

Anatomical Approach to Scrotal Emergencies: A New Paradigm for the Diagnosis and Treatment of the Acute Scrotum

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Abstract

Acute scrotal pain is a common reason for emergency room visits in men of all ages, but especially in children and young adults. Differentiating those etiologies that require immediate surgical intervention from those that can be treated medically is often challenging. Excluding testicular torsion and avoiding unnecessary surgery although difficult in the past is easier now with advances in ultrasound and other diagnostic techniques. In this paper we suggest an anatomical approach to the acute scrotum by partitioning the contents of the scrotum and spermatic cord into distinct zones. It is postulated that this will facilitate physical and ultrasound exam making pre-surgical diagnosis more accurate. Zone I extends from the internal ring through the inguinal canal to the end of the spermatic cord. Zone II comprises the scrotum, subcutaneous tissues and the tunica vaginalis. Zone III encompasses the testicle with associated appendage and Zone IV includes the epididymis with its appendage. All pathological conditions affecting each zone and the resulting presentation of the acute scrotum are discussed.

INTRODUCTION

Acute scrotal pain is a common reason for emergency room visits in men of all ages, but especially in children and young adults. Differentiating those etiologies that require immediate surgical intervention from those that can be treated medically is often challenging. Early surgical exploration was universally recommended in the past when testicular torsion could not be confidently differentiated from other common etiologies, such as, epididymitis or torsion of an appendage. This methodology promoted unnecessary surgery in many patients that could otherwise have been treated conservatively. With advances in ultrasound and other imaging techniques, it may be possible to make a rapid definitive diagnosis of a benign disorder thus avoiding surgery or unnecessary antibiotics. In this paper we suggest an anatomical approach to the acute scrotum by partitioning the contents of the scrotum and spermatic cord into four distinct zones. It is postulated that this will facilitate physical and ultrasound exam making pre-surgical diagnosis more accurate.

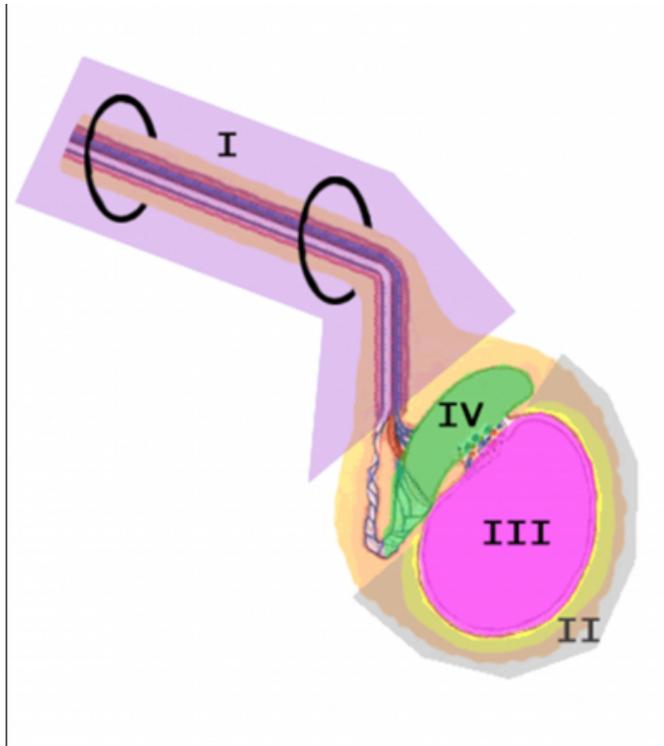
and scrotum can produce symptoms that make localization of the disease process difficult. We suggest the following paradigm of zonal classification of the anatomical constituents in order to aid in the management and treatment of the acute scrotum (Figure 1). Following, a comprehensive review of all disease processes affecting each zone is presented.

