

Acute Scrotal Emergencies



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KEYWORDS

- Scrotal emergencies • Testicular torsion • Fournier gangrene • Testicular trauma
- Scrotal ultrasonography

KEY POINTS

- Testicular torsion, Fournier gangrene, and testicular trauma are urologic emergencies.
- Testicular torsion is time sensitive with higher salvage rates under 6 hours.
- It is important to have a high index of suspicion for Fournier gangrene, because it has a high mortality rate.
- In the setting of trauma, testicular rupture and penetrating injuries through the dartos fascia require surgical exploration.

INTRODUCTION

Scrotal emergencies, however uncommon, can be life and fertility threatening. Testicular torsion, Fournier gangrene, and scrotal trauma are all considered emergent urologic conditions. These conditions need to be separated from the wide differential diagnoses presenting as acute scrotal pain to the emergency department.

Genitourinary complaints represent less than 1% of emergency department visits overall.¹ The more life-threatening and fertility-threatening diagnoses are less common than their more benign counterparts. The annual incidence of testicular torsion for boys under the age of 18 years is approximately 3.8 per 100,000.² A recent European study estimated the incidence of epididymitis to be 2.45 per 1000.³

Although these conditions are uncommon, it is important to diagnose and treat early. A review of pediatric malpractice claims in the emergency department from 2001 to 2015 demonstrated that male genital conditions were among the highest reported in malpractice suits, with misdiagnoses being the primary error.⁴

Diagnosis of testicular torsion is time sensitive. Testicular torsion has a greater than 90% salvage rate if surgery is performed within the first 6 hours of symptom onset. After 6 hours, there is a time-dependent increase in the rate of testicular atrophy and

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orchiectomy.⁵ It is important to establish the diagnosis early and advocate for definitive management with urology colleagues. Approximately 30% of cases of failed testicular salvage can be attributed to misdiagnosis and another 13% to delay in treatment after the diagnosis has been made.⁶

An acute scrotum is defined as acute pain of the scrotum. Pain is typically accompanied by local signs, such as swelling or tenderness, and/or generalized symptoms, such as vomiting or fever.⁷ There is a large differential diagnosis for acute scrotal pain. True emergencies should be separated from urgencies. True urologic emergencies include testicular torsion, Fournier gangrene, and testicular trauma. Other abdominal emergencies to keep in mind that may present as scrotal pain include, but are not limited to, an incarcerated inguinal hernia, appendicitis, or referred pain from an abdominal aortic aneurysm.

Torsion should be differentiated from appendage torsion and epididymitis, whereas Fournier gangrene should be ruled out in infectious presentations of scrotal pain, including scrotal cellulitis and scrotal abscesses. In the setting of trauma, it is important to identify penetrating trauma and testicular rupture from simple testicular contusions. See **Box 1** for a full list of the differential diagnoses for acute scrotal pain.

PRESENTATION AND CAUSES

The presentation of an acute scrotum can be broken down into 4 subcategories: the painful swollen testicle, the painless swollen testicle, the erythematous testicle, and the traumatic testicle. Within each of these groups there is a diagnosis that cannot be missed.

However, not all scrotal emergencies present with pain in the genital area. It is important to rule out scrotal emergencies in patients presenting with lower abdominal pain. In a retrospective review of cases of testicular torsion, Progorelić and colleagues⁹ investigated 9 cases of confirmed testicular torsion that presented with lower abdominal pain only. Of the 9 cases, 6 did not have an initial scrotal examination, which delayed diagnosis of testicular torsion, leading to orchiectomy in 5 of the 6 cases. The patient who was saved from orchiectomy was re-examined and underwent surgery within 5 hours. The other 5 cases did not receive a genitourinary examination or get definitive surgical intervention until after 18 hours (the range was from 18 to 72 hours). Of the 6 cases without a genitourinary examination, the first contact was with a general practitioner or an emergency physician.

The Painful Scrotum

Testicular torsion

Testicular torsion occurs when the spermatic cord twists causing venous congestion, decreased arterial blood flow and eventually ischemia of the testicle. There are 2 types of torsion: extravaginal and intravaginal. Extravaginal torsion occurs in the perinatal period, it occurs with twisting of the entire tunica vaginalis. It may present as a vanishing testicle or painless swollen hemiscrotum. Intravaginal torsion is the twisting inside the tunica vaginalis, occasionally as the result of a congenital bell clapper deformity. The deformity occurs when the testicle is not fully fused to the posterior scrotal wall. This results in the testicle being suspended horizontally, which predisposes it to torsion.¹⁰ This deformity is estimated to be present in approximately 12% of men (**Fig. 1**).¹¹

Testicular torsion can occur at any age, although it is most common at 2 peaks in life: during the first year of life and around puberty (12–18 years old).^{2,12,13} Testicular torsion generally presents as acute onset scrotal pain with associated nausea or

