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CLINICAL REVIEW

The management of acute testicular pain in children and adolescents

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Sudden onset testicular pain with or without swelling, often referred to as the "acute scrotum," is a common presentation in children and adolescents, and such patients are seen by urologists, paediatricians, general practitioners, emergency doctors, and general surgeons. Of the many causes of acute scrotum, testicular torsion is a medical emergency; it is the one diagnosis that must be made accurately and rapidly to prevent loss of testicular function.

This review aims to cover the salient points in the history and clinical examination of acute scrotum to facilitate accurate diagnosis and prompt treatment of the most common presentations. In particular, it will guide clinicians in distinguishing testicular torsion from the other conditions that commonly mimic this surgical emergency in children and adolescents—epididymo-orchitis and torsion of the testicular appendage (cyst of Morgagni).

What are the common causes of the acute scrotum?

The incidence of the different causes of the acute scrotum varies across studies.[1-4] Testicular torsion, epididymo-orchitis, and torsion of the testicular appendage account for more than 85% of cases.

Testicular torsion

The incidence of testicular torsion has been estimated at approximately 1 in 4000 males younger than 25 years, with the left side more commonly implicated.[5] In 2012-13 in England, 2753 patients with a mean age of 16 years were admitted to hospitals with testicular torsion.[6] The condition typically occurs in neonates or post-pubertal boys but has been reported in males of all ages.

Testicular torsion is caused by twisting of the spermatic cord resulting in occlusion of the blood supply to the testes. This typically occurs spontaneously. Two types of testicular torsion may occur—intravaginal and extravaginal. Intravaginal torsion is secondary to the lack of normal fixation of the posterior lateral aspect of the testes to the tunica vaginalis. Consequently the testis is free to swing and rotate within the tunica vaginalis of the scrotum. This defect is referred to as the "bell-clapper deformity," occurring in 12% of all males; of those, 40% of cases are bilateral [7] (figure⇓). This type of abnormality mainly occurs in adolescents. In contrast, extravaginal torsion occurs more often in neonates (figure), occurring in utero or around the time of birth before the testis is fixed in the scrotum by the gubernaculum. Consequently, both the spermatic cord and the tunica vaginalis undergo torsion together, typically in or just below the inguinal canal.

Epididymo-orchitis, epididymis, and orchitis

Epididymo-orchitis is an inflammation of the epididymis and testes, usually caused by infection secondary to reflux of urine, urinary tract pathogens, or sexually transmitted infections. Inflammation limited to the epididymis alone is referred to as epididymitis or to the testes alone as orchitis. In children, the cause is usually unclear, with underlying disease evident in only 25% of cases.[8] In post-pubertal boys, acute epididymo-orchitis is usually caused by sexually transmitted infections, with a preceding history of unprotected sexual intercourse. In all age groups, urinary tract infection can result in an episode of acute epididymo-orchitis. Thus awareness of risk factors for urinary tract infections, such as abnormalities of the urinary tract (whether anatomical or functional) or recent instrumentation of the urinary tract (such as urethral catheterisation or cystoscopy) is important.

Torsion of testicular appendage (cyst of Morgagni)

The hydatid of Morgagni is a small embryological remnant at the upper pole of the testis, often referred to as the testicular appendage. Torsion can occur spontaneously. When torted it can result in pain secondary to ischaemia of the cyst. A torted testicular appendage (cyst of Morgagni) most commonly occurs in prepubertal boys.

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The bottom line

- The acute scrotum is a medical emergency because any unnecessary delay can result in irreversible damage to the testis
- Key elements in the history are the age of the patient and the duration and onset of symptoms
- Testicular torsion is most common in neonates and post-pubertal boys
- If testicular torsion is suspected urgent exploration and detorsion are key to maximise testicular salvage rates
- Although ultrasonography is useful, it should not delay surgical exploration if testicular torsion is suspected. A small but real, negative exploration rate is acceptable to minimise the risk of missing a critical surgical diagnosis

Sources and selection criteria

We searched PubMed and Clinical Evidence online using the search terms "acute scrotum", "testicular torsion", "epididymo-orchitis", and "torted testicular appendage". Historically, the management of the acute scrotum has changed little, and much of the data reviewed were case series and best expert opinion from book chapters. In addition we consulted up to date national and international guidelines published by the European Association of Urology and the Royal College of General Practitioners.

What are the less common causes of testicular pain?

Acute idiopathic scrotal oedema

Acute idiopathic scrotal oedema is a self limiting swelling of the skin of the scrotum, with normal underlying testis and epididymis. It tends to occur unilaterally and typically in children under 10 years of age.[9] Ultrasonography confirms the diagnosis, with noticeable thickening of the scrotal wall and a normal underlying testis. The cause is not known for certain, but an allergic reaction is suspected.

Testicular cancer

Testicular cancer usually presents with a slow growing painless lump or hardness in the testes. Doctors should be aware that although testicular pain is not a typical mode of presentation, it is reportedly the presenting symptom in up to 20% of men with testicular cancer,[10] presumably secondary to haemorrhage within the tumour. Furthermore, in around 10% of cases an inflammatory testicular tumour can mimic features of epididymo-orchitis, resulting in delay of the correct diagnosis.[11]

Varicocele

A varicocele is an abnormal tortuous enlargement of the veins in the scrotum due to failure of the valves draining the testicular veins. A varicocele is found in 15-20% of adolescents and is uncommon in children under 10 years of age. It appears mostly on the left side (78-93% of cases).[8] Varicoceles may lead to pain, swelling, and subfertility.

Hydrocele

A hydrocele occurs as a result of a patent processus vaginalis, which allows abdominal fluid to move in and out of the processus.

Testicular trauma

Major testicular trauma is usually clear from the history, typically presenting after either a direct blow to the testis, straddle injury, or very penetrating injury, where there is usually an entry and exit site. A thorough clinical assessment should be performed for any collateral injuries. Trauma may cause a haematocele—testicular rupture, whereby the fibrous covering of the testis (tunica albuginea) can be breached—or a haematoma.

Referred pain

An inguinoscrotal hernia can radiate into the scrotum and mimic other scrotal disorders. Classically, an incarcerated hernia will be swollen and excruciatingly tender. It is also associated with abdominal pain and vomiting if the hernia contains small bowel that becomes obstructed. Appendicitis or renal colic can mimic scrotal disorders. Usually a thorough history taking, physical examination, and imaging (if necessary) can differentiate these causes of scrotal swelling from testicular torsion.

What are the clinical features?

Table 1⇓ summarises the clinical features of testicular torsion, torsion of the testicular appendage, and epididymo-orchitis. Box 1 summarises the important features to elicit from the history.

Age

Age is an important factor when considering the differential diagnosis of the acute scrotum (table 2⇓). In the neonatal period, testicular torsion is the most common cause, whereas torsion of the testicular appendage is more likely in the prepubertal period. In the post-pubertal period, testicular torsion is the most common cause of acute scrotum, accounting for nearly 90% of cases in one series.[12] Although age helps to differentiate from the most likely diagnosis, it does not exclude any of these disorders.

