



The painful scrotum: an ultrasonographical approach to diagnosis

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ABSTRACT

Many disease processes, including inflammation, testicular torsion, testicular trauma, and testicular cancer, may have a similar clinical presentation as a painful scrotum. Differentiation of these disease processes is important for proper management. High-resolution ultrasonography (US) combined with colour Doppler ultrasonography (CDUS) is the imaging modality of choice in evaluating these patients. Gray-scale US helps to better characterise scrotal lesions. CDUS demonstrates testicular perfusion which aids in reaching a specific diagnosis. This pictorial essay is intended to review the causes, US appearances of disease processes causing the painful scrotum, and examination pitfalls of scrotal US.

Keywords: epididymitis, orchitis, scrotal abnormalities, testicular torsion, testicular trauma, testicular neoplasms, ultrasonography

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INTRODUCTION

Acute scrotal pain is important from a clinical standpoint because of numerous aetiologies, including inflammatory processes, testicular torsion, testicular rupture, and testicular cancer. Prompt diagnosis is required to differentiate surgically-correctable lesions from abnormalities that can be adequately treated by medical therapy alone. Clinical symptoms and physical examination are often not enough for definite diagnosis due to pain and swelling that limit an accurate palpation of the scrotal contents.

High-resolution ultrasonography (US) combined with colour Doppler ultrasonography (CDUS) facilitates the simultaneous assessment of anatomical information and perfusion changes in many scrotal abnormalities⁽¹⁻³⁾. Familiarity with US features of the scrotal disorders causing a painful scrotum is crucial for making the correct diagnosis and providing proper management. This pictorial essay is intended to review the causes, US appearances of disease processes

causing the painful scrotum, and examination pitfalls of scrotal US.

TESTICULAR TORSION

Testicular torsion results in severe ischaemia of the testis. Patients present with acute scrotal pain that is difficult to differentiate from epididymo-orchitis. It commonly occurs at puberty, although there is also a peak during the neonatal period. The onset of symptoms is usually spontaneous but may follow trauma. There are two types of torsion, namely: extravaginal and intravaginal. Extravaginal torsion occurs in the neonates and infants, due to the loose attachment of the testis and spermatic cord to the scrotum. Therefore, the entire cord above the level of the scrotum may undergo torsion.

Intravaginal torsion occurs at puberty and is usually associated with an abnormal development of the tunica vaginalis. This abnormality is called "bell-clapper" deformity, in which the tunica vaginalis completely covers the epididymis and testis. In this condition, fixation of the testis to the posterior wall of the scrotum is incomplete. The testis is free to fall forward and rotate in the tunica vaginalis, much like a clapper inside a bell. This deformity is usually bilateral and requires bilateral orchiopexy⁽¹⁻⁴⁾.

Rapid diagnosis is important in order to salvage a viable testis with prompt surgery. The testicular salvage rate is 80% to 100% if surgery is performed within 5 to 6 hours, but the rate decreases to approximately 20% if detorsion is performed after 12 hours after the onset of symptoms⁽⁵⁾. Complete testicular ischaemia lasting longer than 24 hours results in irreversible infarction, which is known as "missed torsion". If torsion persists for more than 10 days, it is termed "chronic torsion"⁽¹⁾.

US appearances of testicular torsion are variable, depending on the duration of torsion. In the first few hours, the testis often appears normal. After 4 hours, the testis is enlarged with diffuse hypoechoogenicity. As time passes, a heterogeneously-echoic testis is seen because of haemorrhage and necrosis. The swollen epididymis is also seen because the deferential

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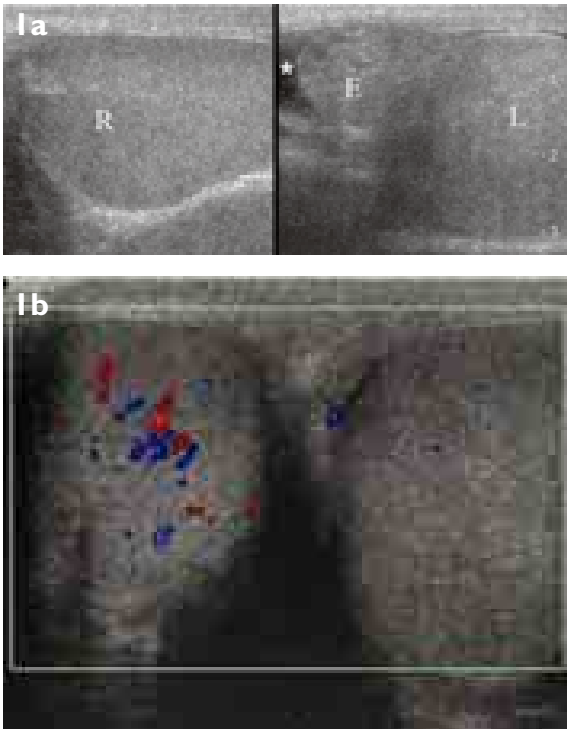