Box 1**Differential diagnoses for acute scrotal pain**

Ischemic

- Testicular torsion
- Torsion of the testicular appendage

Infectious

- Epididymitis
- Epididymo-orchitis
- Orchitis
- Scrotal cellulitis
- Scrotal abscess
- Fournier gangrene
- Hansen disease^a
- Filariasis^b

Traumatic

Blunt:

- Testicular contusion
- Testicular rupture

Penetrating

- Testicular rupture

Hematocele

Scrotal degloving

Inflammatory

- Henoch-Schonlein purpura

Idiopathic

- Idiopathic scrotal swelling

Oncologic

- Testicular tumors

Other

- Strangulated/incarcerated inguinal hernia
- Referred pain from abdominal pathology, for example, ruptured abdominal aortic aneurysm or nephrolithiasis

^aCaused by *Mycobacterium leprae*.

^bA parasitic disease caused by *Wuchereria bancrofti*, which manifests as lymphedema or a hydrocele often associated with epididymo-orchitis.⁸

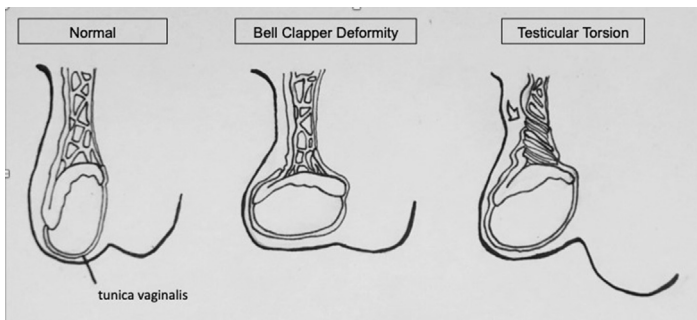


Fig. 1. Demonstration of normal testis, bell clapper deformity, and testicular torsion. (Courtesy of M. Bourke, DO, Bronx, NY.)

vomiting.¹³ It can occur after minor trauma or during periods of testicular growth (ie, puberty); however, it usually occurs in the absence of a preceding event.¹⁴ Fujita and colleagues¹⁵ found there was an increased rate of onset during sleep. This is possibly owing to a unilateral cremasteric reflex or simply lower ambient temperatures, which have also been linked to an increased rate of torsion. It is important to keep in mind that intermittent torsion may also precede complete torsion.¹⁶

Testicular torsion can often be hard to differentiate from appendage torsion and epididymitis. There are 2 features of the clinical history that have been shown to increase the likelihood of diagnosis. Presence of nausea and/or vomiting and less than 24 hours since the onset of pain have both been proven to be associated with testicular torsion more often than the latter diagnosis.^{13,17,18} One study demonstrated that, in patients with acute scrotal pain from testicular torsion, the presence of nausea and vomiting had a specificity of 93% and a sensitivity of 69%.¹⁹ Thus, in the setting of acute scrotal pain, systemic symptoms of nausea and vomiting make testicular torsion more likely.

Appendage torsion

Appendage torsion, although not a scrotal emergency in itself, must be differentiated from testicular torsion. Appendage torsion is the twisting of a testicular or epididymal appendage, which is an embryologic remnant of the Mullerian ducts. Appendage torsion is usually seen in prepubertal boys 7 to 12 years old.¹⁵ Onset is acute to subacute. It is often difficult to differentiate appendage torsion from testicular torsion based on history because both groups may have acute onset testicular pain and swelling. However, patients with appendage torsion are less likely to have systemic symptoms, including nausea or vomiting (Fig. 2).¹⁹

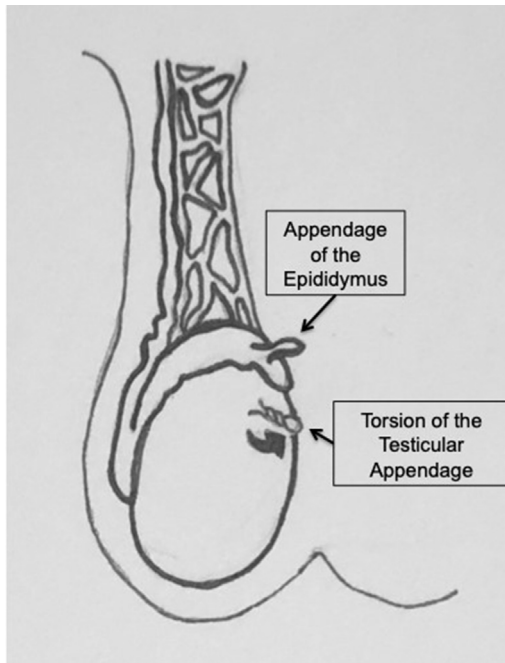


Fig. 2. Testicular appendage with torsion. (Courtesy of M. Bourke, DO, Bronx, NY.)