ANATOMICAL ZONE CLASSIFICATION PARADIGM

Pathological conditions of the contents of the inguinal canal

Figure 1

Figure 1: Anatomical Zone Classification Paradigm: Zone I extends from the Internal ring through the inguinal canal to the end of the spermatic cord. Zone II comprises the scrotum, subcutaneous tissues and the tunica vaginalis. Zone III is the testicle and Zone IV is the epididymis



OUTLINE OF PATHOLOGY OF EACH ZONE

1. Zone I

- a. Extends from the internal ring through the inguinal canal, to the end of the spermatic cord
 - a. Thrombosis of Spermatic Veins
 - b. Varicocele
 - c. Lymphangitis
 - d. Cremasteric Muscle Spasm
 - e. Incarcerated Hernia
 - f. Appendicitis
 - g. Ruptured Abdominal Aortic Aneurysm
 - h. Sperm Granulomas
 - i. Trauma or Torsion of

Undescended Testicle

- j. Entrapment Neuropathies

3. Zone II

- a. Comprises the scrotum, subcutaneous tissue and tunica vaginalis
 - a. Stings and bites
 - b. Furunculosis
 - c. Scrotal Wall Cellulitis
 - d. Fournier’s Gangrene
 - e. Scrotal Lacerations/Perforations
 - f. Hematocele
 - g. Scrotal Hematoma
 - h. Acute Idiopathic Scrotal Edema
 - i. Fat Necrosis of Scrotum
 - j. Hemorrhage from Scrotal Angioma

5. Zone III

- a. Includes the testicle and the appendix testis
 - a. Testicular Torsion
 - b. Mumps Orchitis
 - c. Mediterranean Fever
 - d. Lupus Orchitis
 - e. Torsion of Appendix testis
 - f. Testicular Abscess
 - g. Bleeding into Testicular Tumors
 - h. Hematocele

7. Zone IV

- a. Includes the epididymis and appendix epididymis

- a. Epididymitis
- b. Epididymal Cysts
- c. Infected spermatocele
- d. Epididymal tumors
- e. Torsion of Appendix Epididymis

ZONE I

THROMBOSIS OF SPERMATIC VEINS

Testicular vein thrombosis presents as acute onset pain usually with an inguinoscrotal mass.[1] Case reports have shown this entity to be spontaneous, effort or exercised induced, and due to pampiniform ectasia or Henoch-Schönlein purpura.[1-5] Diagnosis is exceedingly difficult due to the rarity of spermatic vein thrombosis and its mimicking of other acute scrotal etiologies.[5] Sonographic appearance can mimic that of an incarcerated hernia as it may appear as a hypoechoic non-compressible mass with no blood flow.[3] Venography is diagnostic but surgical exploration should not be delayed if testicular torsion cannot be ruled out. Treatment includes surgical ligation and excision or conservative management with or without anticoagulation. Conservative management is suggested if the diagnosis can be confirmed prior to surgical exploration.[1, 5, 6]

VARICOCELE

Varicoceles are very common occurring in up to 15% of adult men.[7] Varicoceles are often asymptomatic but, at times, may cause mild to moderate pain, thus being confused with an acute scrotum.[8] Primary varicoceles are usually idiopathic and present in men 15-25 years old. The incidence of left-sided varicoceles far exceeds that of right-sided. Varicoceles are believed to be caused by absent or incompetent valves and or the anatomical variance of the left sided drainage system.[8, 9] Secondary varicoceles may be non-compressible and develop from external compression, most commonly from neoplasm.[7] Onset of pain is insidious and exam is usually diagnostic. Palpation reveals a “bag of worms” with or without a palpable thrill.[7] Not all varicoceles are palpable but the significance of non-palpable ones is in debate.[7] Ultrasound can be used to confirm the diagnosis with sensitivity and specificity approaching 100%. Fertility may be affected by excess free radicals or temperature variation but treatment improves semen

parameters and pregnancy rates in most couples.[9]

Conservative treatment and reassurance is appropriate if pain is tolerable, fertility is not an issue and patients would like to avoid surgery. Otherwise, treatment includes angiographic embolization or surgical varicocelectomy.[9]

LYMPHANGITIS

Worldwide, lymphangitis is most commonly caused by parasitic infection and ensuing filariasis. Lymphangitis can also result from chronic lymphedema caused by pelvic or abdominal malignancy or may be congenital or idiopathic.[Campbell's] Patients may present with pain, erythema and swelling in the groin region with or without a palpable cord, fever and inguinal lymphadenopathy. Chyluria may occur due to fistula development between lymphatics and the urinary tract. Scrotal exam may show lymphedema or hydrocele secondary to obstruction of the lymphatics by the inflammatory reaction or by the parasites themselves. Subsequent infection with bacteria can prolong the adenolymphangitis or cause an exacerbation of latent disease and is associated with fever and cellulitis.[10] Diagnosis is confirmed by histologic demonstration of the organisms in the chyluric fluid or hydrocele fluid. Treatment involves administration of diethylcarbamazine, ivermectin or albendazole alone or in combination. Current efforts are focused on prevention in endemic areas.