Fig. 1 Acute torsion. 16-year-old boy who presented with left scrotal pain for four hours. (a) Longitudinal US image of the scrotum shows an enlarged heterogeneously-hypoechoic left epididymis (E) and testis (L). The right testis (R) is normal. Minimal left hydrocoele is seen as an anechoic area (*). (b) CDUS image shows normal vascular flow in the right testis and markedly reduced vascular flow in the left testis.

artery supplying the epididymis is often involved in the torsion. Reactive hydrocoele and thickening of scrotal skin are also seen. These findings are similar to epididymo-orchitis but their CDUS appearances are different. Flow within the torsed testis is reduced or absent (Fig. 1) but flow within the inflamed testis is increased. The contralateral testis is used as a control.

In missed torsion, lack of intratesticular flow and increase of blood flow in the peritesticular tissues (Fig. 2) are seen⁽¹⁻⁶⁾. Radionuclide scintigraphy had been used to assess perfusion of the scrotal contents until the development of CDUS. CDUS can be rapidly performed, and is reliable in differentiating torsion from epididymo-orchitis. CDUS has been found to be 86% sensitive, 100% specific, and 97% accurate in diagnosis of testicular torsion⁽⁷⁾. In chronic torsion, the testis becomes small and hypoechoic (Fig. 3).

Important pitfalls in the diagnosis of testicular torsion are incomplete torsion and spontaneous detorsion^(1,3,6,8). Patients with incomplete torsion (rotation less than 360°) have complete venous obstruction but arterial flow is still detected. Hence, the presence of Doppler signal in a patient with clinical suggestion of testicular torsion does not exclude torsion. In these patients, spectral Doppler US analysis shows the high resistive index with

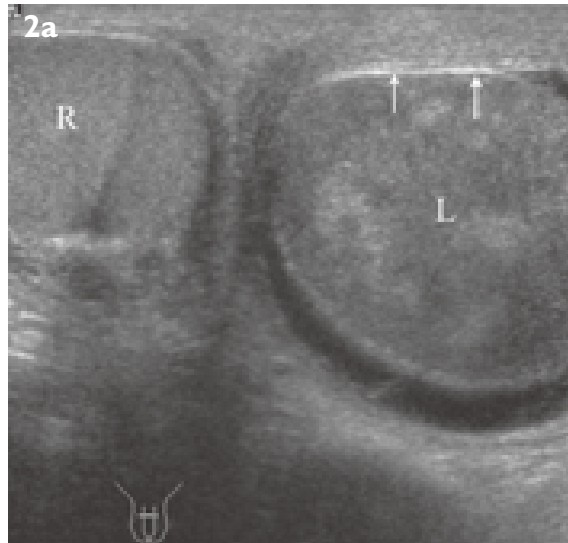


Fig. 2 Missed torsion. 15-year-old boy who presented with left scrotal pain for 10 days. (a) Transverse US image of the scrotum shows an enlarged inhomogeneously-hypoechoic left testis (L) compared to the normal right testis (R). There is left scrotal skin thickening and a hydrocoele. (b) CDUS image shows normal vascular flow in the right testis and absent vascular flow in the left testis but increased peritesticular flow. (c) At operation, the spermatic cord was twisted and the testis was infarcted.