Epididymitis and orchitis

Like appendage torsion, epididymitis and orchitis may present similarly to testicular torsion. Epididymitis and orchitis are inflammation of the structures within the scrotum. Epididymitis is inflammation of the epididymis, whereas orchitis involves the testicle. The most common cause of both is bacterial infection.⁷ The cause is generally broken down based on age group. In infants, epididymitis may be caused by sterile urine reflux secondary to a congenital anomaly.^{18,20,21} In children, a post-viral infectious phenomenon is the most likely cause of the inflammation.^{22,23} Therefore a careful history reviewing recent viral illness is important. In young boys under the age of 14, it is rare to have a bacterial cause.²² In young men under 35 year old, the cause is most commonly sexually transmitted infection or complications from a sexually transmitted infection. In men over the age of 35 years, it is more commonly associated with benign prostatic hyperplasia. In the population of men who have sex with men, it is also important to consider *E. coli* or fungal infections.⁷

Epididymitis may present with hemiscrotal pain and swelling, similar to testicular torsion or appendage torsion. It may also present with associated symptoms of abdominal pain, nausea, or vomiting. However, epididymitis, unlike testicular or appendage torsion, is more likely to present with dysuria and micturition complaints.^{18,20}

Isolated orchitis is rare; it typically presents as a progression of epididymitis.²⁴ When isolated, it is usually a result of a systemic viral infection (ie, Coxsackie virus, Epstein-Barr virus, varicella, or echovirus). Mumps is the most common viral cause of orchitis.²⁵ When the scrotum is involved, mumps presents as initial unilateral testicular involvement that later progresses to bilateral after 1 to 9 days.²⁵ When the causative organism is bacterial, it is almost always epididymo-orchitis.²⁴ Immunocompromised patients are also at risk of fungal infections.⁷

Inguinal hernia

In the differential diagnosis of painful scrotal swelling, it is important to consider an inguinal hernia. Inguinal hernias will not be further reviewed. It is mentioned here as a reminder that the presentation of acute scrotal pain and swelling can be caused by pathologic conditions of the abdomen.⁷

The Painless Swollen Scrotum

Hydrocele, varicocele, and spermatocele

Hydrocele is an accumulation of fluid around the testicle. It is the most common cause of painless scrotal swelling in children.⁷ The swelling is often more prominent while awake, standing, or crying.

A varicocele is another cause of painless scrotal swelling. It most commonly occurs during puberty and on the left side due to a difference in venous drainage. A varicocele occurs when venous return from the scrotum is altered causing dilation of the spermatic cord veins, also known as the pampiniform plexus.

Finally, a spermatocele can also cause painless testicular swelling. This occurs when a sperm-filled cyst arises in the epididymis.

Testicular malignancy

Testicular malignancy is another cause of painless testicular swelling. However, this may be more easily distinguished from the above diagnoses on physical examination. It usually presents as an asymptomatic testicular mass. However, in rare cases, a mass may present with pain caused by acute bleeding within a tumor.⁷

The Erythematous Scrotum

Idiopathic scrotal edema

Idiopathic scrotal edema is a rare, self-limiting cause of an acute scrotum. It occurs between the ages of 3 to 9 years. It is defined as swelling of the scrotal skin without swelling of the deeper tissues. It is an important diagnosis to be aware of, because it needs to be differentiated from more malignant causes of scrotal edema and pain.^{26,27}

Scrotal abscess and Fournier gangrene

Scrotal infections can range from mild cellulitis to a surgical emergency, such as Fournier gangrene. Patients can develop superficial or deep infections. A scrotal abscess and cellulitis are examples of superficial infections. Scrotal abscesses are derived from simple hair follicles and only involve the scrotal wall. Deep infections involve deeper structures, such as the testes or epididymis. Fournier gangrene is a rapidly progressive polymicrobial necrotizing fasciitis of the perineal, perianal, or genital areas.⁷ The national incidence of Fournier gangrene is 1.6 per 100,000. Immunocompromised patients, particularly patients with a history of diabetes or alcohol abuse, are at higher risk for acquiring Fournier gangrene.²⁸ Previous studies had reported a mortality rate averaging between 20% and 40%; however, Sorensen and Krieger²⁹ reviewed the State Inpatient Database for the years of 2001 and 2004 and found a lower mortality rate of 7.5%. The mortality rate improves in hospitals treating more than 1 case of Fournier gangrene a year.²⁹ The most important predictors of mortality are age more than 60 years or complications during treatment, such as need for mechanical ventilation or red blood cell transfusion.³⁰

The Traumatic Scrotum

Testicular trauma

Isolated urologic trauma is relatively uncommon. It is more commonly found in patients with multiple traumatic injuries.³¹ Approximately 10% of all abdominal traumas also have a genitourinary injury.³¹

Traumatic injuries to the scrotum include blunt injuries, penetrating injuries, burns, bites, and scrotal avulsions. Blunt traumatic injuries may include scrotal hematoma, hematocele, testicular contusion, and complete testicular rupture. Scrotal hematocele occurs when the tunica vaginalis fills with blood, whereas disruption of the tunica albuginea is considered to be a ruptured testicle.³¹ Testicular rupture and penetrating injuries are true scrotal emergencies requiring surgical management.

