Lesson 17  Hernias  Page 2
Patients with hernia can present with a wide range of symptoms—or with no symptoms. Emergency physicians must be able to differentiate between an asymptomatic, reducible hernia and a strangulated hernia as well as determine which patients can be safely discharged for outpatient followup and which patients require emergent surgical consultation.

Lesson 18  Nontraumatic Hip Pain in Adults  Page 10
Hip pain is a common presenting complaint in adults. However, in the absence of trauma, emergency physicians must be prepared to identify conditions needing emergent interventions such as avascular necrosis and septic arthritis as well as be able to recognize and manage conditions causing referred pain from surrounding structures.

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As defined in 1804 by Astley Cooper, a hernia is a protrusion of any viscus from its proper cavity. The protruded parts are generally contained in a sac-like structure, formed by the membrane with which the cavity is naturally lined.

Since Cooper first wrote about hernias, several different types of hernias have been identified. This article reviews the pathophysiology, evaluation, and treatment of most of these hernias. Hernias are seen by emergency physicians either during a routine physical examination for other medical complaints or when the patient has developed a complication associated with the hernia.

Differentiating between an asymptomatic reducible hernia and a strangulated hernia in a septic patient is crucial for proper treatment. Also, emergency physicians must be able to determine which patients with a hernia can be safely discharged for outpatient followup and which patients require emergent surgical consultation.

**Case Presentations**

**Case One**

A 45-year-old man presents with a chief complaint of a mass in his scrotum. He states that he has had this for years but it has been getting bigger. He denies any past medical history. He denies any fevers, abdominal pain, nausea, or vomiting. He has not seen a physician in 15 years. He states that normally he can push the mass back in but that he has not been able to for the past 8 hours.

Physical examination shows a well-nourished man in no distress. Vital signs are blood pressure 135/85, pulse rate 75, respiratory rate 14, and oral temperature 36.7°C (98.1°F). Breath sounds are clear. Heart sounds are normal, without murmur, rub, or gallop. The abdomen is soft, nontender, and nondistended, with normal bowel sounds. The scrotum is enlarged with a right-sided mass. The testicles are palpated and are nontender. Bowel sounds are heard within the scrotum of the right side. The mass is soft and nontender with no overlying erythema.

**Case Two**

A 62-year-old woman is brought in by her family after two days of persistent right lower abdominal pain. Today she states that she feels hot but has not taken her temperature. She also has developed nausea with multiple episodes of vomiting. The pain has progressively worsened. She states that her abdomen feels tight. Her past medical history consists of hypertension and depression. She is a smoker and a social drinker.

Vital signs are blood pressure 110/65, pulse rate 115, respiratory rate 20, and temperature 38.6°C (101.5°F). This is an overweight woman who appears uncomfortable. Breath sounds are clear. Heart sounds are tachycardic without murmur, rub, or gallop. The abdomen is distended, diffusely tender, with guarding and severe tenderness to palpation in the right suprapubic and groin area. There appears to be a mass in the
Hernias
Hernias are areas of weakness or frank disruption of the fibromuscular tissues of the body wall through which intracavity structures pass. They are among the oldest recorded afflictions of humans. They can broadly be classified into congenital and acquired types. Congenital hernias typically occur in the groin, although they may be found in other locations such as the umbilicus or femoral canal.

Groin Hernias
Several classification schemes for groin hernias exist. The simplest and most common system separates them into direct and indirect inguinal hernias and femoral hernias. The term “sports hernia” refers to groin pain related to athletic participation but not associated with a true anatomic hernia.

Indirect inguinal hernias are the most common groin hernias in men and women. The hernia develops at the internal ring, which is the site where the spermatic cord in men (the round ligament in women) exits the abdomen. The origin is lateral to the inferior epigastric artery, in contrast to direct hernias which arise medially to the inferior epigastric vessels.

Most indirect inguinal hernias are congenital, even though they may not become obvious until later in life. They are most commonly thought to arise due to defective obliteration of the fetal processus vaginalis, which follows the path of the gubernaculum through the inferior anterior abdominal wall, preceding the testicle which then passes through the inguinal canal and into the scrotum at birth. Increased abdominal pressure in association with reduced muscular tone in the groin area may lead to protrusion of intraabdominal contents into the sac, resulting in a detectable hernia.

Indirect hernias develop more frequently on the right, the side that descends last. The internal ring normally closes following the migration of the testicle into the canal and thus into the scrotum. The failure of this to occur, combined with failure of obliteration of the processus vaginalis, provides the necessary defect through which the hernia can develop, either in the neonatal, adolescent, post-pubescent, or adult periods.

Direct inguinal hernias occur through the Hesselbach triangle, formed by the inguinal ligament (Poupart) inferiorly, the inferior epigastric vessels laterally, and the rectus abdominus muscle medially. They occur as a result of a weakness in the floor of the canal. This weakness appears to be an inborn flaw in many cases, although some can occur because of acquired deficiencies in the abdominal musculature. The relationship between direct inguinal hernias and 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.

Femoral hernias account for less than 10% of all groin hernias, but 40% present with emergencies such as incarceration or strangulation. Femoral hernias develop in the empty space at the medial aspect of the femoral canal, an area that can widen over time and after trauma. The femoral nerve, femoral artery, and femoral vein are all lateral to the empty space in the femoral canal where femoral hernias develop. Femoral hernias are more common in women than in men, particularly older women. The reason for the higher incidence in women may relate to comparatively less bulky musculature at baseline, and/or weakness of the pelvic floor muscles from previous childbirth. Bowel obstruction is a frequent clinical presentation of femoral hernia.

Obturator hernias pass through the obturator foramen, following the path of the obturator nerves and muscles. Obturator hernias occur with a female-to-male ratio of 6:1 because of a gender-specific larger canal diameter. Because of its anatomic position, this hernia presents more commonly as a bowel obstruction than as a protrusion of bowel contents.

When evaluating possible groin hernias in male patients, do not forget the possibility of testicular torsion, which can have a similar presentation. Unilateral scrotal pain in a young male needs further workup and consideration of testicular torsion because of the devastating complications of misdiagnosis.
Abdominal Hernias

Ventral hernias occur as a result of defects in the abdominal wall. They are typically classified by etiology and location as incisional, umbilical, epigastric, and Spigelian.

Incisional hernias, by definition, develop at sites where an incision has been made for a prior abdominal procedure. Hernias are due to the failure of fascial tissues to heal and close following laparotomy.

Any condition that inhibits natural wound healing will make a patient susceptible to the development of an incisional hernia. Such conditions include infection, obesity, smoking, medications such as immunosuppressives, excessive wound tension, malnutrition, fractured sutures, poor surgical technique, and connective tissue disorders. Emergency surgery increases the risk of incisional hernia formation.

It is estimated that an incisional hernia will develop in approximately 10% to 15% of abdominal incisions, and in up to 23% of patients who develop postoperative wound infection. Such hernias can occur after any type of abdominal wall incision, although the highest incidence is seen with midline (the most common incisions for many abdominal procedures) incisions.

Incisional hernias can increase in size to enormous proportions; giant ventral hernias can contain a significant amount of small or large bowel. At the extreme end of the spectrum is the giant incisional hernia that leads to loss of abdominal domain, which occurs when the intraabdominal contents can no longer lie within the abdominal cavity.

An umbilical hernia is an opening in the linea alba that develops when the umbilical scar fails to heal at birth. The incidence of umbilical hernia ranges from 10% to 30% and is more common in African American children than in Caucasians. Many umbilical hernias close in the first 12 to 18 months of life; repair is rarely recommended until a child is approximately 3 years old.

Umbilical hernias in adults are acquired rather than congenital and occur more commonly in women than in men, with a 3:1 ratio. Umbilical hernias are associated with increased intraabdominal pressure due to obesity, abdominal distension, ascites, and pregnancy.