Pain

Testicular torsion typically presents with sudden onset severe unilateral pain, often associated with nausea or vomiting. In contrast, epididymo-orchitis and torsion of the testicular appendage tend to cause pain that is more gradual in onset, typically over a few days. In one retrospective study of 204 boys presenting with torsion, torsion of the testicular appendage, and epididymitis there was no difference in the presenting symptoms other than duration of symptoms.[13] For boys with testicular torsion, medical attention was sought earlier than for those with torsion of the testicular appendage and epididymo-orchitis: 9.5 hours versus 48 hours and 22 hours, respectively. A history of recurrent attacks of severe pain that resolved spontaneously might suggest intermittent testicular torsion and de-torsion. In children, or shy or embarrassed teenagers, clues from parents can also be helpful. Testicular torsion should also be considered where there is a history of minor trauma but the trauma was simply a "red herring," especially when the severity of symptoms is not explained by the nature of the trauma.

In neonates, torsion can occur during the prenatal or postnatal period. Prenatal torsion classically presents at birth as a hard,

Box 1 Important features to elicit from the history

- Age
- Onset and duration of symptoms
- Location of pain:
  - Testes
  - Epididymis
  - Upper pole of testes
- Dysuria and frequency
- Sexual history (where appropriate)
- Fevers
- Medical history—for example, abnormality of urinary tract, urinary tract infection
- Recent catheterisation or instrumentation of the urinary tract

non-tender mass in the scrotum. In contrast, postnatal torsion normally presents with acute pain and swelling of the testes. A previous normal scrotum on a check after delivery suggests an acute event has occurred.

A male with varicocele is usually asymptomatic, but occasionally there is a dull ache or dragging sensation in the scrotum. A non-tender swelling that fluctuates in size, usually related to activity or raised intra-abdominal pressure such as in a child with a cough, may suggest a hydrocele. An incarcerated hernia typically presents with severe pain over a swelling in the groin or scrotum. If the hernia contains small intestine there would be associated vomiting with abdominal pain and swelling. Appendicitis is typically associated with abdominal pain that localises to the right iliac fossa.

Urinary symptoms

A history of dysuria, frequency, and foul smelling urine may suggest epididymo-orchitis secondary to a urinary tract infection. Symptoms of urethritis or penile discharge, although often absent, may suggest epididymo-orchitis secondary to a sexual transmitted disease.

Fevers

Fevers are associated with epididymo-orchitis, reported in 16% of cases in one series.[14] In orchitis caused by mumps, fevers begin before the characteristic unilateral or bilateral parotid swelling, followed 7-10 days later by unilateral testicular swelling. Mumps orchitis occurs in approximately 20-30% of males with mumps infection.[8]

Sexual history

A detailed sexual history should be obtained in sexually active adolescent boys. This is a sensitive clinical encounter, which often needs to be performed alone with the patient, as he may feel uneasy about revealing personal details in the company of partners or relatives. Further information on obtaining a sexual history can be obtained from the guidelines set out by the British Association of Sexual Health and HIV.[15]

Medical history

A urological history is important, such as an abnormality of the urinary tract making patients more prone to urinary tract infections and thus epididymo-orchitis. Instrumentation of the urinary tract, such as urethral catheterisation or cystoscopy, is a risk factor for urinary tract infections and secondary epididymo-orchitis.

How is it assessed?

Patients' general appearance should be assessed for levels of discomfort and early signs of distress or sepsis. This should be followed by a general abdominal examination, including examination of the flanks for tenderness, a sign of renal or ureteric colic that can result in referred pain to the scrotum. The bladder should be palpated for distension and the groins examined for hernias, any other swellings, and skin changes such as cellulitis.

The observed symmetry should be assessed visually between both sides of the scrotum checking for discrepancies in size and position of the testes, degree of swelling, and any changes to overlying skin (box 2). In testicular torsion the affected testis is high riding (when compared with the contralateral testis), swollen, and excruciatingly tender. It may also have a horizontal lie.

The cremasteric reflex is rarely intact in testicular torsion but is usually present in patients with torsion of the testicular appendage and epididymo-orchitis. This simple test has 100% sensitivity and 66% specificity, as the cremasteric reflex can be absent in neonates and in people with neurological disorders.[8] The cremasteric reflex (L1/L2 spinal nerves) is elicited by gentle pinching or stroking of the inner thigh while observing the scrotal contents. The normal response, owing to shared innervations, is for the cremasteric muscle to contract, resulting in elevation of the ipsilateral testicle. Scrotal elevation relives pain in epididymo-orchitis but not in torsion (Prehn's sign). This sign may be difficult to test reliably in children.

Tenderness limited to the upper pole of the testis could represent torsion of the testicular appendage, and if co-existent with a small bluish discoloration at the superior pole of the testis (called the "blue dot sign"), this is pathognomonic of the diagnosis. In a Scandinavian study, however, this sign was reported in only 10% of boys with a torsion of the testicular appendage.[14] In acute epididymo-orchitis the epididymis, palpated posterolateral to the testis, is exquisitely tender, swollen, indurated, and warm to palpation. The figure illustrates the anatomy of the scrotum and twisting of the cord causing a testicular torsion.

How is the acute scrotum investigated?

Prompt urological or surgical review

All cases of acute testicular pain are due to torsion until proved otherwise. If torsion is suspected after a prompt clinical assessment, a scrotal exploration should be carried out without delay. An immediate referral must be made to the emergency urology or surgical team. Before further assessment food should be withheld and patients provided with adequate analgesia.

Box 2 Assessment of patient presenting with "acute scrotum"

- Check position, size, and symmetry of testes
- Check the overlying skin for evidence of erythema
- Check for a "blue dot sign"
- Check the cremasteric reflex
- Determine sites of maximal tenderness:
  - Testes
  - Epididymis
  - Upper pole of testes
- Examine inguinal and abdominal region for hernia and appendicitis

Urinalysis

A urinalysis should be performed to rule out a urinary tract infection. The presence of nitrites and leucocytes on urinalysis, with a consistent history of dysuria, may support a diagnosis of epididymo-orchitis secondary to a urinary tract infection. A midstream urine specimen should be sent for microscopy, culture, and sensitivity.

Of note, a normal urinalysis result does not exclude epididymo-orchitis and similarly an abnormal result does not exclude testicular torsion.

Ultrasonography

For those patients where the diagnosis is unclear from the clinical assessment, access to urgent Doppler ultrasonography may be helpful. Ultrasonography has a reported sensitivity of 63.6-100% and specificity of 97-100% for diagnosing testicular torsion.[8] Although ultrasonography may reduce the number of scrotal explorations, it is operator dependent and can be difficult to perform in prepubertal boys. In addition, in early phases of torsion or in intermittent torsion the arterial blood flow may be misleading, giving a false negative result. In fact, in a multicentre study of 208 boys with torsion, 24% had a normal testicular blood flow. High resolution ultrasonography has shown better results as the torted cord can also be directly visualised.[16]

Taken together, prompt Doppler ultrasonography in experienced hands can be useful in facilitating the diagnosis of an acute scrotum. It must be stressed that ultrasonography should not delay the decision to undertake a scrotal exploration if testicular torsion is suspected.