CREMASTERIC MUSCLE SPASM

As with other muscles in the body, the cremasteric muscle may go into periodic spasm. Pain will be the only presenting complaint and hemiscrotal elevation may be noted on exam. Most cases are self limited and non-recurring therefore patient reassurance and conservative measures are all that are necessary. For repeat cases, non-steroidal anti-inflammatory agents can be advised to treat the pain.

INCARCERATED HERNIA

Inguinal hernias can occur in both sexes at any age but are most common in very young boys or older men. Due to a patent processus vaginalis which occurs in 20% of boys, indirect hernias are the most common.[11] Incarcerated hernias will present with acute onset severe scrotal and abdominal pain. The patient may also have nausea and vomiting if there is bowel obstruction. Exam may reveal a low-grade fever and abdominal exam consistent with bowel obstruction. Scrotal exam will exhibit marked tenderness on palpation and swelling of the hemiscrotum. Bowel sounds may be audible in the scrotal sac. Diagnosis can be

accomplished clinically if the palpated mass can be discriminated from the testicular apparatus.[7] Otherwise ultrasound can assist in diagnosis showing the dilated loop of bowel in the scrotal sac.[7] Upright and flat abdominal plain radiographs should also be taken to assess degree of obstruction. If the bowel is obstructed and the hernia is not reducible, immediate surgical repair is necessary.[11]

APPENDICITIS

Due to the possibility of a patent processus vaginalis, peritonitis can rarely spread to the scrotum and present as an acute scrotum in the pediatric population.[12] Acute scrotum has been reported to occur in both ruptured and non-ruptured appendicitis with findings of a patent processus vaginalis at surgery.[13-15] Patients normally present with pain, erythema and swelling around the scrotum with peritoneal signs on abdominal exam, with or without fever.[11] Rarely a patient will present after an appendectomy for perforated appendicitis with an acute scrotum.[14] Treatment by appendectomy is usually curative.

RUPTURED ABDOMINAL AORTIC ANEURYSM

Rarely a ruptured abdominal aortic aneurysm (AAA) may result in blood pooling in the scrotum via a patent processus vaginalis. This finding is called the “blue scrotum sign of Bryant” and may allow early clinical detection of a AAA avoiding almost inevitable mortality.[11] An abdominal exam will usually differentiate this entity from other causes of acute scrotum.

SPERM GRANULOMA

A sperm granuloma is a chronic inflammatory response to extravasated sperm cells.[16] It occurs as a result of trauma, infection or surgery, especially vasectomy.[7, 17] It can occur in all four anatomical zones depending on the site of trauma, infection or surgery.[16, 18] Although sperm granulomas commonly occur after vasectomy only 3% are symptomatic.[7] Spermatic granulomas most commonly present as a painful nodule in the inguinal region. Ultrasound can aid in the diagnosis, but only pathologic diagnosis is accepted, thus making surgery the treatment of choice.[7, 19]

TRAUMA OR TORSION OF UNDESCENDED TESTICLE

Cryptorchidism occurs in up to 4.5% of newborns with an even higher prevalence in preterm babies.[20] The undescended testicle can be located anywhere along the path

of descent but most commonly is located in the inguinal canal.[7] Torsion in the cryptorchid testicle, although rare, is thought to be more common than in the normal testicle, but the incidence is not truly known.[21] Signs and symptoms of torsion of an inguinal testicle include pain with an inguinal mass and empty hemiscrotum.[22] Patients may also complain of abdominal pain but will have a benign abdominal exam. It is more difficult to diagnose torsion in undescended testis, but inguinal pain with an empty scrotum should prompt further evaluation.[23] Surgical management includes inguinal exploration to confirm diagnosis and orchidopexy or orchiectomy if the testis is not viable. The abnormal position of the inguinal testis also puts it at risk for trauma. The possible positioning of the testis in the inguinal canal should be kept in mind when a young boy presents with abdominal or inguinal pain following trauma to the area. The astute practitioner who notes an inguinal mass and an empty hemiscrotum will not miss the opportunity to diagnose cryptorchidism and avoid associated morbidities.