Epigastric hernias are defects in the abdominal midline between the umbilicus and the xiphoid process. The defects are similar to umbilical hernias but considerably smaller, with defects that are often no more than 1 cm in diameter. Frequently, the hernias are incarcerated and, because of the small size of the defect, they must be opened and enlarged to reduce the preperitoneal fat in the hernia sac.

A Spigelian hernia occurs along the semilunar line, which is the caudal most extent of the posterior rectus sheath. This anatomic location is weak because of the absence of a posterior sheath behind the rectus muscle. Spigelian hernia is well described but relatively rare. Nearly 1,000 cases have been reported in the medical literature. It is likely these hernias will become more frequently diagnosed, as they are readily seen on computed tomography (CT) scans as well as laparoscopic views of the anterior abdominal wall.

Diastasis recti is an anatomical term describing an acquired condition in which the right and left rectus muscles have separated. The fascia has become stretched, most often due to body habitus or pregnancy. Diastasis recti do not represent an abdominal wall hernia; there is no fascial defect and therefore, no risk of incarceration or strangulation.

Clinical Presentation

Grom hernias can be completely asymptomatic or present with symptoms ranging from minimal discomfort to frank peritoneal signs if a loop of bowel is strangulated. The most common symptom is a heaviness or dull sense of discomfort that is most pronounced when straining, lifting, or otherwise increasing intraabdominal pressure. This pain is caused by the contents of the hernia (either bowel, viscera, or fat) pressing into the tight ring at the neck of the sac. As the intraabdominal pressure increases, the contents of the hernia are forced into the ring constricting them. Pain may also arise from stretching of the ilioinguinal nerve. Little pressure is required to create discomfort, which then resolves as the pressure is released when the patient stops straining or lies down.

Typically, discomfort is more prominent 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 more sedentary workers.

The patient with an incisional hernia complains of a bulge in the abdominal wall originating deep to the skin scar. This may cause a varying degree of discomfort or may present as a cosmetic concern. Symptoms are usually aggravated by coughing or straining, as the hernia contents protrude through the abdominal wall defect.

In large ventral hernias, the skin may present with ischemic or pressure necrosis leading to frank ulceration. Presentation of the incisional hernia with incarceration causing bowel obstruction is not uncommon.

Patients with umbilical hernias may present with a soft protuberance at the umbilicus. The protuberance or bulge may be symmetric, located slightly above, slightly below, or to one side or another. Umbilical hernias most often present incarcerated in men; women, particularly those close to their ideal body weight, are more likely to have easily reducible hernias. Typically, it is omentum or preperitoneal fat that incarcerates into the hernia.

Epigastric hernias can be asymptomatic, but many times patients will note a small, slightly uncomfortable lump between the
umbilicus and the xiphoid. Risk of bowel incarceration or strangulation is minimal.

Spigelian hernias most often present with a swelling in the middle to lower abdomen just lateral to the rectus muscle. The patient may complain of a sharp pain or tenderness at this site. The hernia is usually reducible in the supine position. The reducible mass may be palpable, even if it sits below the external oblique musculature.

Diastasis recti can be distinguished from incisional, congenital, or acquired midline hernias of the abdominal wall. While a true hernia is associated with a fascial defect, patients with diastasis recti have no detectable fascial defect when they are supine. If a hernia is reducible, the abdominal contents can be returned to their original compartment. Reduction not only allows symptomatic relief for patients but also reduces the risk of future incarceration.

An incarcerated hernia cannot easily be returned to its original compartment. Overlying skin should appear to be normal, the contents should not be tense, and bowel sounds can sometimes be heard. The incarcerated tissue may be bowel, omentum, or other abdominal contents. A smaller aperture of herniation and adhesions can precipitate incarceration.

A strangulated hernia is a surgical emergency in which the blood supply to the herniated tissue is compromised. Strangulation comes from herniated bowel contents passing through a restrictive opening that eventually reduces venous return and leads to increased tissue edema, which further compromises circulation and stops the arterial supply. Such a hernia may be recognized in early stages by severe pain and by tenderness, induration, and erythema over the herniation site. As tissue necrosis ensues, findings may include leukocytosis, decreased bowel sounds, abdominal distension, and a patient who appears to be toxic, dehydrated, and febrile. The mortality rate for patients with a strangulated hernia is high, and treatment should be initiated immediately.

**Physical Examination**

In general, the physical examination should be performed with the patient in both the supine and standing positions, with and without the Valsalva maneuver. The examiner should attempt to identify the hernia sac as well as the fascial defect through which it is protruding. This allows proper direction of pressure for reduction of hernia contents. The examiner should also identify evidence of obstruction and strangulation.

When attempting to identify a hernia, look for swelling or a mass in the area of the fascial defect. Place a fingertip into the scrotal sac and advance up into the inguinal canal. If the hernia comes from superolateral to inferomedial and strikes the distal tip of the finger, it most likely is an indirect hernia. If the hernia strikes the pad of the finger from deep to superficial, it is more consistent with a direct hernia. If the hernia is elsewhere on the abdomen, attempt to define the borders of the fascial defect.

A bulge felt below the inguinal ligament is consistent with a femoral hernia. Strangulated hernias are differentiated from incarcerated hernias by the following: pain out of proportion to examination findings, fever or toxic appearance, and pain that persists after reduction of hernia.

Incisional hernias are found in the presence of an obvious surgical incision. Congenital or acquired midline hernias of the abdominal wall are confined to the umbilicus or the epigastrium. Epigastric hernias are generally no larger than 2 cm in diameter.

Incisional hernia, on examination, is usually easy to identify and the edges of the fascial defect can often be defined by palpation. The entire abdominal wall along the length of the incision should be inspected and palpated carefully as multiple hernias are often present in the setting of an incisional hernia.

The diagnosis of diastasis recti is often made when a patient in the supine position attempts to raise his or her head during an office examination. The increase in intraabdominal pressure as the two rectus muscles contract causes a diffused fusiform bulge through the thin midline fascia.

Accurate diagnosis of Spigelian hernias by physical examination is quite challenging. As the hernia develops, preperitoneal fat emerges through the defect in the Spigelian fascia, bringing an extension of the peritoneum with it through the fascia. The hernia is nevertheless covered by the intact external oblique aponeurosis. For this reason, almost all Spigelian hernias are interparietal, and only rarely will the hernia sac lie in the subcutaneous tissues anterior to the external oblique fascia. The hernia cannot develop medially because of resistance from the intact rectus muscle and sheath. Therefore, a large Spigelian hernia is most often found laterally and inferior to its defect in the space directly posterior to the external oblique muscle.

**Workup**

For the most part, the diagnosis of a hernia is made clinically. Laboratory and radiographic diagnostic studies are reserved for patients whose clinical presentation is not obvious and for those who are toxic appearing. Results from a CBC are usually nonspecific; leukocytosis with left shift can occur with strangulation. Electrolytes, BUN, and creatinine levels can help in assessing the hydration status of a patient with nausea and vomiting. These tests are rarely needed for patients with hernias except as part of a preoperative workup. Urinalysis can aid with narrowing the differential diagnosis of genitourinary causes of groin pain in the setting of associated hernias.
CRITICAL DECISION
Is imaging necessary for the diagnosis of a hernia, and if so, what modality should be used?

Imaging studies are not required in the normal workup of a hernia. Ultrasonography can be used in differentiating masses in the groin or abdominal wall or in differentiating testicular sources of swelling. The tests should be imaged if there is any uncertainty as to whether testicular torsion is present. If an incarcerated or strangulated hernia is suspected, consider performing an upright chest radiograph to exclude free air (extremely rare) and flat and upright abdominal films to diagnose a small bowel obstruction (neither sensitive nor specific) or to identify areas of bowel outside the abdominal cavity. Abdominal CT can be helpful if concern remains for an incarcerated or strangulated hernia.

Femoral hernias can be difficult to differentiate from inguinal hernias if they present cephalad to or directly overlying the inguinal ligament. CT scanning can help differentiate femoral hernias from inguinal hernias when the diagnosis is uncertain. CT scanning of the abdomen will also confirm the presence of a Spigelian hernia.