Specialist tests

If epididymo-orchitis secondary to sexually transmitted infection is suspected, in addition to a midstream urine specimen for microscopy, culture, and sensitivity, a Gram stained urethral smear should be taken and examined for the presence of urethritis (leucocytes), in particular Gram negative intracellular diplococci (*Neisseria gonorrhoeae*). Alternatively, microscopic urethritis can be shown using first pass urine. Other more specific investigations include urethral swabs for culture and a nucleic acid amplification test for *N gonorrhoeae* and *Chlamydia trachomatis*.[17]

How is it treated?

Testicular torsion

Testicular torsion is a clinical diagnosis and if suspected urgent scrotal exploration should be performed. This can be done either through a midline incision allowing access to both testes or through two small incisions over each testis. If torsion is found the testis should be detorted and placed in warm saline soaked swabs and observed for up to 10 minutes. If the testis is viable, a three point fixation should be performed. The contralateral testis must also be fixed, as there is up to a 40% risk of torsion developing.[18] If the testis fails to reperfuse it must be removed at the time of exploration. If the testis is normal, fixation is not recommended as sutures could breach the testes-blood barrier and risk antisperm antibodies developing, which may affect fertility.

During the preoperative consent procedure, patients and their parents should be informed of several key problems related to the procedure. Fixation of both testes is often required. Patients should be warned that the sutures can sometimes be felt through the scrotal skin, causing pain or irritation. Although rare, despite detorsion and fixation, the testes can shrink and atrophy with no guarantee of future fertility. If perfusion fails to return and the testis is deemed non-viable it should be removed. In a large cohort analysis of 2443 boys and 152 newborns, the rate of orchiectomy was high, occurring in 41.9% of boys undergoing surgery for torsion.[19] Testicular salvage is strongly correlated to the duration of symptoms. Salvage rates have been reported as high as 95% if the testis is detorted within 0-4 hours of the onset of pain, falling to 45-60% if left for 8-10 hours, and decreasing dramatically thereafter.[18] Infection and haematoma can also occur after exploration.

Epididymo-orchitis

In adolescence, epididymo-orchitis is most often caused by sexually transmitted infections, and antimicrobial treatment should cover causative organisms, typically *C trachomatis* and *N gonorrhoeae*. Empirical treatment should initially be given following culture or nucleic acid amplification testing and altered according to the results when available. Often, immediate referral to genitourinary medicine for thorough investigation is appropriate. If a urinary tract infection is suspected and the cause of the resulting epididymo-orchitis, antimicrobials should be prescribed that target the common pathogens: Gram negative organisms such as *Escherichia coli* or Gram positive enterococci and antimicrobials should be targeted accordingly.

Box 3 summarises the empirical treatment of epididymo-orchitis as recommended by the combined document produced by the Royal College of General Practitioners and British Association for Sexual Health and HIV.[17] Treatment should then be tailored to the results of the urinary or urethral cultures or nucleic acid amplification test. Other advice includes appropriate rest, scrotal support, and analgesia such as anti-inflammatory drugs. Patients with suspected epididymo-orchitis secondary to a sexually transmitted infection should abstain from sexual intercourse and partners should be tested and treated accordingly.

In prepubertal boys the cause is normally idiopathic. Antibiotic treatment is not usually indicated (however, it is often started) as the results of urinalysis in most cases are negative. Symptoms

Box 3 Empirical antimicrobial treatment for epididymo-orchitis[17]

Epididymo-orchitis likely secondary to sexually transmitted infection

Where *Neisseria gonorrhoeae* is unlikely:

Doxycyline 100 mg twice daily for 10-14 days or

Ofloxacillin 200 mg twice daily for 14 days

Where *N gonorrhoeae* is suspected:

Ceftriaxone 500 mg intramuscularly* 1 dose and

Doxycyline 100 mg twice daily for 10-14 days

Epididymo-orchitis likely secondary to urinary tract infection†

- Ofloxacillin 200 mg twice daily for 14 days or
- Ciprofloxacillin 500 mg twice daily for 10 days

*Intramuscular injections are difficult for most general practitioners to organise in surgery. If this is so, discuss with genitourinary medicine specialists. Ofloxacin may be used but it is vital that sensitivity testing (that is, culture, not nucleic acid amplification test) is taken first (ciprofloxacin does not effectively treat chlamydia infection).

†Alter according to result of midstream urine specimen.

are normally self limiting, and supportive treatment is recommended.

If epididymo-orchitis presents late, areas of fluctuation overlying an erythematous tender scrotum could suggest development of an abscess. This can be confirmed with ultrasonography and often requires incision and drainage with occasional loss of the testes due to necrosis.

Mumps orchitis usually presents with testicular swelling in the setting of a preceding history of fevers and parotitis. The mainstay of treatment is conservative, but secondary superimposed bacterial infection can result, requiring antibiotics. In the United Kingdom, mumps is a notifiable disease. It is important to try to prevent spread of the infection to others, particularly teenagers and young adults who have not been vaccinated.

Torsion of testicular appendage

If the diagnosis of torsion of testicular appendage is certain, it can be managed conservatively with adequate analgesia. If there is any doubt about the diagnosis a surgical exploration must be performed. If torsion of the testicular appendage is seen at the time of surgery, it can be ligated and excised. Removal of the opposite appendage is not indicated.

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Additional educational resources

Resources for healthcare professionals

European Association of Urology (www.uroweb.org/guidelines/online-guidelines/)—guidelines for the management of paediatric conditions, testicular cancer, and urological infection

Royal College of General Practitioners (http://elearning.rcgp.org.uk)—eLearning section

Resources for patients

NHS Choices. Testicular lumps and swelling (www.nhs.uk/conditions/testicular-lumps-benign/pages/introduction.aspx)—(free) provides information on different causes of testicular pain and swelling and how they present

Urology Care Foundation (www.urologyhealth.org/urology/)—(free) provides details on testicular torsion and epididymitis/orchitis—what they are and how they are diagnosed and treated, with a dedicated section for frequently asked questions

Tables

Table 1| **Clinical presentation of three causes of acute scrotum**

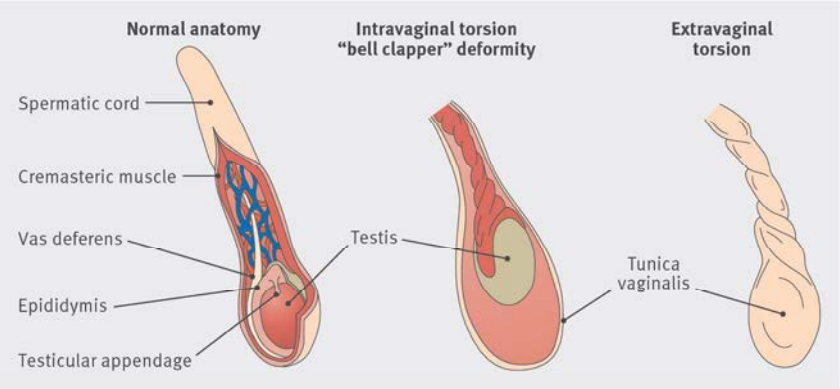
Clinical feature	Testicular torsion	Torsion of testicular appendage	Epididymo-orchitis
Age	Neonates and post-pubertal	Prepubertal	Post-pubertal (sexually active)
Onset of symptoms	Acute	Subacute	Subacute
Site of maximal tenderness	Diffuse	Upper pole	Epididymis
Cremasteric reflex	Absent	Present	Present
Other findings	High riding swollen testis	Positive “blue dot” sign	Epididymis warm and indurated, pain relief with testicular elevation (Prehn’s sign), fever

Table 2| **Relative frequency (%) of different causes of "acute scrotum" in 154 cases, categorised by age group**[12]

Age group	Testicular torsion	Torsion of testicular appendage	Epididymo-orchitis	Other*
0-12	34	47	4	15
13-21	86	9	0	5

*Negative exploration, acute scrotal oedema.

