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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.<sup>1–4</sup> 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.<sup>5</sup> In 2012–13 in England, 2753 patients with a mean age of 16 years were admitted to hospitals with testicular torsion.<sup>6</sup> 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<sup>7</sup> (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.<sup>8</sup> 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 torqued it can result in pain secondary to ischaemia of the cyst. A torqued testicular appendage (cyst of Morgagni) most commonly occurs in prepubertal boys.

**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 "torsed 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.<sup>9</sup> 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,<sup>10</sup> 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.<sup>11</sup>

### 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).<sup>8</sup> 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 haematocoele—testicular rupture, whereby the fibrous covering of the testis (tunica albuginea) can be breached—or a haematoma.

### Referred pain

An inguinal 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.<sup>12</sup> 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.<sup>13</sup> 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.<sup>14</sup> 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.<sup>8</sup>

## 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.<sup>15</sup>

## 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.<sup>8</sup> 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 relieves 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 discolouration 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.<sup>14</sup> 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.<sup>8</sup> 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.<sup>16</sup>

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*.<sup>17</sup>

**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.<sup>18</sup> 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 orchectomy was high, occurring in 41.9% of boys undergoing surgery for torsion.<sup>19</sup> 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.<sup>18</sup> 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.<sup>17</sup> 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<sup>17</sup>***Epididymo-orchitis likely secondary to sexually transmitted infection*

Where *Neisseria gonorrhoeae* is unlikely:

Doxycycline 100 mg twice daily for 10-14 days or

Ofloxacin 200 mg twice daily for 14 days

Where *N gonorrhoeae* is suspected:

Ceftriaxone 500 mg intramuscularly\* 1 dose and

Doxycycline 100 mg twice daily for 10-14 days

*Epididymo-orchitis likely secondary to urinary tract infection†*

- Ofloxacin 200 mg twice daily for 14 days or

- Ciprofloxacin 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.

**Contributors:** MTJ, AG, and ACC wrote the article. MTJ is the guarantor. AP critically commented on the article. All authors agreed the final version.

**Competing interests:** We have read and understood the BMJ policy on declaration of interests and declare the following: none.

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**Cite this as:** *BMJ* 2015;350:h1563

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**Additional educational resources***Resources for healthcare professionals*

European Association of Urology ([www.uroweb.org/guidelines/online-guidelines/](http://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](http://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/](http://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**

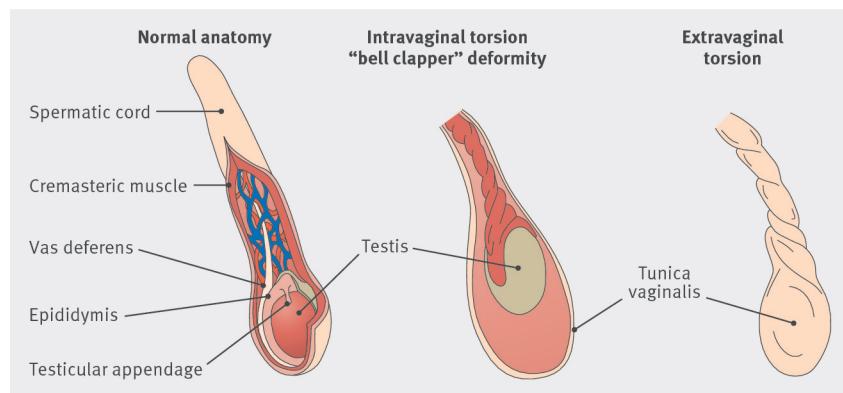
Clinical feature	Testicular torsion	Torsion of testicular appendage	Epididymo-orchitis
Age	Neonates and post-pubertal	Prepubertal	Post-pubertal (sexually active)
Onset of symptoms	Acute	Subacute	Subacute
Site of maximal tenderness	Diffuse	Upper pole	Epididymis
Cremasteric reflex	Absent	Present	Present
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<sup>12</sup>**

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](http://www.clinicalscience.org.uk)