Ultrasound examination has been shown to be the most reliable and easiest method to assist in the diagnostic workup. Even if the hernia is fully reduced during examination and no mass is palpable, ultrasonography can show a break in the echogenic shadow of the semilunar line associated with the fascial defect.

In the obese patient with a suspected incisional hernia that cannot be confirmed on examination, CT of the abdomen is the best test to visualize intraabdominal contents within the hernia sac.

Management

After the diagnosis of hernia has been made, treatment options depend on the condition of the patient and of the hernia. As always, one must assess the patient’s ABCs and make sure that the patient does not need any immediate resuscitation. Once that has been determined and addressed if necessary, the hernia should be assessed to determine if the hernia is reducible, incarcerated, or strangulated.

A reduction of a protruding hernia should be attempted, unless the patient appears extremely ill and has signs of peritonitis, intestinal obstruction, or toxicity from gangrenous bowel. Elective repair after successful manual reduction has a lower complication rate than emergent operative reduction. Success rates for manual reduction are influenced by the duration of incarceration and the age of the patient.

CRITICAL DECISION
What techniques can help facilitate hernia reduction?

To reduce an abdominal hernia, lay the patient supine. To reduce a groin hernia, place the patient in a 20° Trendelenburg position (this position allows gravity to help retract the herniated tissue into the abdomen or pelvis). In children, a unilateral frog leg position has been shown to align the inguinal rings for better reduction. Apply an ice pack to the area to reduce edema, and provide sufficient sedation and analgesia if necessary to reduce pain during the procedure. The reduction in pain also helps reduce guarding and abdominal muscular constriction, thereby decreasing the intraabdominal pressure and permitting easier reduction.

Wait 20 to 30 minutes. Some hernias self-reduce because of the application of cold compresses to reduce edema, the force of gravity, and relaxation of the muscles surrounding the hernia from sedation and analgesia.

Slowly apply pressure distal to the hernia while guiding the proximal portion through the fascial defect. Use two hands to allow guidance through the fascial defect and simultaneous gentle pressure. This part of the reduction can take 5 to 15 minutes. Too much distal pressure causes the hernia to balloon around the fascial opening, making reduction more difficult. Guidance of the proximal hernia into the abdomen is the key to successfully moving the tissue through the fascial defect. Even with proper sedation and technique, not every hernia can be manually reduced; in which case, surgical reduction is more urgent to prevent strangulation.

CRITICAL DECISION
When should hernia reduction not be attempted?

The patient who appears toxic and has signs of peritonitis, intestinal obstruction, and an identifiable hernia with overlying erythema or gangrenous tissue should be aggressively treated. Manual reduction is contraindicated for patients with strangulated hernias. In these cases, begin nasogastric suction, fluid replacement, and antibiotics. If the diagnosis of strangulated hernia is missed and manual reduction is performed, necrotic bowel may be introduced into the abdomen, causing peritonitis and sepsis. This could result in clinical deterioration and requires urgent reduction in the operating room.

CRITICAL DECISION
Which patients with hernia can be managed safely with outpatient followup?

A recent large prospective trial suggests that in patients who are minimally symptomatic, nonoperative treatment can produce outcomes similar to those experienced by minimally symptomatic patients who undergo surgical repair. In symptomatic patients, reduction helps to alleviate symptoms, but elective surgical repair is usually warranted for long-term management.

Followup visits with a general surgeon should be scheduled within the next one to two weeks for those patients with easily reducible hernias.
or with hernias found on physical examination. Discharge patients with umbilical hernias with close followup care if the defect is less than 2 cm in diameter and the hernia is not incarcerated or strangulated. Educate patients to avoid those activities that increase intraabdominal pressure and to return if they are unable to reduce the hernia or if they experience fever, vomiting, or increased pain.

**CRITICAL DECISION**
Which patients with hernia require surgical evaluation in the emergency department?

All patients with incarcerated or strangulated hernias require admission and immediate surgical evaluation. If attempts to reduce a hernia fail, surgical consultation should be obtained. When pain persists after reduction and the patient is not well appearing, the patient should be admitted for observation.

**Case Resolutions**

**Case One**
The patient with the mass in his scrotum was nontoxic with no sign of hernia strangulation. The patient attempted self-reduction and was not able to reduce the hernia. The patient was placed in 20° Trendelenburg position. An ice pack was applied to the right groin area. The patient was given morphine and after 15 minutes the hernia was manually reduced using gentle pressure. Two hands allowed guidance through the fascial defect with simultaneous gentle pressure. The patient tolerated the procedure well and was given a followup appointment with general surgery in one week. The patient was educated to avoid activities that increase intraabdominal pressure. He was also instructed to return for inability to reduce the hernia and for increased pain, fever, or vomiting.

**Case Two**
The woman who presented with abdominal pain and was found to have a mass in the groin area was placed on a cardiac monitor and intravenous access was obtained. Laboratory blood work was obtained and the patient was given a 1-liter fluid bolus. The CBC showed a WBC count of 18,000 cells per microliter and 80% neutrophils and 14% bands. Results of the basic metabolic panel were unremarkable. CT scans of the abdomen and pelvis were obtained with intravenous contrast. The CT scans showed a femoral hernia with signs of bowel obstruction and inflammatory changes and venous congestion consistent with strangulation.

The patient was started on intravenous cefoxitin. A nasogastric tube was placed, and surgery was consulted. The patient was taken to surgery, and the bowel was found to be viable. The femoral hernia was repaired and the patient had a full recovery.

**Summary**
Abdominal and groin hernias are common in the general population. Patients with hernias can present with asymptomatic fascial defects, be critically ill with full-blown sepsis and bowel ischemia, or have symptoms anywhere between these extremes. Emergency physicians should be able to recognize and appropriately treat various hernias. Practitioners need to know when a hernia needs emergent surgical attention versus outpatient followup. Emergency physicians should be able to recognize, diagnose, and reduce appropriate hernias in the emergency department.

**References**


The LLSA Literature Review

“The LLSA Literature Review” summarizes articles from ABEM’s “2014 Lifelong Learning and Self-Assessment Reading List.” These articles are available online in the ACEP LLSA Resource Center (www.acep.org/llsa) and on the ABEM Web site.

Article 5

Identifying Nontechnical Skills Associated With Safety in the Emergency Department: A Scoping Review of the Literature

Reviewed by J. Stephen Bohan, MD, MS, FACEP; Harvard Affiliated Emergency Medicine Residency, Brigham and Women’s Hospital


Everyone knows that bad things happen if a physician or nurse is inadequately trained or inexperienced in doing a procedure, but how might a health care provider’s lack of nontechnical skills (eg, communication, ability to work in a team, leadership) affect patients? This unusual study set out to review the existing literature on this topic and did so in two stages. The first stage looked for studies that specifically linked failures in these elements to safety and then, in a second stage, looked for studies that addressed the findings of the first stage. They found 11 articles in stage 1 and 21 further articles in stage 2.

Nine core emergency medicine nontechnical skills were reviewed, as follows: communicating, managing workload, anticipating, situational awareness, supervising and providing feedback, leadership, maintaining standards, using assertiveness, and decision making. They then provided the key findings in each of the articles, grouped by the skills enumerated (eg, related to errors in communication, they noted the untoward effects of absent or unstructured hand offs, ambient noise, and problems with hierarchy; related to workload management, they noted prioritization and interruptions).

Lack of supervision was thought to account for almost a third of all important safety lapses, and errors in decision making, ie, diagnostic errors, were thought to make up about one half of all errors in care.