Figure



Normal scrotal anatomy; intravaginal torsion (twisting of spermatic cord alone within tunica vaginalis resulting in testicular torsion) showing "bell clapper" deformity with horizontal lie of testes owing to lack of normal fixation of testis to tunica vaginalis; and extravaginal torsion, where both spermatic cord and tunica vaginalis undergo torsion together. Adapted from www.clinicalscience.org.uk

Testicular Torsion

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Each year, testicular torsion affects one in 4,000 males younger than 25 years. Early diagnosis and definitive management are the keys to avoid testicular loss. All prepubertal and young adult males with acute scrotal pain should be considered to have testicular torsion until proven otherwise. The finding of an ipsilateral absent cremasteric reflex is the most accurate sign of testicular torsion. Torsion of the appendix testis is more common in children than testicular torsion and may be diagnosed by the "blue dot sign" (i.e., tender nodule with blue discoloration on the upper pole of the testis). Epididymitis/orchitis is much less common in the prepubertal male, and the diagnosis should be made with caution in this age group. Doppler ultrasonography may be needed for definitive diagnosis; radionuclide scintigraphy is an alternative that may be more accurate but should be ordered only if it can be performed without delay. Diagnosis of testicular torsion is based on the finding of decreased or absent blood flow on the ipsilateral side. Treatment involves rapid restoration of blood flow to the affected testis. The optimal time frame is less than six hours after the onset of symptoms. Manual detorsion by external rotation of the testis can be successful, but restoration of blood flow must be confirmed following the maneuver. Surgical exploration provides definitive treatment for the affected testis by orchiopexy and allows for prophylactic orchiopexy of the contralateral testis. Surgical treatment of torsion of the appendix testis is not mandatory but hastens recovery. (Am Fam Physician 2006;74:1739-43, 1746. Copyright © 2006 American Academy of Family Physicians.)

AGF This article exemplifies the AAFP 2006 Annual Clinical Focus on caring for children and adolescents.

☐ **Patient information:** A handout on testicular torsion, written by the authors of this article, is provided on page 1746.

The annual incidence of testicular torsion is one in 4,000 males younger than 25 years.[1] Intravaginal torsion, caused by a congenital malformation of the processus vaginalis, accounts for 90 percent of cases.[2] In this malformation, the tunica vaginalis covers not only the testicle and the epididymis but also the spermatic cord. This creates a "bell-clapper deformity" that allows the testis to rotate freely within the tunica vaginalis. A torsed testicle is shown in *Figure 1.*

Torsion usually occurs in the absence of any precipitating event[3]; only 4 to 8 percent of cases are a result of trauma.[4] Other factors predisposing patients to testicular torsion include an increase in testicular volume (often associated with puberty), testicular tumor, testicles with horizontal lie, a history of cryptorchidism, and a spermatic cord with a long intrascrotal portion.[5]

Torsion initially obstructs venous return. Subsequent equalization of venous and arterial pressures compromises arterial flow, resulting in testicular ischemia. The degree of ischemia depends on the duration of torsion and the degree of rotation of the spermatic cord. Ischemia can occur as soon as four hours after torsion and is almost certain after 24 hours. In one study, investigators quoted a testicular salvage rate of 90 percent if detorsion occurred less than six hours from the onset of symptoms; this rate fell to 50 percent after 12 hours and to less than 10 percent after 24 hours.[6] Rotation can range from 180 degrees to more than 720 degrees. Greater degrees of rotation lead to a more rapid onset of ischemia, but the degree of rotation rarely can be determined without surgical intervention.

Differential Diagnosis

Testicular torsion must be diagnosed quickly and accurately. Delay in diagnosis (and subsequent delay in surgery) risks testicular viability, whereas overdiagnosis subjects patients to unnecessary surgery. Studies have shown that between 16 and 42 percent of boys with acute scrotal pain have testicular torsion.[7-9]

The differential diagnosis of the acutely painful scrotum includes testicular torsion,

SORT: KEY RECOMMENDATIONS FOR PRACTICE

Clinical recommendation	*Evidence rating*	*References*
The history and physical examination of a patient with acute scrotal pain should include evaluation of the testicular lie and cremasteric reflex.	C	14, 16
Either Doppler ultrasonography or scintigraphy can be the initial diagnostic study. Physicians should order whichever test is faster and more readily available at their institution.	C	17, 18
Any patient with a history and physical examination results suspicious for torsion should have surgery immediately.	C	19
Manual detorsion provides quick and noninvasive treatment. Return of blood flow should be documented, and subsequent elective orchiopexy is recommended.	C	13, 21

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, see page 1666 or http://www.aafp.org/afpsort.xml.

trauma, epididymitis/orchitis, incarcerated hernia, varicocele, idiopathic scrotal edema, and torsion of the appendix testis. The appendix testis is a müllerian duct remnant on the superior aspect of the testicle. In one retrospective review of 100 boys younger than 15 years who presented to the emergency department with acute testicular pain, researchers found that 70 had torsion of the appendix testis, 12 had testicular torsion, and 10 had epididymitis.[10]

It is difficult to differentiate testicular torsion from torsion of the appendix testis and epididymitis/orchitis based on historical features alone. The authors of a retrospective review of 204 boys with torsion, torsion of the appendix testis, or epididymitis/orchitis found no difference in presenting symptoms or historical features other than duration of symptoms.[11] The boys with testicular torsion did, however, seek medical attention earlier (9.5 hours, compared with 48 hours in the boys with torsion of the appendix testis).[11] Another study of 90 patients with testicular pain found that boys with torsion of the appendix testis tend to be younger than those with testicular torsion.[12] Although epididymitis can occur in any age group, it is more common after puberty.

If there is a history of scrotal trauma, it can be tempting to attribute scrotal pain entirely to the preceding trauma. However, if the pain lasts more than one hour after the trauma, the testicle should be evaluated for possible trauma-induced torsion.

Figure 1. Torsed testicle.

Clinical Examination

The physical examination may help to differentiate causes of acute scrotal pain. In epididymitis, the scrotal skin becomes edematous and its appearance has been likened to an orange peel. This change occurs late in the course of the disease, however. Initially, the only sign may be tenderness of the epididymis and possibly pyuria.

When the appendix testis undergoes torsion, a hard, tender nodule 2 to 3 mm in diameter may be palpable on the upper pole of the testicle. A blue discoloration may be visible in this area and is referred to as the "blue dot sign." Scrotal edema develops rapidly, however, and often obscures the physical examination findings. Finally, the epididymis remains posterior when only the appendix testis undergoes torsion. The affected testis is comparable in size to the unaffected testis.