ENTRAPMENT NEURALGIAS

The ilioinguinal or genitofemoral nerve can be damaged during inguinal surgery causing neuralgia. In men, a history of hernia surgery in particular should raise suspicion of this entity.[24] Pain in the inguinal region may be accompanied by paresthesias or other neurologic symptoms. Diagnosis depends on relief of these symptoms with injection of local anesthetic.[25] Treatment may be accomplished with pain medication, nerve blocks or neurectomy.[24]

ZONE II

STINGS OR BITES

Due to the location and usual non-exposure of the scrotum it is not a common area for insect bites, but they can occur. Patients may not notice the bite but will complain of pain and rash with or without swelling. Urticaria is a common hypersensitivity reaction to stings from various organisms.[26] The resulting erythema, swelling and pain may be confused with other causes of acute scrotum. The appearance of the scrotal skin and the examination of the testicular apparatus can differentiate a sting from other dangerous diagnoses. Stings and bites are usually self-limited and can be treated conservatively. However, the possibility of anaphylaxis should not be forgotten and any signs or symptoms of breathing difficulty or cardiovascular compromise necessitate prompt hospitalization and stabilization.[27]

SCROTAL FURUNCULOSIS

Furuncles are perifollicular, pustular abscesses that can be exquisitely tender. Children or adults who are not aware of the lesion may complain solely of scrotal pain on the affected side. Examination should reveal the abscess, which is amenable to incision and drainage with topical or systemic antibiotics covering for both staphylococcus and streptococcus species.[Campbell's]

SCROTAL WALL CELLULITIS

Cellulitis is, uncommon in the male genital region, is usually caused by group A streptococcus, or *S. aureus*. [Campbell's] In neonates different pathogens may be at play, such as Group B strep, and there may be a greater propensity for these local infections to become secondarily systemic.[28] Scrotal wall cellulitis is much more common in obese, diabetic or immunocompromised persons.[7] Etiologies have also been reported to include the practice of a bizarre ritual of scrotal inflation with saline via kits purchased on the internet, self mutilation during psychotic episodes and hot tub inoculation.[29-31] Symptoms include pain, erythema and swelling of the scrotum with and without skin breakdown. Patients commonly have a fever and elevated white count.[Campbell's] Scrotal cellulitis may result in rapid accumulation of fluid between Colle's and Buck's fascia which may compromise blood flow to the scrotal contents and penis. Rapid diagnosis and treatment with systemic antibiotics and surgical decompression if necessary are required to avoid gangrene.[32]

FOURNIER'S GANGRENE

Fournier's gangrene is a polymicrobial necrotizing fasciitis originating from perineal or genital regions that quickly extends to the abdomen and thighs along fascial planes.[33, 34] Fournier's gangrene can occur in a wide age range of patients but is more common in diabetic and immunocompromised patients. It can be difficult to diagnose without a high index of suspicion and has an extremely high mortality, even when promptly diagnosed and treated.[35] Patients will have a history of recent perirectal or perineal infection and/or recent surgery or instrumentation. Pain with erythema, swelling, scrotal crepitus and skin discoloration and breakdown are prominent signs and symptoms, but patients may also present with systemic toxicity without a known focus.[35] Irritative and obstructive urinary symptoms may or may not be noticeable. Diagnosis is usually clinical but can be aided by plain films of the abdomen or scrotal ultrasound demonstrating gas in the

subcutaneous tissues.[7] It may be difficult to differentiate Fournier's gangrene from simple scrotal cellulitis early on, but the rapid development of systemic toxicity should clear up any ambiguity. Patients should be immediately hemodynamically stabilized and started on intravenous broad-spectrum antibiotics covering both aerobes and anaerobes. Surgical debridement should quickly follow and be repeated until there is confidence that only healthy tissue remains. Treatment with hyperbaric oxygen to improve tissue oxygenation is controversial due to the high cost, low availability and the limited body of evidence supporting its use.[34] When available this treatment should be initiated in patients with extensive disease and/or immunocompromise because prognosis is significantly worse in this group.[34] Reconstructive skin and scrotal surgery can follow to decrease the cosmetic morbidity of this infection.[35]