Highlights

- It appears that nontechnical errors may exceed technical errors (since they apply to every patient) as causes of safety lapses in emergency medicine.
- A literature review isolated nine nontechnical areas/activities of emergency medicine practice that can lead to error—communicating, situational awareness, maintaining standards, managing workload, supervising and providing feedback, using assertiveness, anticipating, leadership, and decision making.
Nontraumatic Hip Pain in Adults

Amir Shahideh, MD, and Kseniya Orlik, MD

Objectives

On completion of this lesson, you should be able to:

1. Create a broad differential for nontraumatic hip pain and identify life-threatening or limb-threatening conditions that can present with hip pain.
2. Explain the utility of radiography, magnetic resonance imaging, and ultrasonography in the evaluation of hip pain.
3. List risk factors for avascular necrosis and septic arthritis.
4. Interpret laboratory results from synovial fluid analysis and use this information to evaluate the likelihood of a septic joint.
5. Identify conditions that may cause referred pain to the hip.

From the EM Model

1.0 Signs, Symptoms, and Presentations
1.1 General

Nontraumatic hip pain is a common complaint among patients presenting to the emergency department and can indicate emergent as well as nonemergent conditions. Some types of hip pathology commonly affect the elderly. In fact, according to a National Health and Nutrition survey, 14.3% of adults 60 years and older report hip pain on most days over a 6-week period. Pregnant women, postpartum patients, menopausal patients, and patients with specific comorbidities are particularly prone to population-specific hip pathology.

Adult patients seeking diagnosis and relief of both acute and chronic hip pain present a challenge to emergency physicians who must maintain a high suspicion for pathology requiring emergent intervention. The hip joint and its surrounding bursa, musculature, vasculature, and innervation, as well as nearby pelvic structures, comprise a complex anatomic region that must be thoroughly evaluated when developing a differential diagnosis for nontraumatic hip pain. Advances in radiography, sonography, and laboratory testing have allowed physicians to more readily identify pathology involving the hip and surrounding structures, aiding greatly in the diagnosis, classification, and management of these patients. Key elements of medical history, physical examination, laboratory studies, and imaging modalities used in the evaluation of nontraumatic hip pain in the adult patient will be discussed.

Case Presentations

Case One

A 46-year-old woman with a history of rheumatoid arthritis presents with a 32-hour history of progressively increasing pain in her right hip. She has never had pain like this before. The pain is severe and is worsened by walking, movement of the hip, and weight bearing on the right leg. The hip is also tender to the touch. The patient's only medication is a low-dose prednisone regimen for her rheumatoid arthritis. She reports no falls, no trauma, no recent illnesses, no drug use, no nausea, no vomiting, and no diarrhea. She has no other medical problems. On physical examination, her vital signs are blood pressure 125/82, heart rate 86, respiratory rate 20, and temperature 38.7°C (101.6°F). Pain is reproducible and severe with palpation of the affected hip and with passive range of motion. There is no erythema over the right hip. Examination of the left hip and bilateral knees is unremarkable. There is no visible deformity of either hip joint. Laboratory workup is remarkable for WBC count of 12 × 10^9/L, with 90% neutrophils, erythrocyte sedimentation rate (ESR) 55 mm/h, and C-reactive protein (CRP) 1.8 mg/dL. Radiography of the right hip is unremarkable and negative for fracture or dislocation. Sonography of the right hip reveals an effusion.

Case Two

A 36-year-old woman presents with persistent left hip pain and
mild, intermittent right hip pain of 4 months’ duration. The pain initially developed in her left groin, radiating to the buttock and left knee during the third trimester of pregnancy with her second child. The pain has gradually worsened and is exacerbated by weight-bearing activity. A month prior to delivery, she developed pain in her right hip that was not as bad, but was also exacerbated by standing and walking. The patient’s obstetrician reassured her that this was likely sciatica and no further testing was performed. The patient is concerned today because the pain has worsened since the time of her delivery. Her past medical history is remarkable for alcohol abuse and sickle cell trait. On physical examination, vital signs are within normal limits and the patient is afebrile. She has a Trendelenburg gait and is unable to ambulate without severe pain in her left groin and buttock as well as some pain in the right hip. Internal rotation of the left hip is limited to 10° and is normal in the right hip. Radiographs of the left and right hip are ordered.

Case Three
A 76-year-old man presents complaining of severe pain in his left hip that started 8 hours ago. He was walking in the park with his grandson when he experienced a sudden onset of the pain, which felt as though someone had struck him in the left hip. The patient reports no history of trauma or falls. His past medical history is remarkable for hypertension, which is well controlled with beta-blockers. He also reports that he has been a smoker for the past 30 years and still smokes one pack per day of cigarettes. He ambulated into the emergency department despite some increased pain with weight bearing on the affected leg. His vital signs are blood pressure 108/69, heart rate 95, respiratory rate 20, and temperature 36.6°C (97.8°F). On physical examination, the patient is an overweight man with symmetrical and intact distal pulses. There is no tenderness to palpation over the left hip, and he has fully intact range of motion within the left and right hip joints. There is no mass, swelling, warmth, lymphadenopathy, or color change of the skin overlying his left hip. Knee and back examinations are also unremarkable. Given the lack of local findings, rectal and genitourinary examinations are performed which are unremarkable. The emergency physician decides to perform a thorough abdominal examination.

Critical Decisions

* What conditions should emergency physicians consider in the differential diagnosis of nontraumatic hip pain, and what aspects of the patient’s history can help narrow the differential?*

* Which key elements on physical examination could help in the diagnosis and further management of nontraumatic hip pain?*

* What laboratory and imaging modalities can help in the evaluation of patients with nontraumatic hip pain?*

* What are the important risk factors for avascular necrosis of the hip, and when should this diagnosis be suspected?*

* How can laboratory tests and ultrasonography help in the evaluation of a patient with suspected septic arthritis of the hip?*

* What serious conditions not related to the hip could cause referred pain to the hip and present as hip pain?*

* How should the pregnant patient with hip pain be evaluated?*
usually aggravated by direct pressure and intolerable to pressure on the affected side. Lateral hip pain increased via direct pressure and with or without difficulty in weight bearing can also suggest femoral involvement. Metastatic lesions, multiple myeloma, and primary tumors of the femur such as chondrosarcoma should all be considered. Sacroiliitis and discitis can also mimic hip pain, as these structures commonly refer pain through the hip via the gluteus muscles and the posterior-lateral thigh. Thus, a careful history pertaining to the back and extremities must be elicited. Paresthesia and hypoesthesia of the leg and thigh often accompany the referred pain noted in these conditions. Hypoesthesia and paresthesia of the leg and thigh usually radiate beyond the upper, outer thigh. Very tight-fitting clothing can cause this condition, as well as pregnancy and obesity. Pain with paresthesia and hypoesthesia radiating beyond the upper, outer thigh suggests a diagnosis of lumbar radiculopathy.

Pain that is constant and present at night should raise suspicion for possible infectious, inflammatory, or neoplastic conditions. Sudden onset of hip pain is more suggestive of septic arthritis, fracture, AVN, and acute synovitis. Septic arthritis of the hip is a true emergency. Emergency physicians must maintain a high level of suspicion for the septic joint in a patient with acute onset of hip and groin pain with or without fever, toxic appearance, and severe pain with weight bearing and range of motion.

Patient age has an important role in narrowing the differential. For example, osteoarthritis should be considered high on the differential in patients over the age of 50 who present with hip pain, while SCFE must be suspected in younger individuals, although it can occur in any age group.

Comorbidities should not be overlooked when evaluating hip pain. For instance, patients with chronic inflammatory disease, glucocorticoid therapy, or coagulopathic disorders are more susceptible to osteonecrosis of the femoral head. Patients with diabetes mellitus or peripheral vascular disease are at increased risk for arterial occlusive disorders. Peripheral vascular disease and aortoiliac vascular occlusive disease (Leriche syndrome) must not be overlooked. Patients may complain of aching pain in the buttock, hip, and thigh that initially occurs with activity and walking, subsequently progressing to pain at rest. The physician must carefully elicit a history of possible claudication events as well as risk factors for vascular disease such as hypertension, diabetes, smoking, and poorly healing wounds or color changes of the extremities. Patients with associated fevers, weight loss, or history of cancer require a more extensive workup. A careful review of systems should include eliciting any history of fevers, weight loss, and urogenital, neurologic, and abdominal symptoms. Any changes in the patient’s activity levels should be noted. History of surgeries, old hip fractures, and past medical history along with current and past medications can offer important clues in diagnosis.