In contrast, in patients with testicular torsion, the epididymis may be located medially, laterally, or anteriorly, depending on the degree of torsion. The epididymis may be located posteriorly with 360 degrees of torsion. The spermatic cord shortens as it twists, so the testis may appear higher in the affected scrotum. This is a very specific finding and, when present, is strong evidence of testicular torsion. Because of venous congestion, the affected testis also may appear larger than the unaffected testis.

The most sensitive physical finding in testicular torsion is the absence of the cremasteric reflex. This reflex is elicited by stroking or pinching the medial thigh, causing contraction of the cremaster muscle, which elevates the testis. The cremasteric reflex is considered positive if the testicle moves at least 0.5 cm. In a study of 225 healthy boys, investigators noted that this reflex was present in all of the boys older than 30 months but in less than one half of those younger than 30 months.[13]

Although two studies found the loss of the cremasteric reflex to be at least 99 percent sensitive for testicular torsion,[12,14] there has been a single case report of a normal cremasteric reflex in the presence of testicular torsion.[15]

Diagnostic Studies

Imaging should be done only in equivocal cases in which suspicion for torsion is low. Any patient with a history and physical examination suspicious for torsion should have immediate surgery. As is the case in patients with appendicitis, a negative surgical exploration is preferable to a missed diagnosis.[16] An approach to the patient with acute scrotal pain is shown in *Figure 2*.[17]

The most commonly used diagnostic modalities are Doppler ultrasonography, radionuclide imaging, and surgical exploration. Typical imaging findings for ultrasonography and radionuclide imaging are shown in *Table 1*. Intratesticular blood flow can be visualized with Doppler ultrasonography. In patients with testicular torsion, the blood flow in the symptomatic testis is decreased or absent compared with the asymptomatic testis. In addition, the torsed testicle appears to be enlarged. Initially, the testicle may have decreased echogenicity, although echogenicity may increase after infarction has occurred.

Doppler ultrasonography also can differentiate between ischemia and inflammation. In patients with inflammation, such as that associated with orchitis, intratesticular blood flow is increased. In those with epididymitis, the testicle is of normal size, but the epididymis is enlarged.

The testicular salvage rate is 90 percent if detorsion occurs less than six hours from the onset of symptoms, but it falls to 50 percent after 12 hours and to less than 10 percent after 24 hours.

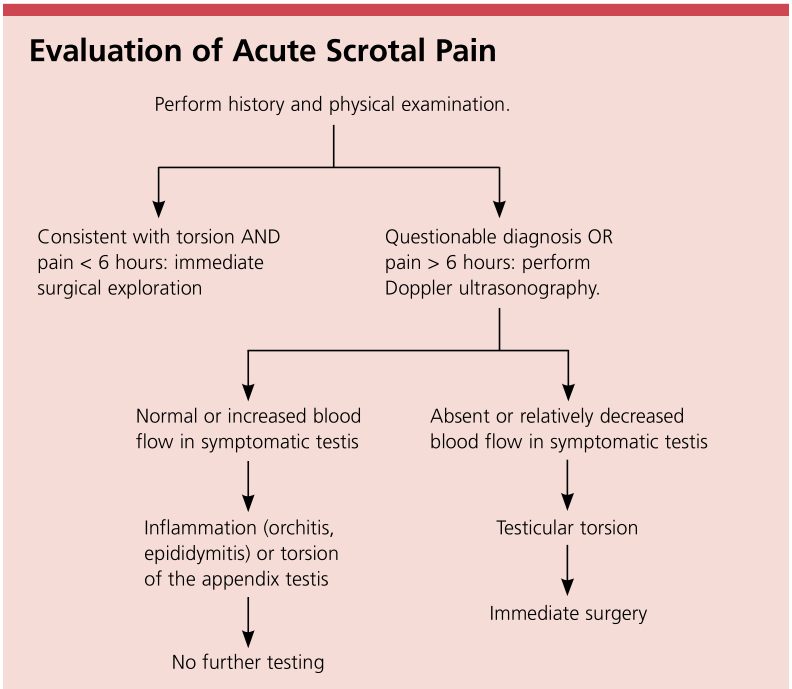

Figure 2. Algorithmic approach to the evaluation of the patient with acute scrotal pain.

TABLE 1
Typical Imaging Findings in the Patient with an Acutely Painful Scrotum

Diagnosis	*Appearance on ultrasonography*	*Appearance on scintigraphy*
Normal testis	Homogenous echogenicity surrounded by thin bright line (the tunica albuginea)	Symmetric homogenous uptake
Testicular torsion	Absent or decreased blood flow	Decreased perfusion on symptomatic side Photopenic lesion on static imaging
Epididymitis/ orchitis	Increased blood flow	Increased perfusion

Ultrasonography also can differentiate testicular disease (e.g., torsion, tumor) from extratesticular disease (e.g., hydrocele, abscess, hematoma).

False-negative results on Doppler ultrasonography may be caused by intermittent torsion or by early torsion when only venous outflow is occluded. False-positive results can occur because blood flow may not be detected in the smaller prepubescent testicle. Doppler ultrasonography has a sensitivity of 88 percent and specificity of 90 percent in detecting testicular torsion.[18] Given a 20 percent pretest probability of torsion, 69 percent of patients with abnormal results on Doppler will have testicular torsion and 97 percent of patients with normal results will not.

Common causes of testicular loss after torsion are delay in seeking medical attention, incorrect initial diagnosis, and delay in treatment at the referral hospital.

Scintigraphy using technetium 99m pertechnetate to evaluate the painful testicle has nearly 100 percent sensitivity for testicular torsion.[19] Patients with testicular torsion have decreased delivery of radiotracer to the ischemic testis, resulting in a photopenic lesion. With inflammation or infection, there is increased perfusion.

Although scintigraphy may be more sensitive for testicular torsion, ultrasonography is faster and more readily available. This is a critical consideration in a condition that depends on rapid diagnosis for a positive outcome.

Treatment

Once the diagnosis of testicular torsion is confirmed, the rapid restoration of blood flow to the testis is critical. Manual detorsion can provide quick and noninvasive treatment. The physician stands at the supine patient's feet and rotates the affected testicle away from the midline, as though opening a book. For suspected torsion of the left testicle, the physician places his or her right thumb and index finger on the testicle and rotates the testicle 180 degrees from medial to lateral. This procedure can be done with intravenous sedation, with or without local anesthesia (5 mL of 2 percent lidocaine [Xylocaine] infiltrating the spermatic cord near the external ring). If successful, there should be a dramatic decrease in pain.

Because torsion of more than 360 degrees is possible, more than one rotation may be needed to fully detorse the testis. The return of blood flow should be documented. Although successful detorsion confirms the diagnosis of testicular torsion and relieves the acute problem, elective orchiopexy is still recommended. A review of nine studies (with 102 total patients) showed only a 26.5 percent success rate with manual detorsion,[20] but other researchers cite success rates of more than 80 percent.[21]

Attempts at manual detorsion should not delay surgical consultation. Only surgical exploration can provide a definitive resolution if torsion is present, and, as noted above, any patient with a history and physical examination results suspicious for torsion should have surgery immediately. In addition, given the risks of a missed diagnosis, scrotal exploration may be needed if a definitive diagnosis cannot be made. If the testicle is not viable, it must be removed. The anatomic abnormality that predisposed the testicle to torsion may be bilateral. Therefore, prophylactic orchiopexy of the contralateral testis is universally recommended.