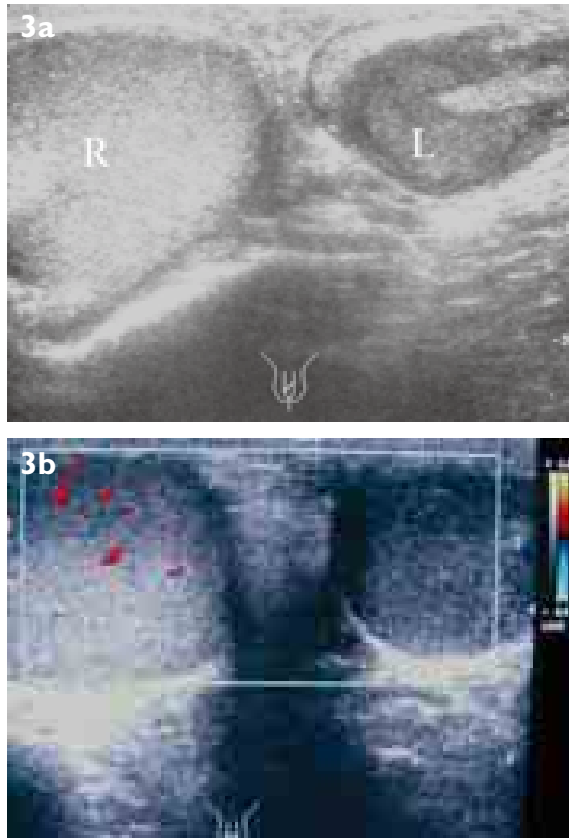


Fig. 3 Chronic torsion. 21-year-old-man who presented with left scrotal pain for many months. (a) Transverse US image of the scrotum shows a normal right testis (R) and a small hypoechoic left testis (L). (b) CDUS image shows normal vascular flow to the right testis and no vascular flow to the small left testis.

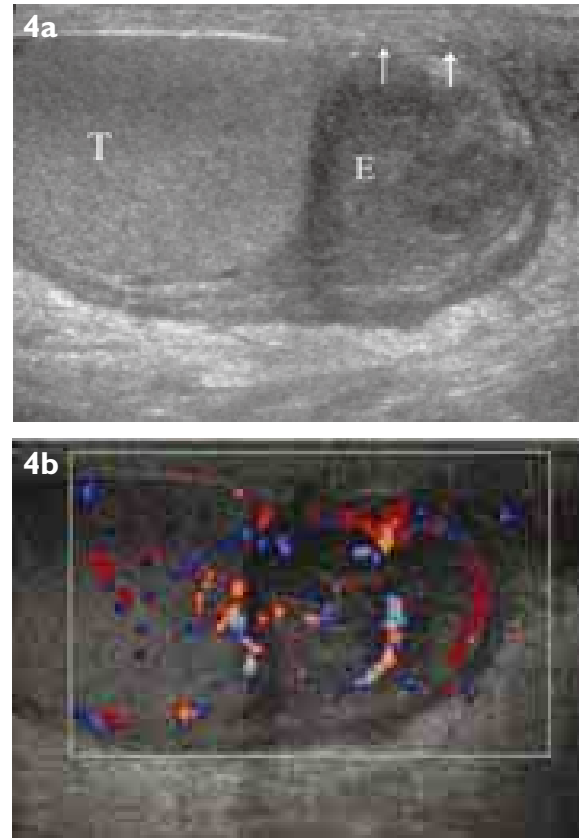


Fig. 4 Epididymitis. 35-year-old-man who presented with left scrotal pain and fever for many days. (a) Longitudinal US image of the left hemiscrotum shows a testis of normal size and echogenicity (T) and a markedly-enlarged tail of the epididymis (E) with inhomogeneous hypoechoogenicity. Note the thickening of the overlying scrotal skin (arrows). (b) CDUS image shows increased vascular flow in the epididymis.

decreased diastolic flow or diastolic flow reversal. A testis with spontaneous detorsion may be hyperemic, simulating epididymo-orchitis. Diagnosis of spontaneous detorsion should be considered in a patient with acute scrotal pain and resolves spontaneously with hyperaemia of the testis.

INFLAMMATION

Bacterial epididymitis and epididymo-orchitis are the most common causes of acute scrotal pain in adults. Common causative organisms include *Neisseria gonorrhoeae*, *Chlamydia trachomatis*, or *Escherichia coli*. Initially, the inflammation affects the epididymis, and then spreads to the testis, scrotal sac and scrotal wall. Isolated orchitis without epididymitis is rare, but may occur as a complication of mumps infection^(1,2).

Patients present with fever, dysuria and a painful scrotal enlargement. The onset of pain is usually insidious. The clinical history and physical examination are usually diagnostic in typical cases. When the testes are elevated over the pubic symphysis (Prehn sign), scrotal pain associated with epididymitis is usually relieved. Scrotal pain caused by torsion will not be lessened with this manoeuvre⁽⁶⁾. However,

differentiation of testicular torsion from acute epididymitis may not be possible in many cases. CDUS is extremely helpful in resolving these clinical dilemmas.