**CRITICAL DECISION**

**Which key elements on physical examination could help in the diagnosis and further management of nontraumatic hip pain?**

A careful physical examination of the patient with nontraumatic hip pain is an essential tool for diagnosis, management, and disposition planning. Important aspects of the physical examination include inspection of the affected limb, noting resting position of the limb, deformity, swelling, and skin changes, palpation of the joint, and range of motion of the joint.

When considering position, it is essential to assess the patient’s gait and overall mobility. This can be accomplished by observing the patient’s ambulation, ability to change position, and ability to perform basic tasks such as sitting, standing, and transferring on and off the examination table. The clinician should carefully observe for limp, refusal to bear weight, and intolerance to squatting, sitting, or standing. Inability to perform these tasks should alert the physician to severe pathology of the hip joint, such as fracture, osteonecrosis, severe arthritis, and metastatic disease of the femur. Gait and positional findings may also signal altered muscular or lumbosacral support pathologies. For instance, Trendelenburg gait, which is caused by weakness of the abductor muscles of the lower limb and characterized by pelvic drop on the unaffected side during heel strike on the affected side, is likely to indicate gluteus medius involvement. However, it may also suggest intrinsic hip joint pathology. A waddling gait may be normally seen in athletes and pregnant women; however a waddling gait can also suggest osteitis pubis. This disorder is caused by overuse of the hip abductors and gracilis muscle. Inability to climb onto the examination table may indicate loss of hip joint flexibility or loss of iliopsoas and quadriceps strength. An antalgic gait will result from refusal to weight bear on the affected side. Important considerations in the patient with an antalgic gait include stress fractures and septic arthritis. Stress fractures may result in a painful limp with antalgic gait where there is shortening of the stance phase of the injured extremity. Early symptoms may be subtle and mimic muscle strain. They may progress from morning stiffness, groin, knee, and medial thigh pain to inability to weight bear with exercise. After rest, pain may increase with initiation of walking. On examination there will be no obvious leg shortening or external rotation. Active and passive movement may produce minor discomfort. Risks for stress...
Corrected text: fracture and abnormal bone should be assessed. Septic arthritis will alter the ability to bear weight on the affected side with severe limitation of active and passive motion of the affected hip. These patients often have accompanying skin changes such as warmth or erythema and often present with fever and toxic appearance.

Inspection of the extremity in the patient with nontraumatic hip pain must include evaluation of the skin, vasculature, and surrounding joint structures. The back, hips, and knees should be examined for scars, masses, and leg length discrepancies. The extremities should be carefully assessed in terms of vascular integrity, pulses, and overlying skin changes. It is important to note the condition of the knees and surrounding musculature for signs of muscle wasting or limited range of motion of the knees. The legs should be assessed as well, looking for color changes over the skin or pallor, which may suggest infectious pathology or arterial occlusive disease respectively. Lower extremity neurologic function should also be evaluated, as stress fractures often present with fever and toxic appearance.

CRITICAL DECISION: What laboratory and imaging modalities can help in the evaluation of patients with nontraumatic hip pain?

Radiography is the imaging modality of choice in the emergency department. Clinical evaluation should always guide imaging and laboratory evaluation. The anteroposterior view of the pelvis and the cross-table view of the affected hip are good starting points for radiographic imaging. A frog-leg view is commonly ordered when AVN is suspected.

When stress fracture is suspected, plain films should be obtained and carefully scrutinized. The fracture lines of stress fractures of the femoral neck can be very subtle on plain radiographs. The femur should be placed into maximal internal rotation. When searching for femoral neck fractures, it is helpful to trace the medial and lateral cortical margins, which should follow smooth S-shaped curves. The “S” is formed by the convex line of the femoral head abutting the concave border of the femoral neck. Any sharp angle along the “S” curve is indicative of fracture. Tracing of the lateral (tensile) and medial (compressive) trabecular lines passing through the femoral shaft to the femoral head and looking for disruption is also helpful and is often the only clue to the presence of a stress fracture. If radiography is negative, magnetic resonance imaging (MRI) is the next step. If fracture is confirmed, the opposite hip must also be evaluated, as stress fractures are often bilateral. Management and disposition will depend on whether the compressive or tensile side is involved. When the compressive aspect is involved with less than half the cortex, the fracture is stable and can be treated conservatively with partial weight bearing, crutches, and orthopedic followup. All tension aspect fractures and more than half the cortex fractures of the compressive aspect are unstable and require operative management.

The key finding on plain radiography in the patient with osteoarthritis is joint space narrowing. One might also see typical acetabular and femoral osteophytesis, subchondral cysts, and sclerosis. Radiography is sufficient for diagnosis of moderate to advanced osteoarthritis with consistent history and physical. However, more advance imaging modalities such as computed tomography (CT) and MRI can be useful if there is suspicion for radiographically lucent stress fractures and in cases of suspected AVN. Insufficiency fractures such as those commonly seen in advanced age with osteoporosis, hyperparathyroidism, or other disorders affecting bone integrity are often radiographically occult. CT or MRI may be used in patients with these comorbidities and negative findings on plain radiographs.

If AVN of the femoral head is suspected, MRI is the imaging modality of choice, especially early in the disease course. At times, radiography in more advanced disease may reveal the characteristic “crescent sign.” There is flattening of the superior portion of the femoral head, which is subtle at times, accompanied by a subchondral fracture parallel to the articular surface.

Tumors involving the proximal femur are usually well visualized with plain radiography. Areas of higher complexity such as of the hip joint and pelvis are better visualized with CT. In comparison to radiography, CT may better assess cortical destruction and periosteal reaction, along with soft tissue organs and retroperitoneal...
Ultrasound imaging is the modality of choice when evaluating an effusion, suspected septic arthritis, or inflammatory conditions involving the hip joint or surrounding soft tissues. It is rapid and cost-effective and can also guide aspiration of the joint for fluid analysis. Ultrasonography offers dynamic evaluation of the soft tissues and bony structures. Color Doppler may be used to assist in differentiating effusion from synovitis. Inner margin distance from the capsule to the cortex at the head-neck junction of 7 mm or more is considered an effusion. Infected fluid can return low-level echoes versus a typically anechoic inflammatory fluid; however, there is no reliable differentiation by sonography alone. Sonography also provides a fast and efficient way to assess the vascularity of the lower extremities, intraabdominal organs, and the aorta and to evaluate for tendinopathy, hematoma, bursitis, and paralabral cyst formation.7,8

Joint fluid analysis can offer further evidence for septic arthritis of the hip as well as for inflammatory arthropathies such as gout and rheumatoid arthritis. However, fluid analysis alone should not be used to rule out the diagnosis of septic arthritis. Complete serum blood count and inflammatory markers such as ESR and CRP may also be ordered. Elevated ESR and CRP should increase suspicion for an inflammatory process; however, they are neither sensitive nor specific for diagnosis. When referred pain from pelvic structures is suspected, a urinalysis may also be of use.9

**CRITICAL DECISION**
What are the important risk factors for AVN of the hip, and when should this diagnosis be suspected?