A missed or delayed diagnosis of testicular torsion may result in litigation. The most common misdiagnosis is epididymitis.[22] There may be a risk of litigation even if the patient's delay in seeking medical attention

contributed to the poor outcome. In a review of 39 closed cases, those presenting with more than eight hours of symptoms had a similar rate of payment to those presenting with less than eight hours of symptoms.[23]

Complications

The most significant complication of testicular torsion is loss of the testis, which may lead to impaired fertility. Common causes of testicular loss after torsion are delay in seeking medical attention (58 percent), incorrect initial diagnosis (29 percent), and delay in treatment at the referral hospital (13 percent).[24]

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Testicular Torsion: Diagnosis, Evaluation, and Management

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Testicular torsion is a twisting of the spermatic cord and its contents and is a surgical emergency affecting 3.8 per 100,000 males younger than 18 years annually. It accounts for 10% to 15% of acute scrotal disease in children, and results in an orchiectomy rate of 42% in boys undergoing surgery for testicular torsion. Prompt recognition and treatment are necessary for testicular salvage, and torsion must be excluded in all patients who present with acute scrotum. Testicular torsion is a clinical diagnosis, and patients typically present with severe acute unilateral scrotal pain, nausea, and vomiting. Physical examination may reveal a high-riding testicle with an absent cremasteric reflex. If history and physical examination suggest torsion, immediate surgical exploration is indicated and should not be postponed to perform imaging studies. There is typically a four- to eight-hour window before permanent ischemic damage occurs. Delay in treatment may be associated with decreased fertility, or may necessitate orchiectomy. (*Am Fam Physician*. 2013;88(12):835-840. Copyright © 2013 American Academy of Family Physicians.)

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Author disclosure: No relevant financial affiliations.

▶ **Patient information:** A handout on this topic, written by the authors of this article, is available at http://www.aafp.org/afp/2013/1215/p835-s1.html. Access to the handout is free and unrestricted.

A good working knowledge of testicular and scrotal anatomy and development is important when assessing a patient who presents with a scrotal condition, because time from presentation to treatment is crucial in preserving organ function.[1-4] The testes develop from condensations of tissue within the urogenital ridge at approximately six weeks of gestation. With longitudinal growth of the embryo, and through endocrine and paracrine signals, which have not yet been well described, the testes ultimately descend into the scrotum by the third trimester of pregnancy. As the testes leave the abdomen, the peritoneal lining covers them, creating the processus vaginalis. The spermatic arteries and pampiniform venous plexus enter the inguinal canal proximal to the testes, and with the vas deferens, form the spermatic cord.[5] The testicle is tethered to the scrotum distally by the gubernaculum.

Testicular torsion is a twisting of the spermatic cord and its contents and is a surgical emergency, with an annual incidence of 3.8 per 100,000 males younger than 18 years.[6] Historically, the annual incidence has been closer to one per 4,000.[7] It accounts for approximately 10% to 15% of acute scrotal disease in children, and results in an orchiectomy rate of 42% in boys undergoing surgery for testicular torsion.[6,8,9]

Age Distribution

The age distribution of testicular torsion is bimodal, with one peak in the neonatal period and the second peak around puberty. In neonates, extravaginal torsion predominates, with the entire cord, including the processus vaginalis, twisting.[10] Extravaginal torsion may occur antenatally or in the early postnatal period and typically presents as painless scrotal swelling, with or without acute inflammation. Testicular viability in neonatal torsion is universally poor; one literature review of 18 case series with 284 patients found a salvage rate of about 9%.[11] Contralateral orchiopexy has been recommended at the time of surgical exploration because the etiology for extravaginal torsion remains unclear.[12] Although no specific risk factors have been identified, poorer fixation of the neonatal tissues to one another has been implicated, and term infants with difficult or prolonged deliveries may be at higher risk.[10]

SORT: KEY RECOMMENDATIONS FOR PRACTICE

Clinical recommendation	Evidence rating	References
Scrotal Doppler ultrasonography is the imaging study of choice to aid in the diagnosis of testicular torsion; however, prompt referral should not be delayed to perform this study.	C	25, 38-40
Immediate surgery should be performed if testicular torsion is suspected, and should not be delayed by imaging studies if physical examination findings are strongly suggestive.	C	16, 17, 34
Manual detorsion should be attempted if surgery is not an immediate option; however, prompt referral should not be delayed to perform this maneuver.	C	48, 49

A = consistent, good-quality patient-oriented evidence; B = inconsistent or limited-quality patient-oriented evidence; C = consensus, disease-oriented evidence, usual practice, expert opinion, or case series. For information about the SORT evidence rating system, go to http://www.aafp.org/afpsort.

In older children and adults, testicular torsion is usually intravaginal (twisting of the cord within the tunica vaginalis).[13] The bell-clapper deformity *(Figure 1)*, in which there is abnormal fixation of the tunica vaginalis to the testicle, results in increased mobility of the testicle within the tunica vaginalis.[14] Whether testicular torsion is intravaginal or extravaginal, twisting of the spermatic cord initially increases venous pressure and congestion, with subsequent decrease in arterial blood flow and ischemia.[15] Although symptoms are typically unilateral, the anatomic conditions that predispose a persion to torsion must be presumed to be bilateral.[14]

Differential Diagnosis

Acute scrotum is defined as a sudden painful swelling of the scrotum or its contents, accompanied by local signs or systemic symptoms.[16] In a patient presenting with acute scrotum, it is imperative to rule out testicular torsion, which is a true surgical emergency.[16-22] A high index of suspicion on the part of the physician is needed; children in particular may not promptly or accurately recall or describe symptom severity and duration.

The differential diagnosis of the acute scrotum is broad *(Table 1[23])*, and the proportion of patients presenting with each of these conditions varies. Although most patients will not require emergent intervention, a significant minority will have testicular torsion, and prompt identification and institution of therapy are crucial.[24-26] Most patients do not present for evaluation immediately upon onset of symptoms, further limiting the therapeutic window for testicular salvage.

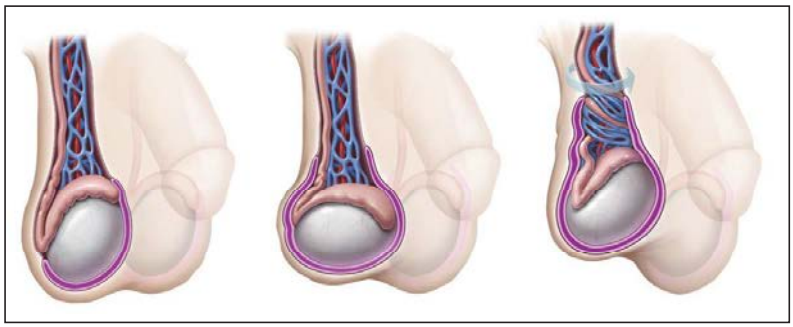

ILLUSTRATION BY TODD BUCK

Figure 1. The bell-clapper deformity with abnormal fixation of the tunica vaginalis to the testicle.

