: computed tomography.

Graphic 88595 Version 4.0

Image 2: **Nonobstructing left inguinal hernia on CT**

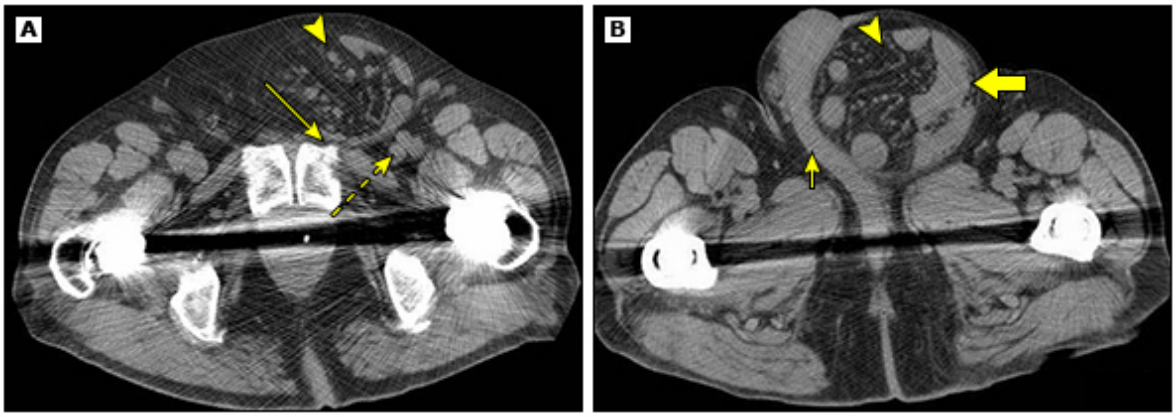


The axial CT images of the lower pelvis (A, B) reveal a left-sided inguinal mass containing contrast-filled small bowel (arrow), which is consistent with an inguinal hernia. A coronal reconstruction (C) and sagittal reconstruction (D) demonstrate nondilated small bowel within the hernia sac (arrows).

CT: computed tomography.

Graphic 88596 Version 3.0

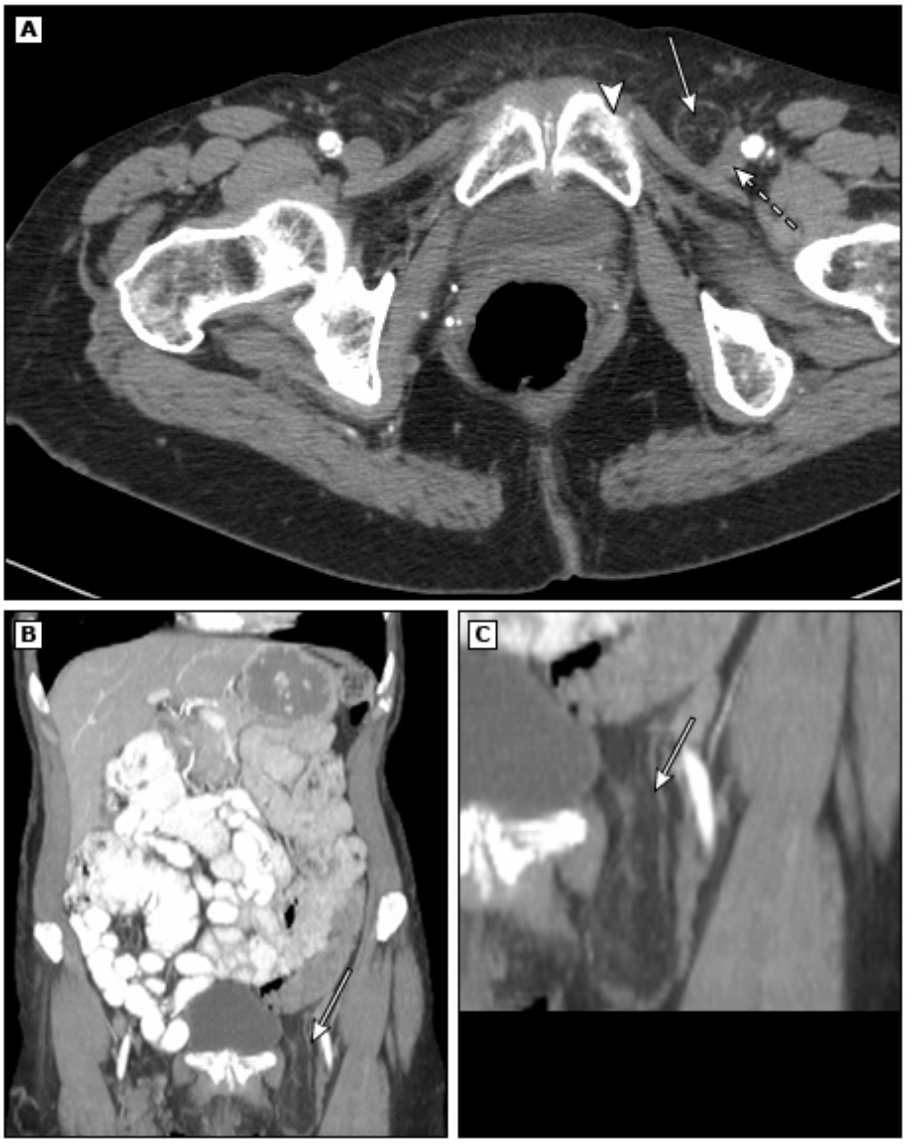
Image 3: **Inguinal hernia on computed tomography**