AVN of the femoral head has become an increasingly common pathology, affecting up to 20,000 patients each year. This leads to approximately 12% of total hip arthroplasties annually. Most adult patients affected are under the age of 50 years and tend to be young men in their 30s and 40s. Unfortunately, from a diagnostic standpoint, most symptoms are nonspecific, and the disease often goes undetected until advanced stages have developed. Patients often complain of worsening pain, usually in the groin, that progresses over time. Symptoms are initially unilateral with progression to bilateral involvement in approximately 72% of patients. Irreversible anoxia of the subchondral bone of the femoral head results in osteocyte death and osteoblastic activity of adjacent bone. Articular collapse via failure of subchondral trabeculae subsequently results.10

Emergency physicians should be able to identify specific comorbidities and known risk factors for AVN (Table 1). Particular consideration should be given to conditions that can compromise an already fragile blood supply to the femoral head such as long-standing systemic steroid use, excessive alcohol intake, coagulopathy and hemoglobinopathy, systemic lupus and associated autoimmune diseases, chronic liver disease and pancreatitis, metabolic pathologies such as diabetes, hyperlipidemia, gout, and Gaucher disease. Sickle cell disease, pregnancy, and chemoradiation therapy are common risk factors that should never be overlooked.3,10

Most patients presenting with AVN of the femoral head will have nonspecific clinical signs. Patients present with slowly progressing, unilateral (and sometimes bilateral) groin pain that increases over weeks to months and can radiate to the medial thigh. Pain may increase with weight bearing and increased load on the affected leg. A sign of advanced AVN is pain at rest, which is caused by elevated intraosseous pressure. Early stages of AVN will include a normal range of motion on physical examination. As the disease progresses, joint destruction will lead to limitation of extension, internal rotation, and abduction.3,11

The initial evaluation of a patient with hip pain and suspected AVN of the femoral head should begin with plain radiography of the pelvis and hips including the anteroposterior, lateral, and frog-leg views, which are necessary for evaluation of the anterior-superior involvement of the femoral head. If radiography is unremarkable, MRI is the most sensitive and specific imaging modality for further evaluation.3 However, it is not commonly used in the emergency department. All patients with suspected early AVN and unremarkable radiography should be referred to an orthopedist for followup and further imaging.

Staging of AVN is an important prognostic indicator. In stage 0 and 1 radiographs are usually normal. Stage 2 is defined by abnormalities on radiograph such as sclerosis, cysts, and osteopenia without subchondral collapse. Stage 3 involves subchondral collapse producing a characteristic “crescent sign.” In stage 4, 5, and 6 there will be evidence of collapse of the femoral head, with destruction of the joint in stage 5 and 6. Nonoperative treatment of AVN of the femoral head has very poor results, and 80% of patients left untreated progress to total collapse of the femoral head necessitating a total hip replacement.3,11

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**Table 1.**
Risk factors for avascular necrosis of the hip

<table>
<thead>
<tr>
<th>Alcohol abuse</th>
<th>Chemotherapy/radiation therapy</th>
<th>Chronic liver disease or pancreatitis</th>
<th>Coagulopathy</th>
<th>Diabetes mellitus</th>
<th>Gaucher disease</th>
<th>Gout</th>
<th>Hyperlipidemia</th>
<th>Pregnancy</th>
<th>Sickle cell disease</th>
<th>Steroid use</th>
<th>Systemic lupus erythematosus</th>
</tr>
</thead>
</table>

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1. Critical Decisions in Emergency Medicine
CRITICAL DECISION
How can laboratory tests and ultrasonography help in the evaluation of a patient with suspected septic arthritis of the hip?

Septic arthritis of the hip joint is a true emergency. Emergency physicians must always maintain a high level of suspicion for the septic joint in any patient presenting with an acutely painful hip. The joint capsule of the hip is strong and narrow, and thus an infection of the joint leads to a significant increase in intra-articular pressure, further leading to compromise of blood supply and rapid destruction of the joint. Early diagnosis and release of intra-articular pressure are essential. Septic arthritis has an incidence of 10/100,000 individuals presenting with acute monoarticular arthritis to the emergency department annually.12

Septic arthritis tends to present more commonly in patients with rheumatoid arthritis or a prosthetic joint. Immunocompromised individuals, injection drug users, postoperative patients, and those with HIV are also at an increased risk for septic arthritis. It is important for emergency physicians to recognize patients with these risk factors.12

Hematogenous spread is by far the most common method of hip joint inoculation. The synovial tissue surrounding the joint lacks a basement membrane, allowing organisms in the blood stream to easily enter the synovial fluid. Because of the danger of rapid destruction of cartilage and other vital joint structures, prompt diagnosis, antibiotic treatment, and orthopedic intervention are essential in reducing associated morbidity and mortality.

Identification of key diagnostic findings is essential to differentiate septic from nonseptic causes of hip arthritis (Table 2). On history, recent joint surgery or overlying cellulitis significantly increases the probability of septic arthritis. Serious pain on movement may be present with a severe reduction in weight bearing activities, including refusal to change position or move the joint. The onset of the pain is usually acute. The patient might also present with fever and feeling ill, although these historical findings are neither sensitive nor specific for a septic joint. Sexual history and review of systems is essential to identifying gonococcal arthritis. Gonococcal arthritis is the most common strain of infectious arthritis and often presents with migratory tenosynovitis. Gonococcal arthritis affects women two to three times more often than men and is much less destructive than non-gonococcal arthritis because of its often rapid and complete response to antibiotic therapy.12

Ancillary testing is vital in confirming the diagnosis of a septic hip joint, as the diagnosis is rarely established by history and physical examination alone. Elevated serum WBC count, ESR, and CRP can increase the suspicion for a septic joint, although normal levels are neither sensitive nor specific enough to rule out the diagnosis. Arthrocentesis under ultrasound guidance, with synovial fluid analysis for WBC count and differential, synovial fluid culture, and Gram stain, is the best single test for significantly increasing or decreasing the likelihood for septic arthritis diagnosis. Specifically, synovial WBC counts of more than 50,000/mm3 significantly increase the probability of septic arthritis.13 WBC counts less than 50,000/mm3, on the other hand, cannot rule out the diagnosis; empiric antibiotics should be started pending further diagnostic testing. The percentage of polymorphonuclear (PMN) cells in the synovial fluid may also be a useful marker. In patients with more than 75% PMN cells, the likelihood of a septic joint is increased, and it increases further with counts above 90%. Synovial glucose and protein are not informative. Elevated lactate on synovial analysis is very sensitive but not very specific for septic arthritis. The presence of organisms on synovial Gram stain further increases the probability of the diagnosis. However, the use of Gram stains and culture as the gold standard is problematic because the sensitivity of the Gram stain is only 29% to 50%.13

Bedside ultrasonography is a fast and cost-effective method to evaluate a suspected septic hip and guide aspiration of synovial fluid for testing. A high-frequency linear probe may be used (9 to 15 MHz) to image the hip joint, although a lower-frequency probe can be required if the patient has a large body habitus. Providing an aseptic environment is paramount. The appearance of effusion on ultrasonography is not sufficient to distinguish between infection and simple effusion. Asking the patient to move the hip will disperse an effusion around the joint, while a thickened synovium will remain unchanged.3,7 Arthrocentesis with ultrasound guidance does carry a small risk of infection and bleeding. However, studies have shown that even in patients with therapeutic warfarin ratios, there is only a 10% chance of an adverse bleeding event.3