SCROTAL LACERATION/PERFORATION

Blunt trauma to the genital area, usually due to a fall, can result in a scrotal laceration or perforation.[36] Perforations can also result from penetrating wounds from gunshots, knives or other sharp objects. If a child presents with scrotal trauma and concomitant rectal trauma sexual abuse should be considered and child protective services notified.[36] In unstable or psychotic psychiatric patients, self-mutilation may be the etiology. These patients should be prevented from causing further harm to themselves.[37] Evaluation of the area should be carried out with Doppler ultrasound which can better define the injury and identify any complications, such as scrotal or intratesticular hematoma, hemocele or testicular rupture.[7, 38] Treatment of the scrotal injury includes debridement and repair of the wound with appropriate perioperative antibiotics.[39] If there are ultrasound or physical exam signs of penetration of dartos fascia, surgical exploration is warranted and all of the contents of the scrotal sac should be scrutinized for injury.[7, 39] If there are any abdominal signs or symptoms further evaluation for an abdominal injury should be undertaken since scrotal penetration can rarely be carried into the abdominal cavity.[39]

HEMATOCELE

Hematocele, a collection of blood within the tunica vaginalis, presents with scrotal pain, swelling and bluish discoloration on the affected side.[7, 40] Hematocele usually occurs secondary to trauma, surgery or neoplasm.[41] Hematocele resulting from scrotal trauma indicates a need for ultrasound evaluation of the testis to assess for

rupture.[42] Surgical exploration has also been advocated irrespective of the likelihood of rupture in the presence of a hematocele or with high suspicion of hematocele.[43] Small hematoceles due to minor trauma can be managed conservatively if the testicle is intact.[7]

SCROTAL HEMATOMA

See scrotal laceration. A scrotal hematoma will appear as a discoloration and swelling of the scrotum usually following trauma. Treatment in the absence of other complications is conservative.[7]

ACUTE IDIOPATHIC SCROTAL EDEMA

Acute idiopathic scrotal edema is a rare cause of testicular pain in children that occurs mostly in children under 10 years old.[44, 45] Patients present with predominately unilateral mild to moderate scrotal pain, erythema and swelling[44] The diagnosis can be made with ultrasound which shows scrotal wall thickening and edema with a characteristic “onion” appearance and normal testicle.[46] It is important to distinguish this self-limited disease from those problems that require surgery or antibiotics.[47] Conservative treatment is recommended.[44]

FAT NECROSIS OF THE SCROTUM

Scrotal fat necrosis or panniculitis is a rare etiology of acute scrotum mostly affecting prepubescent boys.[48] It can be idiopathic, related to trauma or cold temperature exposure, or can occur as a sign of pancreatitis.[49, 50] This entity has a characteristic presentation of unilateral or bilateral scrotal pain and swelling with a tender palpable mass beneath the testicle. In some instances it may be difficult to differentiate from torsion.[49, 51] Symptoms resolve spontaneously within a few weeks with conservative management, making correct diagnosis the key to avoiding unnecessary surgery.[48, 52]

HEMORRHAGE OF SCROTAL HEMANGIOMA

Scrotal hemangioma is an extremely rare congenital lesion, making up less than 1% of all hemangiomas.[53] It may present in childhood as a painful mass in the scrotum, discrete from the epididymis, testicle and spermatic cord.[54] Ultrasound and MRI can assist in diagnosis and can characterize the extent of the lesion for surgical purposes. En bloc resection is recommended with pathological confirmation of a benign hemangioma.[55]

ZONE III

TESTICULAR TORSION

Testicular torsion is the most common urological emergency and must be addressed within 4-6 hours to avoid testicular infarction.[56, 57] Infarction resulting from torsion is a substantial cause of morbidity and infertility in men.[11] Torsion can occur at any age but is most common in neonates and pubescent boys.[8, 11] In neonates, torsion is usually due to non-fusion of the testis complex with the scrotum, resulting in extravaginal torsion. In older children torsion may be due to faulty attachment of the testis to the tunica vaginalis, called a “bell clapper deformity”, allowing free rotation of the testis and subsequent intravaginal torsion. The pain associated with torsion is generally very severe and acute in onset. In neonates the pain may present as irritability that is aggravated with bathing or there may be no pain at all.[8, 11] Due to embarrassment, children and teenagers may claim to have abdominal, inguinal or hip pain and also may downplay the severity of the pain.[8, 11] A history of a similar but less intense pain in the past is suggestive of torsion since the testicle may torse and untorse. Patients may also complain of nausea and vomiting. Examination may reveal an uncomfortable patient not able to sit still with erythema and swelling of the hemiscrotum with or without a low-grade fever. There will be extreme, diffuse tenderness upon palpation of the affected testis with no alleviation of pain on elevation of the hemiscrotum.[7] In advanced stages presenting beyond 12 hours duration, the affected testicle may be high in the scrotum with a transverse lie.[8] The cremasteric reflex is usually absent. If testicular torsion is suspected to have occurred less than 12 hours prior, emergent urological consultation should be sought before any further testing and surgical exploration is likely. Patients with the bell clapper deformity should undergo bilateral orchidopexy to prevent recurrent or contralateral torsion.[8] Urinalysis is usually negative but a positive finding does not rule torsion out.[11] Clinical differentiation from epididymo-orchitis has a false positive rate of 50% resulting in unnecessary surgery.[7] Ultrasound may be employed to help differentiate the two with torsion showing reduced flow on doppler and epididymo-orchitis showing increased flow. If results are equivocal scintigraphy can be used to further assess the viability of the testicle.[7]