Testicular trauma commonly occurs playing sports or during motor vehicle accidents. Injury is more likely in motor vehicle accidents involving 2-wheeled vehicles.³² Testicular dislocation is rare, but may occur with straddle injuries associated with motorcycle accidents.^{33,34} Half of all blunt testicular injuries occur while playing sports.³⁴ Patients may present several days after blunt injury with symptoms similar to epididymitis. Traumatic epididymitis is a self-limiting inflammatory reaction after blunt trauma.

Strangulation injuries, that is, entrapment in a zipper, are another source of testicular trauma. According to the textbook *Urology* by Campbell and Walsh,³⁵ zipper injuries more often occur in "impatient boys or intoxicated men." String, hair, or rubber bands can also cause strangulation injuries. In these cases, Campbell and Walsh recommend keeping child abuse on the differential.

PHYSICAL EXAMINATION

In all cases of scrotal pain or lower abdominal pain in boys or men, a thorough genitourinary examination should be performed to assess for scrotal swelling, tenderness

to palpation, location of tenderness, vascular swelling, discoloration, erythema, drainage, or warmth.

The Painful Scrotum

Testicular torsion

There are several physical examination findings that increase the likelihood of testicular torsion being the source of the painful scrotum. Multiple studies found that an abnormal cremasteric reflex and high position of the testicle were more commonly found in patients with testicular torsion.^{13,17,18} The cremasteric reflex is defined as ipsilateral elevation of the testicle after stroking of the medial thigh. If absent, torsion may be more likely; however, if present, this by no means rules out torsion. The reflex can be absent in a significant percentage of normal men, as well as in those with upper and lower motor neuron disorders, spinal cord injuries, or nerve injuries after hernia repair.³⁶ Absence of the cremasteric reflex has been shown to have a negative predictive value of 98%, meaning if the reflex is present, torsion is less likely.¹⁹ Another helpful physical examination finding is anterior rotation of the epididymis, which was found to have a 98% specificity in testicular torsion.¹⁹ Elevation of the testicle and transverse location of the testicle also had high negative predictive values of 95%.¹⁹ Beni-Israel and colleagues¹⁷ found that high position of the testes had an odds ratio of 58.8 in cases of testicular torsion. When testicular torsion is suspected, a wide-based gait may be seen, because patients try to avoid leg contact with the tender scrotum.¹³

In perinatal torsion, it is possible that the contralateral side may also be torsed, without evidence or abnormal findings on clinical examination.³⁷

Combination of history and physical examination can help narrow the diagnosis as well as differentiate between testicular torsion, torsion appendage, and epididymitis.

Appendage torsion

On examination, isolated superior pole tenderness has a strong correlation with torsion of the testicular appendage.¹⁸ Patients may also have the blue dot sign, which is visualization of the infarcted appendage through the scrotal skin appearing as a blue dot. This sign is pathognomonic for appendage torsion^{18,38} (see **Table 1** for comparison with testicular torsion and epididymitis).

History	Testicular Torsion	Epididymitis	Appendage Torsion
Age	Neonates, adolescents	Adolescents, young adults	Prepubertal
Pain onset	Acute	Gradual, progressive	Acute to subacute
Associated symptoms	N/V	Dysuria	
Physical examination		Fever	
Cremasteric reflex	Absent	Present or absent	Present or absent
Testicle	Testicular swelling, progressive to diffuse hemiscrotal involvement High riding, transverse alignment	Epididymal swelling progressing to diffuse hemiscrotal involvement Normal position	Head of the affected testicle or epididymis; normal position

Epididymitis and orchitis

On normal physical examination, the epididymis is found at the posterior-lateral aspect of the testicle. When palpated it feels soft and fleshy, similar to an earlobe. In epididymitis, the epididymis may be tender on palpation.¹⁸ Patients may not have testicular tenderness. The provider should also check for Prehn sign, which is relief of pain in the lateral recumbent position or with scrotal elevation. If orchitis is present, patients will have more testicular involvement, with increased testicular swelling and tenderness. Testicles should have a normal position in both disease processes¹⁸ (see **Table 1** for comparison with testicular torsion and appendage torsion).

Painless Scrotal Swelling

Hydrocele, varicocele, and spermatocele

Hydrocele may be more prominent while awake, standing, or crying. It presents as posterior swelling behind the testicle. An otoscope can be used to shine light through the scrotal wall. A fluid-filled scrotum will allow light to shine through, whereas a thickened scrotal wall or enlarged testicle will not transilluminate.⁷

Varicoceles are often palpable on the posterior superior portion of the testes; often described as a “bag of worms.”