Computed tomography (CT) scan shows a large hernia (arrowhead, A) medial to the pubic tubercle (arrow, A). In spite of the size of the hernia, there is no evidence for left femoral vein compression (dashed arrow, A), which helps to distinguish this inguinal hernia from a femoral hernia. The hernia is of sufficient volume to displace the base of the penis (short arrow, B). Fat (arrowhead, B) and small bowel (thick arrow, B) are present in the hernia sac. Artifact across the pelvis is caused by bilateral hip replacements.

Graphic 87220 Version 2.0

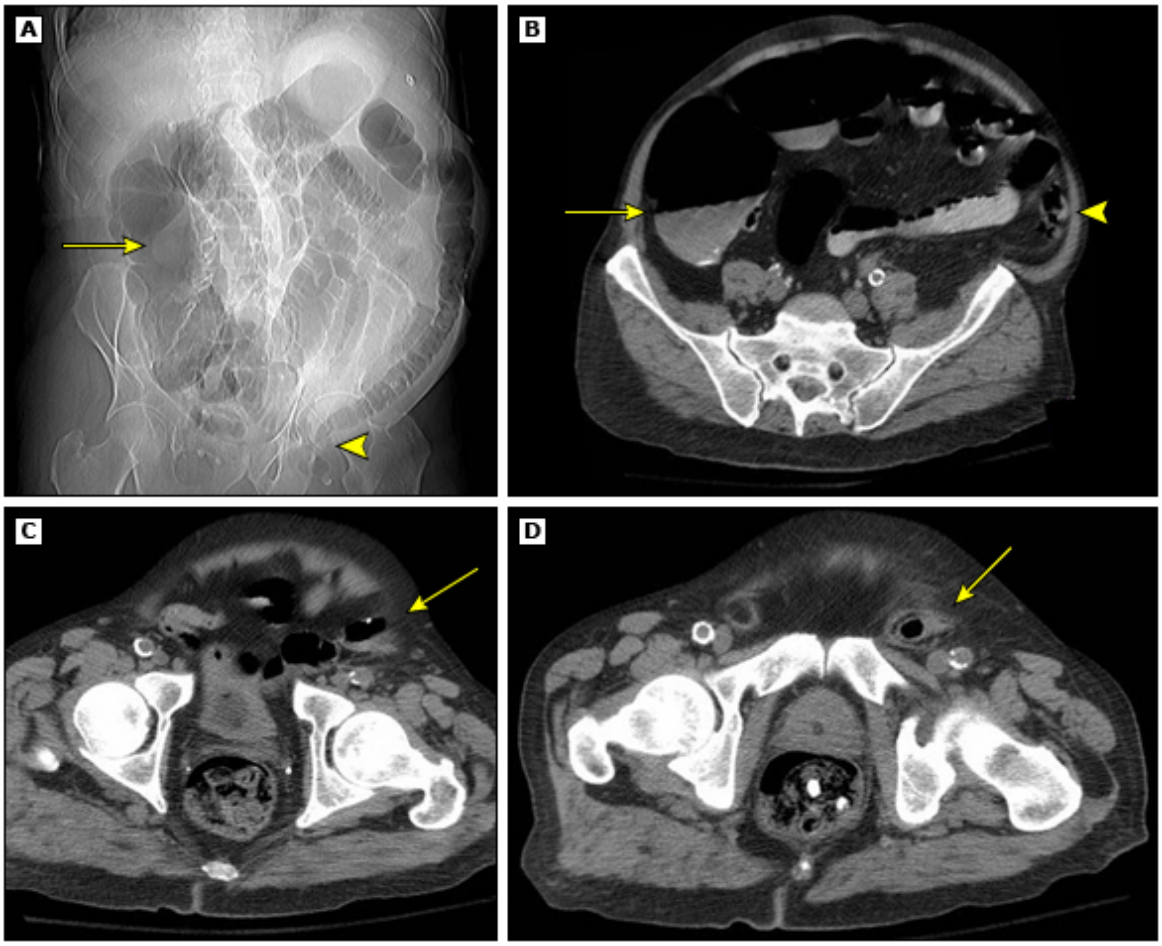
Image 4: **Femoral hernia on computed tomography**



Computed tomography (CT) scan through the femoral heads (A) shows a fat-filled localized mass (white arrow) lateral to the pubic tubercle (white arrowhead) associated with compression of the left femoral vein (white dashed arrow). These findings are consistent with a femoral hernia. The pear-shaped hernia sac is better appreciated in the coronal view (B), which is magnified in (C). There is no evidence of bowel obstruction.

Graphic 87219 Version 1.0

Image 5: **Incarcerated left inguinal hernia on CT**