Physical Examination

The classic presentation of testicular torsion is sudden onset of severe unilateral testicular pain associated with nausea and vomiting.[16-18,22,27-29] Patients may also have nonspecific symptoms such as fever or urinary problems. Although there are no clear precipitating factors, many patients describe a recent history of trauma or strenuous physical activity.[27] The ipsilateral scrotal skin may be indurated, erythematous, and warm, although changes in the overlying skin reflect the degree of inflammation and may change over time.[18,27] A high-riding testicle can indicate a twisted, foreshortened spermatic cord.[30]

The affected testicle can also have an abnormal horizontal orientation. The cremasteric reflex, which is elicited by pinching the medial thigh, causes elevation of the testicle. Presence of the reflex suggests, but does not confirm, the absence of testicular torsion.[18,22,31,32] Comparison of the affected and unaffected sides may help delineate abnormal clinical findings, although scrotal edema and patient discomfort may limit physical examination.[24] Patients in whom the components of the spermatic cord can be distinctly appreciated, whose testes are normally oriented, who have minimal to no scrotal edema, and who have no systemic symptoms (particularly

with examination) are unlikely to have acute testicular torsion.[18,22,27,32,33]

In cases of intermittent torsion, patients typically report recurrent episodes of acute unilateral scrotal pain.[16,29,30] The pain usually resolves spontaneously within a few hours. Clinical examination and imaging are often normal if the patient presents after resolution of torsion. Chronic intermittent torsion may result in segmental ischemia of the testicle and warrants urologic evaluation.[34]

The appendix testis and appendix epididymis are embryologic remnants of the Müllerian and Wolffian systems, respectively. These vestigial structures may torse, with subsequent infarction. Clinically, torsion of an appendix can be difficult to differentiate from torsion of the spermatic cord in the patient with acute scrotal pain; the onset of pain may be similarly abrupt, and systemic symptoms (although less common) may be present.[35] The classic presentation of a torsed appendage is the blue dot sign, where the inflamed and ischemic appendage can be visualized through the scrotal skin[28]; overlying scrotal edema and patient complexion may limit this finding, thus decreasing the sensitivity.[29,33]

When patients with appendiceal torsion present early, focal tenderness at the superior pole of the epididymis, near the torsed appendage, is often appreciated. As local inflammation occurs, the development of local edema may make the diagnosis more challenging. In a series of 119 males with acute scrotum, more than one-half had torsion of a testicular appendage, whereas approximately one-third had testicular torsion.[25]

Patients with normal examination results, but with significant tenderness along the epididymis or testicle, may have epididymo-orchitis.[27,28,36] Epididymitis is rare in prepubertal children, except in the presence of abnormal genitourinary anatomy or recent viral infection.[37] In older patients, particularly those who are sexually active or who have recently undergone a procedure, bacteria from the bladder or urethra can infect the epididymis or testicle.[36] History and physical examination, as well as urinalysis, are helpful in confirming or excluding this diagnosis.[36,37]

Table 1. Differential Diagnosis of the Acute Scrotum

Diagnosis	*Clinical clues*
Epididymo-orchitis	Altered genitourinary structure or function
	Recent viral illness
	Tenderness in testicle or epididymis
Hematologic disorders	Abnormal laboratory values
	Diffusely hard testicle (in leukemia or lymphoma)
	History of hematologic disorders
Idiopathic scrotal edema	No signs or symptoms of infection
	Swelling of overlying scrotal skin
Infection	Abnormal urinalysis
	Altered genitourinary anatomy
	Epididymal or testicular tenderness
	Fever
Inguinal hernia or hydrocele	Fluctuation of swelling or mass throughout day or with activity
	Groin mass
Torsion of the appendix testicle or appendix epididymis	Blue dot sign
	Tenderness over the head of the testicle or epididymis
Torsion of the spermatic cord	Absent or decreased blood flow on ultrasonography
	High-riding testicle
	Nausea, vomiting, or both
	Palpable twist in cord
	Sudden onset of symptoms
Trauma	Ecchymosis
	History of trauma or mechanism of injury
Tumor	Elevated tumor markers or abnormal laboratory test results
	Hard mass within testicle
	Systemic symptoms (if metastatic)
Varicocele	Dull, aching pain
	Fluctuation of swelling or pain throughout day or with activity

Information from reference 23.

Imaging

In patients with a history and physical examination suggestive of torsion, imaging studies should not be performed; rather, these individuals should undergo immediate surgical exploration[38] *(Figure 2[9])*. The delay associated with performing imaging can extend the time of testicular ischemia, thereby decreasing testicular salvage rates.[17] Negative surgical exploration is preferable to a missed diagnosis because all imaging studies have a false-negative rate. Data provided by imaging studies are

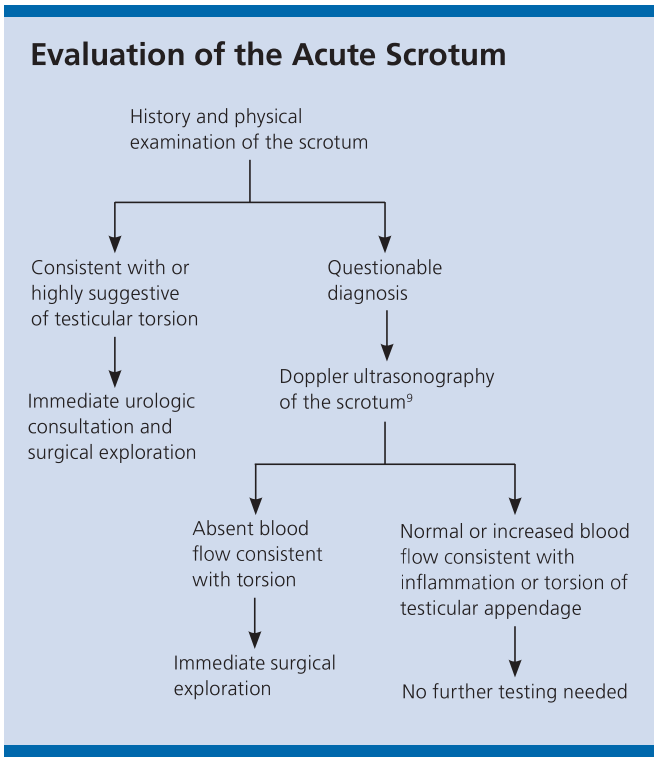

Figure 2. Algorithm for evaluating acute scrotal pain.