Finally, a spermatocele may feel like a painless cyst on the testicle. All painless masses should be differentiated from testicular malignancy.

Testicular malignancy

Testicular malignancy generally presents as a firm nontender mass on examination.

The Erythematous Scrotum

Idiopathic scrotal edema

Idiopathic scrotal edema generally presents as unilateral or bilateral scrotal swelling, erythema, and pain. It should be differentiated from scrotal abscess and deeper infections.^{26,27}

Scrotal abscess and Fournier gangrene

Differentiating a scrotal abscess or cellulitis from Fournier gangrene may be difficult on first visualization. Patients may have overlying erythema or swelling. Crepitus and ecchymosis are common features in Fournier gangrene.³⁹ Patients may also present with purulent discharge from the perineum or with fever.³⁹ It is important to remember that fever may not always be present. Oguz and colleagues³⁹ found that only 42% of patients had fever on first presentation.

The Traumatic Scrotum

Testicular trauma

Scrotal trauma often presents with scrotal pain and swelling. Patients may have scrotal discoloration or a tender, firm scrotal mass that fails to transilluminate. This could indicate a hematocele.⁷ An empty hemiscrotum in the setting of trauma is suggestive of testicular dislocation.⁷ In a patient with scrotal trauma, external signs may not correlate with internal injury. There should be high suspicion of testicular injury with any open wounds to the scrotum.⁴⁰

DIAGNOSIS

Aside from clinical diagnosis, ultrasonography is the diagnostic modality of choice for the presentation of acute scrotal pain.⁴¹ In general, ultrasonography is performed by a

radiologist or ultrasonography technician; however, bedside ultrasonography by an emergency physician can also aid in diagnosis.⁴²

Emergency physicians can accurately diagnose patients presenting with acute scrotal pain using bedside ultrasonography. In 1 study, emergency physicians were able to differentiate between surgical emergencies, such as testicular torsion, and other less-urgent conditions. In this study, the emergency physicians' ultrasonography findings agreed with confirmatory testing in all but 1 case. The 1 case that was identified as an epididymal mass by the emergency physician turned out to be epididymitis.⁴²

The Painful Scrotum: Testicular Torsion, Appendage Torsion, Epididymitis, and Orchitis

In the presentation of an acute painful scrotum, testicular torsion must be identified. It is imperative to rule out testicular torsion in a timely manner. In general, laboratory work and urinalysis are not helpful in the diagnosis of testicular torsion but may help with ruling in epididymitis. Ultrasonography is the diagnostic modality of choice when evaluating a painful scrotum.⁴³ According to the American College of Radiology, color Doppler ultrasonography is the primary modality to evaluate patients with acute scrotal pain.⁴¹ Ultrasonography findings consistent with testicular torsion include absent or diminished intratesticular blood flow in the symptomatic testicle when compared with the asymptomatic testicle, or evidence of spermatic cord torsion with a "whirlpool or snail sign."⁴⁴ One study from 2010 found that overall sensitivity, specificity, positive predictive value, and negative predictive value for color Doppler ultrasonography in testicular torsion diagnosis were 96.8%, 97.9%, 92.1%, and 99.1%, respectively.⁴³ Other more recent studies from 2013, found a sensitivity of 100% with a lower specificity of 97.9% to 75.2%.^{44,45} Overall the studies agree in the sense that ultrasonography is a good rule out test despite occasional false negatives. False-positives can also occur, especially in infants and young boys who have normally reduced blood flow.⁴⁶ As many as 50% of boys younger than 8 years old do not show intratesticular flow.⁴⁷ This is the reason that it is important to compare both testicles in 1 view.

Comparison of flow between both testicles is an important step in assessing for torsion. Imaging the spermatic cord to find a kink in the cord is more sensitive than color Doppler alone in adults and children^{48–51} (**Box 2**).^{52–54}

More recently, researchers have been looking at a clinical scoring system to help diagnosis of testicular torsion.⁵⁵ The Testicular Workup for Ischemia and Suspected Torsion (TWIST) score may help guide younger clinicians to the diagnosis of testicular torsion.⁵⁶ In a validation study using the TWIST score among pediatric emergency physicians, a high TWIST score of 7 had a 100% specificity and 100% positive predictive value for testicular torsion (**Box 3**).^{57,58}

When there is high suspicion for testicular torsion given the history and physical presentation, ultrasonography should not delay surgical consultation or exploration, because ultrasonography is not 100% sensitive. If ultrasonography shows Doppler flow and there is still high suspicion for torsion, the patient should undergo surgical exploration, because that is the definitive diagnostic modality.⁵⁹

Epididymitis and appendage torsion may be hard to differentiate on ultrasonography. Epididymitis generally appears with increased or normal color Doppler flow with an enlarged epididymis and sometimes a reactive hydrocele. Appendage torsion will appear to have normal flow, with an area of hyperechoic material near the superior portion of the testicle.⁴⁷ Urinalysis may show pyuria in the setting of epididymitis.