The preliminary scout film (A) demonstrates dilated ascending colon (arrow) with a focal narrowing of the distal descending colon in the left inguinal region (arrowhead). There is an air fluid level in the dilated ascending colon (B, arrow). The descending colon is normal in caliber (B, arrowhead). A knuckle of incarcerated bowel in a left inguinal hernia can be seen (arrows in C and D).

Graphic 88597 Version 2.0

Table 1: **Differential diagnosis of groin swellings**

Inguinal	Inguinoscrotal	Femoral	Inguinofemoral	Scrotal
Inguinal hernia	Inguinal hernia	Femoral hernia	Inguinal lymph nodes	Skin: boils, sebaceous cysts, papillomas, warts
Lymph nodes	Hydrocele: encysted hydrocele of the cord, infantile hydrocele, hydrocele of the hernia sac	Lymph nodes	Distended psoas bursa	Subcutaneous tissue: lymph scrotum, filariasis Tunica vaginalis: hydrocele, pyocele, hematocele, chylocele
Encysted hydrocele of the cord	Spermatic cord: varicocele, funiculitis, lymph varix, diffuse lipoma of the cord, hematoma of the cord	Saphena varix	Effusion in the hip joint	Testis: Orchitis (acute/chronic), neoplasms
Undescended testis	Testis: undescended, ectopic testis	Ectopic testis		Epididymis: cysts, acute or chronic infections
In females or pregnant women: round ligament varicoses				Spermatic cord: varicocele, lymph varix

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Graphic 134123 Version 5.0