Prompt orthopedic consultation and antibiotic coverage should be implemented in every patient suspected of septic arthritis. The physician must consider common pathogens such as Staphylococcus aureus and, increasingly, methicillin-resistant S. aureus (MRSA) when selecting empiric antibiotics. Patients with sickle cell disease have an increased susceptibility for Salmonella.
Multiple pathologies originating from structures within the pelvic, abdominal, retroperitoneal, and spinal regions can cause referred pain to the hip. Thus, history, review of systems, and physical examination for the patient with hip pain must also include evaluation of the abdomen, pelvis, back, and lower extremities. Serious and life-threatening conditions such as arterial embolic disease and ruptured abdominal aortic aneurysm (AAA) with associated retroperitoneal bleeding can initially present with hip or buttock pain. An abdominal and back examination should be performed on every patient presenting with hip pain, with special attention where there is lack of findings on hip joint examination. Musculoskeletal conditions such as lumbar radiculopathy and lytic bone lesions secondary to malignancy can present with hip pain and an inability to bear weight. Progressive hip pain present at night, with systemic symptoms such as weight loss, failure of symptom improvement with previous medical management, fatigue, and fevers should prompt high suspicion for malignancy involving the femur, the hip joint, or associated pelvic structures. A rectal examination and fecal occult blood testing may be helpful in patients with symptoms suspicious for intraabdominal malignancy such as colon cancer. Infections conditions such as abscess of the pelvic region, including intraabdominal, perirectal, and muscular abscesses should be considered, especially in patients with risk factors for infection. Appendicitis, renal calculi, and intraabdominal and pelvic tumors can also present with pain radiating to the hip and should be considered. A CT of the abdomen and pelvis should be obtained if intraabdominal or pelvic pathology is suspected and plain radiography and physical examination are nondiagnostic for hip joint pathology. Women of childbearing age should receive a pregnancy test to exclude pregnancy, including ectopic pregnancy. A urinalysis may be useful to investigate for possible urinary tract infections, as guided by the history and review of systems. The inguinal canal, pelvis, and abdomen should be examined for hernias that may have become incarcerated. In sexually active females, pelvic inflammatory disease and sexually transmitted diseases should be considered, thus a sexual history may be helpful. How should the pregnant patient with hip pain be evaluated? The evaluation of the pregnant patient presenting to the emergency department with nontraumatic hip pain may be challenging. Hip pain during the later stages of pregnancy and the postpartum period is common in some women, especially those of smaller frame. This pain can usually be attributed to lumbosacral strain, transient osteoporosis of the hip, sciatica, or pelvic structure compression. There are numerous physiologic changes during pregnancy that can affect bone structure, including high levels of adrenocortical activity, elevated parathyroid hormone levels, and increased sheer mechanical stress. Three conditions involving the hip joint itself predominate in the limited literature examining hip pain in pregnancy. These conditions are transient osteoporosis of the hip, femoral head osteoporosis, and femoral head fracture. A careful history and physical examination remain key elements in ruling out emergent conditions such as septic arthritis and stress fracture in the pregnant patient. Due to the challenges associated with radiation exposure during radiographic imaging, especially in early pregnancy, an ultrasound evaluation is a good primary imaging modality. Ultrasound allows for dynamic evaluation of the fetus and fetal heart tones in terms of evaluation of a viable pregnancy as well as of associated joint capsule, vasculature, and musculature of the pelvis. Venous thrombosis should be considered higher in the differential diagnosis, as pregnancy increases the risk for venous thrombosis and AVN secondary to a hypercoagulable state. Venous thrombosis classically presents with pain and swelling with a preferentially left-sided and proximal venous location in pregnant patients. Although hip pain with venous thrombosis is rare, deep venous thrombosis should be considered when evaluating a pregnant patient with hip or leg pain. An ultrasound and Doppler evaluation is an effective way to evaluate the pregnant patient with findings suspicious for deep venous thrombosis of the lower extremity vasculature. A urinalysis should be obtained to rule out any urinary tract infection. Transient osteoporosis of the hip is a common condition observed in pregnant women. Although its etiology is uncertain, there appears to be some correlation with bone marrow edema. It affects women in the late second and third trimesters of pregnancy, as well as during the early postpartum period. The condition may also affect middle-aged men. The degree of disability is often out of proportion to physical findings. Radiographic findings include osteopenia with preservation of the joint space. There are often no other abnormalities on ancillary testing. Symptoms and radiographic findings usually resolve spontaneously within a few weeks to months and treatment is conservative. One must be careful to not overlook progression of transient osteoporosis of the hip to AVN of the femoral head. Transient osteoporosis of the hip is also associated with increased risk for femoral neck fracture.
Case Resolutions

■ Case One
In the case of the woman with rheumatoid arthritis, the physician performed an ultrasound-guided aspiration of synovial fluid from the patient’s right hip revealing a synovial WBC count of 56,000/mm³, with 95% PMN cells. Culture and Gram stain results were pending at the time. The clinician made the decision to admit the patient to the orthopedic surgery service with a high suspicion of septic arthritis and to start the patient on antibiotics in the emergency department. The patient was taken to the operating room where the diagnosis of septic arthritis was confirmed. In this particular case, the patient had previous diagnosis of an inflammatory disorder, rheumatoid arthritis. The patient also presented with fever, elevated peripheral WBC count, ESR, and CRP. These findings should only be used to strengthen the suspicion for septic arthritis and never to rule in or rule out the diagnosis as they have high sensitivity, but very poor specificity. The elevation in ESR and CRP could also have been caused by an inflammatory arthritis such as her rheumatoid arthritis. Therefore, the physician rightfully employed ultrasound in the examination of the acutely painful hip. The discovered effusion and synovial fluid analysis increased the probability of septic arthritis.

■ Case Two
In the case of the 36-year-old postpartum woman with a history of sickle cell trait and alcohol abuse, plain radiography of the left hip showed sclerotic changes of the femoral head with bone cysts and associated collapse of the superolateral section of the left femoral head consistent with AVN of the femoral head. The right hip radiograph was unremarkable. The patient was admitted to the orthopedic service and underwent MRI of bilateral hips. She was found to have AVN involving both hips and was taken to the operating room for repair by the orthopedic surgeon.

■ Case Three
In the case of the elderly man with sudden-onset hip pain, the abdominal examination revealed a large, nontender, pulsatile periumbilical mass on palpation. The patient was placed on the monitor, two large-bore intravenous lines were established, and intravenous fluids were given. A CBC, basic metabolic panel, type and cross-match, as well as prothrombin and partial thromboplastin times and INR were obtained. Vascular surgery was consulted while the patient underwent an emergent CT scan of the abdomen and pelvis. Imaging revealed a 10-cm infrarenal AAA that was leaking into the perirenal space on the left and around the left psoas muscle. There was also a 4.5-cm internal iliac aneurysm that did not appear to be ruptured. This patient was emergently taken to the operating room and subsequently transferred to the surgical ICU.

Findings of abdominal pain, back pain, or hypotension may be absent in up to 60% of patients with AAA. Internal iliac aneurysms are known to present with hip pain. However, in this case, the leaking AAA also caused referred pain to the left hip via the iliopectineal muscle and the retroperitoneal infiltration of the articular branches of the lumbar plexus. The physician was right in obtaining a CT scan. In this case, it was important to determine whether there was rupture and leakage of blood from the aneurysmal sack, in which case a CT scan approaches 100% sensitivity and specificity in the initial evaluation of an AAA with and without rupture. Ultrasonography is also close to 100% sensitive and specific in identifying the diameter of the AAA, however it is only 4% sensitive and specific in the identification of retroperitoneal blood, especially in obese individuals. Furthermore, a CT scan provides the emergency physician and vascular surgery with a valuable guide to the extent of the aneurysm, presence of rupture, and its stability. CT is thus the test of choice in the hemodynamically stable patient with suspected AAA and has not been shown to delay diagnosis of AAA or increase mortality.

Summary
Hip pain is a nonspecific complaint with a wide differential diagnosis that does not merely include the pathology associated with the hip joint itself.
but also a large array of conditions caused by the associated musculature, ligaments, abdominal organs, and pelvic structures surrounding the hip. It is important to consider associated comorbidities in relation to history and physical examination findings when creating a differential diagnosis for patients presenting with hip pain. Radiographic imaging of the hips and pelvis along with ultrasonography are valuable initial imaging modalities in the emergency department. Potentially life-threatening conditions such as retroperitoneal bleeding or abscess may cause referred pain to the hip and should not be overlooked in the patient with negative findings on hip examination and imaging studies.

References

The Critical Image

A 50-year-old woman arrived via EMS following a fall from a horse. The patient was hemodynamically stable but complained of significant pelvic pain.

A normal pubic symphysis in a nonpregnant adult measures less than 1 cm. In an open book pelvis fracture, the pubic symphysis separates and widens. In the absence of other fractures, the sacroiliac joints are the usual second site of instability of the pelvis.

Pelvic fractures are often associated with significant venous and sometimes arterial hemorrhage, which can be life threatening as the normal blood volume is only approximately 6 L. An open book pelvis fracture creates a larger-than-normal pelvic volume, resulting in an even greater threat from hemorrhage.