MUMPS ORCHITIS

Mumps is characterized by a parotiditis and is caused by the paramyxovirus.[7] Mumps orchitis is a rare complication of direct infection of the testicular tissue, that in the post vaccine era, is usually seen in boys greater than 10 years

old.[58] Patients will present with worsening usually unilateral testicular pain and swelling with erythema of the scrotal skin.[59] The epididymis is also commonly involved. They will report systemic flu-like symptoms and fever with parotiditis preceding orchitis symptoms by 4-10 days.[58] The contralateral testicle may become involved up to a week later. Diagnosis is clinical but can be confirmed with serum antibody tests. Color Doppler ultrasound can identify testicular inflammation but is not specific for mumps orchitis.[60] Once torsion and epididymitis have been ruled out, treatment is supportive with symptom resolution likely within 10 days.[58] Complications include pyocele or hydrocele which may require surgical drainage.[61] Fertility can be adversely affected by mumps infection in up to 13% of those affected but the previously reported association with cancer has been dispelled.[58]

MEDITERRANEAN FEVER

Familial Mediterranean fever (FMF), an autosomal recessive inflammatory disease primarily affecting peoples from the Mediterranean region, is characterized by recurrent, self-limited attacks of fever and polyserositis, including any combination of peritonitis, pleuritis, pericarditis, arthritis, and erysipelas.[62] Testicular involvement, due to inflammation of the surrounding tunica layers, presents similarly to orchitis with testicular pain and swelling. Diagnosis is clinical and should be suspected in anyone of appropriate heritage who has a history of recurrent febrile illness or a family history of FMF in whom other causes for orchitis have been ruled out.[63] Treatment is primarily medical with prophylactic colchicine to prevent acute attacks and the development of secondary amyloidosis.[62]

LUPUS ORCHITIS

Lupus orchitis can result in an acute scrotum and presents similar to other forms of orchitis. In addition, it can present as a mass.[64] Medical treatment should be directed at reducing lupus flare-ups, while supportive treatment alone should remedy testicular complaints.

TORSION OF APPENDIX TESTIS

The appendix testis (hydatid of Morgani), a remnant of the mullerian duct, is located on the superior pole of the testis and is the most common appendage to undergo torsion.[8] In fact, torsion of appendage is the most common etiology of hospital admission due to acute scrotum in children.[45] Testicular appendage torsion occurs mostly in boys 7-14 years old and presents with pain similar to torsion but more

subacute in onset and more localized to the upper pole of the testis.[7, 8] Unlike testicular torsion, patients will rarely report systemic symptoms.[11] The cremaster reflex remains intact and the torsed appendix may be palpable and/or visible through the scrotum, noted as the "blue dot sign".[8, 11] Transillumination may also aid in visualizing the infarcted appendix. Doppler ultrasound will show increased blood flow and possibly a "hot spot" corresponding to the torsed appendix allowing differentiation from testicular torsion.[7, 11] Management is conservative with rest and scrotal elevation resulting in resolution of symptoms within one week.[7, 8]

TESTICULAR ABSCESS

The development of a testicular abscess is generally preceded by epididymo-orchitis, but may also be the result of mumps infection, testicular trauma or infarction, or rarely following ruptured appendicitis.[7, 65] In immunocompromised patients, scrotal abscess may result from tuberculosis or fungal infection.[66] Signs and symptoms include unilateral testicular pain, swelling and scrotal erythema with a palpable tender mass on exam. Ultrasound is particularly helpful in making the diagnosis showing a heterogeneous hypoechoic focus with a hyperemic rim.[7, 67] Treatment consists of appropriate antibiotics alone or with surgical drainage if necessary.[68] Uncommonly, severe cases may necessitate orchiectomy.[69]