Box 2**Bedside ultrasonography of the scrotum**

Positioning the patient: Use a sheet or towel under the scrotum to support the testicles. Have the patient hold the penis or position it superior laterally. Cover the penis for more privacy.⁵³

Transducer: Use a linear high-frequency 6- to 15-MHz probe. Start the examination by asking where it hurts.

1. First obtain a midline transverse view with both testicles, also known as the saddle view, with the indicator to the right of the patient. Look for decreased flow in the symptomatic testicle compared with the asymptomatic side.
 - Take transverse static color Doppler images of both testicles
 - Take a color Doppler clip to demonstrate flow
2. Scan each testicle in the long axis (longitudinal plane) with the indicator to the head of the patient. The epididymis should be on the left of the screen and the testicle on the right.
3. Rotate the probe 90° with the indicator to the right of the patient for the transverse plane. Scan through the entire testicle. Make sure to scan both testicles.
4. Scan the spermatic cord in the longitudinal plane. Follow the cord from the testicle to the inguinal canal. Image the spermatic cord in the longitudinal and transverse planes; again, repeating on both sides. Look for the whirlpool or snail sign.

Data from Bandarkar AN, Blask AR. Testicular torsion with preserved flow: key sonographic features and value-added approach to diagnosis. *Pediatr Radiol.* 2018 May;48(5):735-744. <https://doi.org/10.1007/s00247-018-4093-0>. Epub 2018 Feb 21 and Blaivas. M. O.J. Ma, J. Mateer (Eds.). *Emergency ultrasound.* New York, NY: McGraw-Hill 2002: 221-228

The Painless Scrotal Swelling: Hydrocele, Varicocele, and Spermatocele; Testicular Malignancy

Differentiating painless scrotal swelling is primarily clinical. However, ultrasonography can help confirm the diagnosis by identifying fluid-filled, vascular, or solid structures (Figs. 3 and 4, Table 2).

The Erythematous Scrotum: Idiopathic Scrotal Edema, Scrotal Abscess, and Fournier Gangrene

It is important to differentiate scrotal edema and scrotal abscesses from the life-threatening Fournier gangrene. Idiopathic scrotal edema can be identified with ultrasonography. It is often seen as a hyperemic thickened scrotal wall around the testicle, described as the fountain sign.⁶¹ A scrotal abscess may look like a fluid-filled structure within the scrotal wall.

Box 3**TWIST score (testicular workup for ischemia and suspected torsion)****History and Physical Presentation**

	Points
Testicular swelling	2
Hard testicle	2
Absent cremasteric reflex	1
Nausea or vomiting	1
High-riding testicle	1

High risk = 7 points.

100% sensitive and specific for testicular torsion.

Data from Refs.⁵⁶⁻⁵⁸

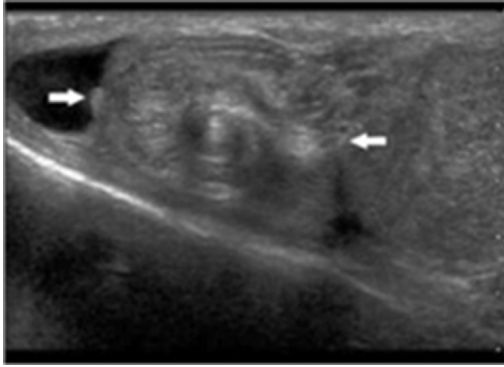


Fig. 3. The arrows indicate the Whirlpool sign on this gray scale ultrasonogram of the spermatic cord. (From Vijayaraghavan SB. Sonographic differential diagnosis of acute scrotum: real-time whirlpool sign, a key sign of torsion. *J Ultrasound Med.* 2006 May;25(5):563-74.)

The diagnosis of Fournier gangrene is primarily clinical.⁶² However, advanced imaging can be helpful if the diagnosis is not clear clinically. A computed tomography (CT) scan can play an important role in evaluating the extent of disease for surgical planning.⁶³ CT findings may include fascial thickening, fluid collections, fat stranding, or subcutaneous emphysema.⁶³ Ultrasonography may also be used in the early diagnosis of Fournier gangrene.⁵³ On gray-scale ultrasonograms, the scrotal wall appears with multiple echogenic foci and areas of shadowing representing gas.⁵³

The Traumatic Scrotum: Testicular Trauma

Testicular rupture and penetrating injuries to the scrotum are both surgical emergencies. Although testicular rupture is rare, it is crucial to rule it out. Ultrasonography can