Information from reference 9.

secondary to examination findings, and management should be based primarily on history and physical findings.[24] Patients with physical findings strongly suggestive of testicular torsion should be referred for surgical exploration regardless of ultrasound findings.[16,17,33,39,40]

The most commonly used imaging modality is Doppler ultrasonography,[41] which is a highly sensitive (88.9%) and specific (98.8%) preoperative diagnostic tool with a 1% false-negative rate.[38] Doppler ultrasonography evaluates the size, shape, echogenicity, and perfusion of both testicles. Color Doppler imaging of testicular torsion demonstrates a relative decrease or absence of blood flow within the affected testicle.[38-40,42] If blood flow is absent on Doppler imaging and consistent with torsion, immediate surgical exploration is indicated.[43]

Radionuclide imaging also can be used to evaluate the acute scrotum.[44] The technique involves injection of an isotope intravenously followed by blood flow images of the scrotum. Testicular isotope scanning can differentiate epididymitis, which results in "hot spots" caused by increased perfusion near the affected testicle, from testicular torsion, which results in "cold spots" caused by decreased blood flow to the affected testicle.[45] However, availability, speed, and lack of radiation make ultrasonography the first-line imaging modality.[38-40,42]

Management

Prompt restoration of blood flow to the ischemic testicle is critical in cases of testicular torsion,[1-3] and prompt referral to a urologist is recommended.[19] There is typically a four- to eight-hour window before significant ischemic damage occurs, manifested by morphologic changes in testicular histopathology and deleterious effects on spermatogenesis.[3] Altered semen parameters and potential decreased fertility secondary to increased permeability of the blood-testicle barrier may not normalize even after blood flow has been successfully restored.[46] The viability of the testicle in cases of torsion is difficult to predict; hence, emergent surgical treatment is indicated despite many patients presenting beyond the four- to eight-hour time frame.[23,29] Reported testicular salvage rates are 90% to 100% if surgical exploration is performed within six hours of symptom onset, decrease to 50% if symptoms are present for more than 12 hours, and are typically less than 10% if symptom duration is 24 hours or more.[4,26,47] These percentages should be considered approximate rather than absolute for the purpose of counseling patients or making clinical decisions.

Manual detorsion should be attempted if surgery is not an immediate option or while preparations for surgical exploration are being made, but should not supersede or delay surgical intervention.[48,49] Manual detorsion should not replace surgical exploration.[4,33] The testes are typically detorsed from the medial to lateral side, turning the physician's hands as if "opening a book."[50] Analgesic administration, intravenous sedation, or a spermatic cord block may facilitate detorsion by relaxing cremasteric fibers and controlling pain enough to allow manipulation of the testicle for detorsion. The testicle is typically twisted more than 360 degrees, so more than one rotation may be required to completely detorse the testicle.[50] The subjective end point is alleviation of pain, although analgesic administration may limit the utility of this measure. Return of blood flow to the testicle on Doppler ultrasonography serves as an objective end point and should always be documented; however, relative hyperemia and altered vascular flow patterns in a newly revascularized testicle may obscure ultrasound results.[4]

Preoperatively, patients should be counseled on the potential need for orchiectomy as part of the surgical informed consent.[17,33,51-53] A transscrotal surgical approach is typically used to deliver the affected testicle into the operative field[20,54,55] *(Figure 3)*. Detorsion of the affected spermatic cord is performed until no twists are visible, and testicular viability has been assessed.

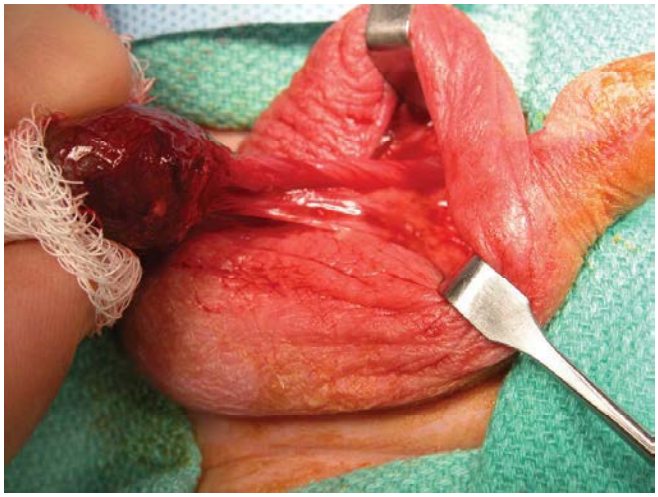

Figure 3. Torsed testicle with twisting of the spermatic cord visualized.

Orchiectomy is performed if the affected testicle appears grossly necrotic or nonviable. Orchiectomy rates vary widely in the literature, typically ranging from 39% to 71% in most series.[33,56,57] Age and prolonged time to definitive treatment have been identified as risk factors for orchiectomy.[51,52] The rate of testicular loss can approach 100% in cases where the diagnosis is missed, emphasizing the necessity of maintaining a high index of suspicion for torsion in males presenting with scrotal pain.[52] If the affected testicle is deemed viable, orchiopexy with permanent suture should be performed to permanently fix the testicle within the scrotum.[58]

Contralateral orchiopexy should be performed regardless of the viability of the affected testicle.[59] The bell-clapper deformity that increases testicular mobility and, therefore, the risk of torsion, is bilateral in up to 80% of patients.[14] It is assumed to be present contralaterally in all patients with testicular torsion.[26,51,53]

Data Sources: Literature searches were performed in PubMed, using various combinations of the search terms testicular torsion, imaging, spermatic cord, physical exam, acute scrotum, orchiectomy, testicular function, and emergency. Search dates: November 2010, December 2010, November 2011, and July 2013.

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Factors Influencing Rate of Testicular Salvage in Acute Testicular Torsion at a Tertiary Pediatric Center

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Introduction: Studies have demonstrated that variables other than duration of symptoms can affect outcomes in children with acute testicular torsion. We examined demographic and logistical factors, including inter-hospital transfer, which may affect outcomes at a tertiary pediatric referral center.

Methods: We reviewed charts of all pediatric patients with acute testicular torsion during a five-year period. Data were collected regarding age, insurance type, socioeconomic status, duration of symptoms prior to presentation, transfer status, time of day, time to surgical exploration, and testicular salvage.

Results: Our study included 114 patients. Testicular salvage was possible in 55.3% of patients. Thirty-one percent of patients included in the study were transferred from another facility. Inter-hospital transfer did not affect testicular salvage rate. Time to surgery and duration of pain were higher among patients who underwent orchiectomy versus orchidopexy. Patients older than eight years of age were more likely to undergo orchidopexy than those younger than eight (61.5% vs. 30.4%, p=0.01). Ethnicity, insurance type, or time of day did not affect the testicular salvage rates. On multivariate analysis, only duration of symptoms less than six hours predicted testicular salvage (OR 22.5, p<0.001).

Conclusion: Even though inter-hospital transfer delays definitive surgical management, it may not affect testicular salvage rates. Time to presentation is the most important factor in predicting outcomes in children with acute testicular torsion. [West J Emerg Med. 2015;16(1):190–194.]

INTRODUCTION

The management of the acute scrotum in pediatric patients can be challenging. In a patient with acute testicular torsion, a delay in presentation, diagnosis, or definitive management may result in poor outcomes such as loss of the affected testis. Previous studies have demonstrated that a number of variables can affect testicular salvage, including symptom duration, insurance type, and race.[1-3] Age has been shown to negatively impact testicular salvage in some studies,[4] while other series show a positive correlation with age and testicular salvage.[1-3]

In geographic areas where pediatric specialty care is unavailable, children may be transferred to tertiary care centers for emergent conditions. Reasons for transferring a pediatric patient for acute scrotum may include lack of availability of pediatric urologists or anesthesiologists, lack of appropriate diagnostic modalities, patient preference, insurance status, or other explanations. Transfer from one hospital to another inherently delays definitive management and may ultimately affect outcome.

The aim of this study was to examine the cohort of patients seen at a tertiary pediatric referral center, comparing patients who presented primarily to our facility to those who