HEMORRHAGE INTO TESTICULAR TUMOR

About 10% of testicular neoplasms present with acute pain due to either concomitant epididymitis or hemorrhage into the tumor.[Campbell's] Bleeding into a tumor can be spontaneous or instigated by even minor trauma resulting in the acute onset of unilateral scrotal pain and swelling. Following hemodynamic stabilization treatment consists of orchiectomy. Further therapy depends on pathologic diagnosis and staging of the tumor.

ZONE IV

EPIDIDYMITIS

Epididymitis is the entity most often confused with testicular torsion. Untreated epididymitis may result in abscess formation, testicular infarction or may adversely affect fertility.[11] In sexually active heterosexual men, C. trachomatis and N. gonorrhoea are the commonest pathogens, but in homosexual men E. coli is also common via anal transmission.[11] In very young or very old patients,

extension from urinary tract infection is more common with gram negative bacteria being the causative pathogens.[11] History of recent urinary tract instrumentation or surgery or anatomical abnormalities are likely in these patients.[11] Rarely epididymitis may be caused by sarcoidosis, brucellosis, Cryptococcus, tuberculosis, mumps or amiodarone.[7] A detailed sexual history should be sought to implicate a likely pathogen and direct treatment.[11] Symptoms include increasing mild to moderate scrotal pain possibly associated with abdominal pain and fever. On palpation the epididymis is very tender and there may be urethral discharge. Pain should be relieved with scrotal elevation (positive Prehn sign) and the cremaster reflex is intact.[8] Urinalysis may show pyuria but it's absence does not rule out epididymitis.[11] Urine culture and urethral cultures may reveal the causative pathogen. Ultrasound shows scrotal wall thickening and hyperemia possibly with reactive hydrocele or pyocele.[7] Treatment includes appropriate antibiotics and scrotal elevation with symptoms resolving in about a week. In children with epididymitis further urologic investigation is suggested due to the high incidence of urinary tract abnormalities.[8]

EPIDIDYMAL CYSTS

Epididymal cysts are usually asymptomatic but occasionally can present with scrotal pain. Palpation reveals a smooth, round mass separate from the testis that transilluminates. Incidence is higher in those with von Hippel-Lindau disease and those with mothers exposed to DES while pregnant.[70][Campbell's] Ultrasound is often necessary to confirm the diagnosis but cannot differentiate a cyst from a spermatocele. Ultrasound shows a well circumscribed round echo-free mass.[71] Excision can be undertaken if cysts are symptomatic, are continually enlarging, or if neoplasm is suspected.[72][Campbell's] They may also be treated with injection sclerotherapy.[73, 74]

INFECTED SPERMATOCELE

Spermatoceles occur in and around the epididymis and may become infected necessitating treatment. Patients complain of scrotal tenderness localized to the epididymis on exam. Ultrasound can aid in distinguishing this lesion from solid lesions, but will differentiate spermatoceles from other cystic structures. Spermatoceles can be effectively treated with percutaneous aspiration or sclerotherapy, although more than one procedure may be necessary.[75]

EPIDIDYMAL TUMORS

Epididymal tumors may present with mild to moderate pain concentrated around a palpable mass. Rarely epididymal tumors may be primary lymphoma, leiomyosarcoma, other sarcomas, adenocarcinomas or epididymal carcinoma.[7, 76-78] Benign tumors include papillary cystadenomas which are more common in von Hippel-Lindau disease and adenomatoid tumors which are the commonest epididymal tumors in the general population.[7] Malignant tumors are found only 25% of the time and comprise mostly metastasis.[7] Treatment depends on Histologic diagnosis and ranges from radiation to chemotherapy, with or without surgical excision.

TORSION APPENDIX EPIDIDYMIS

The appendix of epididymis is attached to the head of the epididymis and found at autopsy, unilateral in 34% and bilateral in 12%.[7] Torsion of this appendix presents similar to torsion of the testicular appendix and differentiation of the two is of no clinical significance. Treatment is conservative with bed rest and scrotal elevation.

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