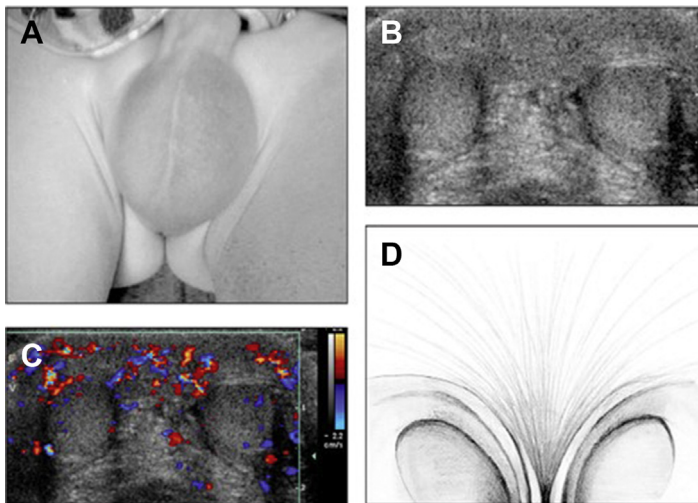


Fig. 4. (A) Child with idiopathic scrotal edema. (B) Gray-scale ultrasonogram of testicles with scrotal edema. (C) Transverse color Doppler image of both testicles showing increased blood flow in the peritesticular scrotal soft tissues, resembling a colored fountain due to intense hyperemia. (D) Representation of ultrasonography findings. (From Geiger J, Epelman M, Darge K. The fountain sign: a novel color Doppler sonographic finding for the diagnosis of acute idiopathic scrotal edema. *Journal of Ultrasound in Medicine.* 2010;29(8):1233–1237.)

Table 2	
Scrotal ultrasonography findings	
Ultrasonography Findings	
Testicular torsion	Absent or decreased flow in testicle, kink in spermatic cord (whirlpool, snail, or spiral sign)
Appendage torsion	Normal flow of the testicle with a hyperechoic area near the superior pole
Epididymitis	Increased or normal blood flow of testicle, sometimes a reactive hydrocele, enlarged epididymis with increased flow ^{47,60}
Scrotal edema	Thickening of the scrotal wall, hypervascularity of the scrotum with normal appearance of the testicle and epididymis, ie, Fountain sign ⁶¹
Fournier gangrene	Multiple echogenic foci (representing gas) with areas of dirty shadowing may be identified within the scrotal wall
Varicocele	Single vein diameter above 3 mm and/or more than 1 mm increase in diameter during the Valsalva maneuver or prominence of venous plexus ⁴⁷
Hydrocele	Fluid collection separating the 2 layers of the tunica vaginalis ⁶⁰
Testicular fracture	Hypoechoic, linear stripe without disruption of the tunica albuginea ⁶⁰
Testicular rupture	Disruption of the homogeneous echogenic tunica albuginea ⁴⁷

demonstrate disruption of the tunica albuginea with 100% sensitivity; however, it only has a 65% to 93.5% specificity.^{64,65} Most other scrotal trauma is clinically diagnosed. Surgical exploration should be considered in all patients with clinical suspicion of penetration of the dartos fascia.⁶⁶

TREATMENT AND MANAGEMENT

The Painful Scrotum: Testicular Torsion, Appendage Torsion, Epididymitis, and Orchitis

As mentioned in the Introduction, testicular torsion is time sensitive. Manual detorsion can be attempted before surgical intervention but should not delay surgical intervention.⁶⁷ Trials of manual detorsion have been found to decrease ischemia time.⁶⁸ Even if the testicle is manually detorsed, surgery is still required. Surgical exploration is the definitive management for testicular torsion.

Before performing manual detorsion, it must be explained that the procedure is painful but, if successful, it will alleviate the pain. Analgesic medication, local analgesia injection (ie, local lidocaine), or procedural sedation should be administered.

Stand at the foot of the bed or to the right of the patient. Holding the testicle between the thumb and index finger, rotate it in an outward direction (like opening a book) from medial to lateral. The initial attempt should be with one and a half full rotations (540°). Relief of pain is a positive end point. You can also reassess with bedside ultrasonography. If the pain worsened with detorsion in the medial to lateral rotation, detorse in the lateral to medial direction, because a third of testicular torsions occur with medial to lateral rotation.⁶⁷

After manual detorsion, patients still require emergent surgical intervention. The urologist will expose the scrotum in the operating room and examine the testicle for viability after detorsion of the spermatic cord. If viable, the testicle is sutured into the inner scrotal lining (also known as an orchiopexy). The noninvolved testicle is also sutured into the lining to prevent torsion. If the testicle is found to be nonviable, the patient will undergo unilateral orchiectomy.⁶⁹

One exception to emergent surgical intervention is in the neonatal population. Because it is nearly impossible to ascertain when the torsion occurred, the testicle is considered not salvageable. Most surgeons take the neonates to the operating room on a semi-elective basis, usually several months later to decrease the risk of anesthesia.³⁷