External pelvic circumferential compression devices are intended to reduce the volume of the pelvis, limiting the potential space for hemorrhage. In addition, anatomic reduction of fracture surfaces may limit bleeding. No randomized controlled trials to date compare patient mortality outcomes with and without treatment with these devices. One retrospective case-control study showed lower transfusion requirements with a circumferential compression device than with external fixation. Case reports suggest improved hemodynamic stability. Other studies demonstrate reduction in pelvic volume, similar to operative stabilization. Risks of application of these devices include pressure sores and lower extremity nerve palsy.1

In cadaver studies, positioning of a compression device over the greater trochanters is more effective in achieving complete reduction than positioning over the mid-pelvis or iliac crests.1

The patient underwent open reduction and anterior pelvic ring fracture fixation.


Feature Editor: Joshua S. Broder, MD, FACEP. See also Diagnostic Imaging for the Emergency Physician (winner of the 2011 Prose Award in Clinical Medicine, the American Publishers Award for Professional and Scholarly Excellence) by Dr. Broder, available from the ACEP Bookstore, www.acep.org/bookstore.
Atrioventricular (AV) junctional rhythm with occasional premature junctional complexes (PJC)s in a pattern of junctional trigeminy, rate 40, peaked T waves suggestive of hyperkalemia. Careful evaluation of the ECG reveals that the rhythm is regularly irregular. The QRS complexes are narrow and occur in groups of three. The first two QRS complexes of each group occur at a rate of 46/minute and have no preceding P waves, suggesting an AV junctional rhythm. The third QRS complex of each group occurs early and has no preceding P wave, indicating that it is a PJC. The groups of beats are separated by markedly prolonged pauses. The prolonged pauses, the absence of P waves, and the peaking of the T waves are all suggestive of hyperkalemia. This patient’s serum potassium level was 7.9 mEq/L (normal 3.5-5.3 mEq/L).

CME Questions

Qualified, paid subscribers to Critical Decisions in Emergency Medicine may receive CME certificates for up to 5 ACEP Category I credits, 5 AMA PRA Category 1 Credits™, and 5 AOA Category 2-B credits for answering the following questions. To receive your certificate, go to www.acep.org/newcriticaldecisionstesting and submit your answers online. On achieving a score of 75% or better, you will receive a printable CME certificate. You may submit the answers to these questions at any time within 3 years of the publication date. You will be given appropriate credit for all tests you complete and submit within this time. Answers to this month’s questions will be published in next month’s issue.

1. Femoral hernias are most commonly found in which of the following patients?
   A. 6-month-old boys
   B. 25-year-old men
   C. 25-year-old women
   D. 55-year-old women

2. Which of the following hernias is the least likely to incarcerate?
   A. Diastasis recti
   B. Direct inguinal
   C. Incisional
   D. Umbilical

3. A 25-year-old man presents with a severely painful large left groin mass. He normally can push the mass back into his abdominal cavity, but today he has not been able to do this for the past 8 hours. Which one of the following may assist in reducing the hernia?
   A. Applying a warm compress to the area
   B. Having the patient bear down while trying to reduce the hernia
   C. Having the patient stand for 20 minutes then trying to reduce the hernia
   D. Providing proper analgesia

4. Which of the following hernias travels through the Hesselbach triangle?
   A. Diastasis recti
   B. Direct inguinal
   C. Femoral
   D. Umbilical

5. Which of the following is the most common hernia in both men and women?
   A. Direct inguinal
   B. Femoral
   C. Indirect inguinal
   D. Umbilical

6. Diastasis recti differ from other hernias in what way?
   A. A palpable mass can be palpated
   B. There is no fascial defect
   C. They are caused by increased intraabdominal pressure
   D. They become more prominent with a Valsalva maneuver

7. What is the most appropriate definitive management of a strangulated hernia?
   A. Emergent surgery
   B. Hernia reduction
   C. Intravenous antibiotics
   D. Outpatient followup with a surgeon

8. Incisional hernias develop in approximately what percentage of abdominal incisions?
   A. 0 to 5%
   B. 10% to 15%
   C. 25% to 30%
   D. 50% to 55%

9. At what age is umbilical hernia repair recommended for patients with persistent hernias?
   A. Only repair if the hernia becomes strangulated
   B. Repair at 2 years of age
   C. Repair prior to patient’s 1st birthday if possible
   D. Repair when the patient is at least 3 years of age

10. In an obese patient with a suspected strangulated hernia what would be the best option to help in the diagnosis?
    A. CT scan
    B. Physical examination
    C. Plain radiographs
    D. Ultrasonography

11. Which of the following findings should raise suspicion for an intraabdominal or pelvic pathology in a patient with acute nontraumatic hip pain?
    A. An antalgic gait
    B. Fever
    C. Flexion of hip and direct pressure over joint do not alter character of the hip pain
    D. The affected extremity is shortened and rotated

12. Which of the following conditions would present with chronic hip pain?
    A. Acute synovitis
    B. Osteoarthritis
    C. Pathological fracture
    D. Septic arthritis

13. What physical examination finding would be expected in a patient with a septic joint?
    A. Absence of dorsalis pedis pulse in the affected extremity
    B. Inability to bear weight on affected joint
    C. No pain on active and passive movement of the joint
    D. Shortened and rotated lower extremity

14. Tenderness to palpation over the lateral hip and greater trochanter without affected gait is seen with which of the following conditions?
    A. Meralgia paresthetica
    B. Septic joint
    C. Stress fracture
    D. Trochanteric bursitis
15. Meralgia paresthetica is a condition caused by which of the following?
   A. Compression of the lateral femoral cutaneous nerve
   B. Compression of the peroneal nerve
   C. Compression of the sciatic nerve
   D. Steroid use

16. Which imaging modality is the most sensitive and specific for identifying AVN?
   A. CT scan
   B. MRI
   C. Plain radiograph
   D. Ultrasonography

17. Which of the following is associated with AVN of the hip?
   B. Femoral nerve compression
   C. Infectious mononucleosis
   A. Patient age 50 years or older
   D. Steroid use

18. What is the most common cause of a septic joint?
   A. Cellulitis
   B. Direct inoculation
   C. Hematogenous spread
   D. Trauma

19. Which of the following synovial fluid analysis results is most consistent with septic arthritis?
   A. WBC 12,000, PMNs 20%
   B. WBC 14,000, PMNs 40%
   C. WBC 25,000, PMNs 50%
   D. WBC 55,000, PMNs 95%

20. What is the pathophysiology of AVN of the hip?
   A. Callous formation
   B. Increased mechanical stress
   C. Irreversible anoxia of the subchondral bone of the femoral head
   D. Vitamin D deficiency
The Drug Box

Oseltamivir

By Michael Nord, DO; Summa Health System Emergency Medicine Residency

Flu-like symptoms are a common complaint in emergency departments around the country in the winter. Emergency physicians must understand how and for whom to provide oseltamivir. The sooner after onset of symptoms that oseltamivir can be started, the more likely it will provide relief. It can also be used prophylactically for patients exposed to the flu. Caution and reduced dosing are advised for patients with renal insufficiency.

Mechanism of action
Neuraminidase inhibitor selective for influenza A and B, prevents virus from crossing respiratory tract mucous lining. Neuraminidase is essential for release, and thus spread, of virus from infected cells

Indications
Influenza symptoms; known influenza exposure prophylaxis

Dosing
75 mg orally twice daily for 5 days; prophylaxis 75 mg orally daily for 10 days

Side effects
Abdominal pain, nausea, vomiting (encourage taking with food)

Estimated cost
$5.50 per tablet

Contraindication/precautions
Use with caution for patients with renal insufficiency; reduce dose in half if creatinine clearance is 10-30 mL/min. Reports of potentially fatal neuropsychiatric adverse events in patients with flu

Pregnancy category C

Feature Editors: Michael S. Beeson, MD, MBA, FACEP; Amy Niertit, MD

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