Transferring a patient with testicular torsion to a tertiary pediatric facility after diagnosis delays definitive management and threatens testicular viability. Urologists at the initial facility should correct testicular torsion when possible.⁷⁰

Epididymitis treatment is based on age at presentation. For patients under the age of 14 years, treatment varies. If urine cultures are positive, some clinicians cover for urinary bacteria, whereas others conservatively manage without antibiotics. There should be follow-up with a pediatric urologist for evaluation of congenital genitourinary anomalies.⁷¹

For sexually active patients over the age of 14 years and younger than 35 years, antibiotics are the mainstay of therapy. According to the Centers for Disease Control and Prevention, treatment should cover gonorrhea and chlamydia. The preferred treatment is ceftriaxone 250 mg intramuscularly plus doxycycline 100 mg daily for 10 days. If the patient practices anal penetration, use fluoroquinolone instead of doxycycline. The Centers for Disease Control and Prevention suggest levofloxacin 500 mg daily for 10 days or ofloxacin 300 mg twice daily for 10 days.⁷²

For patients more than 35 years of age, single coverage with fluoroquinolone is appropriate.⁷²

Adjuvants, including bed rest, ice, scrotal elevation, and nonsteroidal anti-inflammatory drugs (NSAIDs), can be helpful for symptom relief. Treatment of epididymo-orchitis is the same as described above. Isolated orchitis management is determined by the cause of the orchitis (which is not discussed in this article). If the patient seems to be suffering from toxicity, they may require admission; otherwise patients can have urologic follow-up in 5 to 7 days.⁷

Finally, management of appendage torsion solely consists of symptom relief. The same adjuvants used to treat epididymitis can be used with appendage torsion. The pain usually resides when the appendage degenerates in 1 to 2 weeks. It can recur depending on the number of appendages and their positions.⁷³

The Painless Scrotal Swelling: Hydrocele, Varicocele, Spermatocele, or Testicular Malignancy

After diagnosis of a hydrocele, varicocele, or spermatocele, the management is primarily with nonemergent urologic follow-up. With pediatric patients, the parents can be counseled that most hydroceles resolve by 18 to 24 months of age.⁷ With suspected testicular malignancy, the emergency clinician can start the work up with laboratory tests, including α -fetoprotein and β -human chorionic gonadotropin. These patients will need urgent urologic follow-up or even consultation while in the emergency department.⁷

The Erythematous Scrotum: Idiopathic Scrotal Edema, Scrotal Abscess, and Fournier Gangrene

Idiopathic scrotal edema is self-limiting. Episodes resolve in 1 to 4 days with symptom management: scrotal elevation, rest, and NSAIDs.^{61,74} Scrotal abscesses can be treated similarly to abscesses on other areas of the body with drainage and antibiotic treatment. Depending on abscess location and clinical picture, surgical consultation may be necessary.

Fournier gangrene needs aggressive antibiotic therapy and surgical debridement. Like testicular torsion, Fournier gangrene is a true surgical emergency. Broad-spectrum antibiotics are recommended, but specific coverage for Fournier varies.⁷⁵ Most articles, primarily case reviews and retrospective data, recommend broad-spectrum antibiotics.^{63,75} The Infectious Diseases Society of America guidelines from 2014 recommend empirical coverage with piperacillin/tazobactam and vancomycin.⁷⁶ Ultimately, these patients need wide surgical debridement.⁷⁷ Surgery is the definitive treatment. There is mixed evidence on hyperbaric oxygen as adjuvant therapy; most evidence comes from small retrospective studies or case reports, but they demonstrate some benefit or decreased mortality.^{78,79} All patients should be admitted to an intensive care unit because of the high mortality risk.

The Traumatic Scrotum: Testicular Trauma

Minor testicular trauma, such as contusions or zipper injuries, are managed conservatively with supportive care (ice, NSAIDs, scrotal support, and elevation), whereas major trauma is typically managed surgically.

If there is suspicion of testicular rupture, the American Urologic Association recommends scrotal exploration. Early exploration is associated with higher rates of testicular salvage.⁸⁰ For penetrating injuries, surgical exploration is also recommended.⁸¹ More than half of all penetrating scrotal injuries have testicular involvement.⁶⁶

For zipper injuries, there are several options for management. One technique is to use mineral oil. After local anesthesia, the clinician can use mineral oil on the zipper and surrounding skin to gently untangle the zipper from the skin.⁸² The clinician may also try using a wire cutter or bone-cutting pliers. Cut the diamond (or the median bar) of the zipper, which will cause the zipper to fall apart, freeing the skin.⁸³

SUMMARY

Although scrotal emergencies are rare within the emergency department, they can be life and fertility threatening. It is important to differentiate the surgical emergencies (testicular torsion, Fournier gangrene, and testicular trauma) from the less-urgent diagnoses of acute scrotal pain. Among the wide differential, it is imperative that the emergency physician identify the more concerning causes early to save lives and preserve fertility.

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