The gray-scale US finding of acute epididymitis is enlargement of the epididymis with hypoechoogenicity (Fig. 4a). The epididymis may be focally or diffusely involved. The echogenicity of the epididymis may be increased in the chronic stage. There is often associated reactive hydrocoele and scrotal skin thickening. When orchitis is also present, the testis appears enlarged with decreased echogenicity (Fig. 5a). The gray-scale US findings of acute epididymo-orchitis are nonspecific and difficult to differentiate from testicular torsion.

CDUS is helpful to demonstrate blood flow within the epididymis and testis. The inflamed epididymis and testis display increased flow (Figs. 4b & 5b), whereas testicular torsion will display decreased flow. Advanced or untreated cases of epididymo-orchitis may result in abscess formation and pyocele (Fig. 6). An abscess is seen as a focal area of complex hypoechoogenicity (Fig.7). It may be difficult to differentiate focal orchitis or abscess from

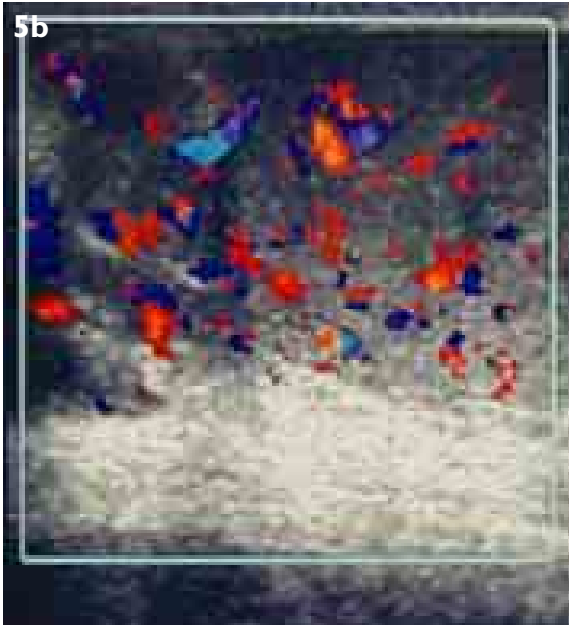
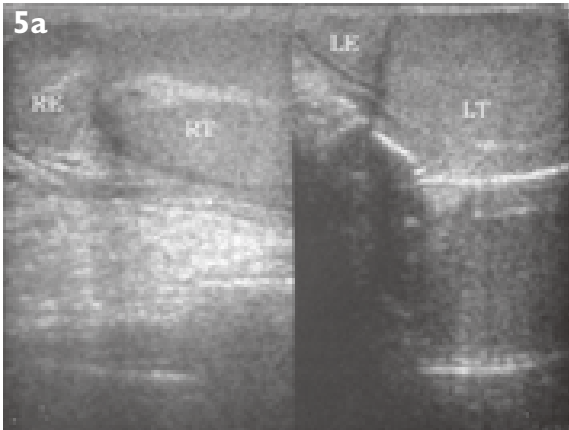


Fig. 5 Epididymo-orchitis. 42-year-old man who presented with right scrotal pain and fever for one week. (a) Longitudinal US image of the scrotum shows an enlarged homogeneously-hypoechoic right epididymis (RE) and testis (RT). The left epididymis (LE) and testis (LT) are of normal size and echogenicity. Note that the right scrotal skin is thicker than the left side. (b) CDUS image shows increased vascular flow in the epididymis and testis.

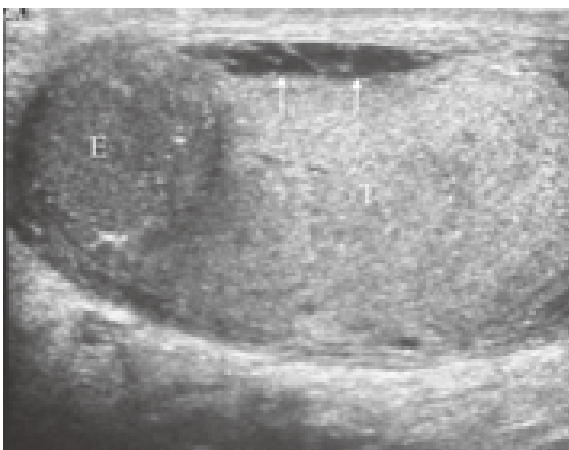


Fig. 6 Epididymo-orchitis with epididymal abscess and pyocoele. 33-year-old man who presented with right scrotal pain and fever for one week. Longitudinal US image of the right hemiscrotum shows an enlarged inhomogeneously-hypoechoic epididymis (E), enlarged inhomogeneously-hypoechoic testis (T) and pyocoele (arrows).

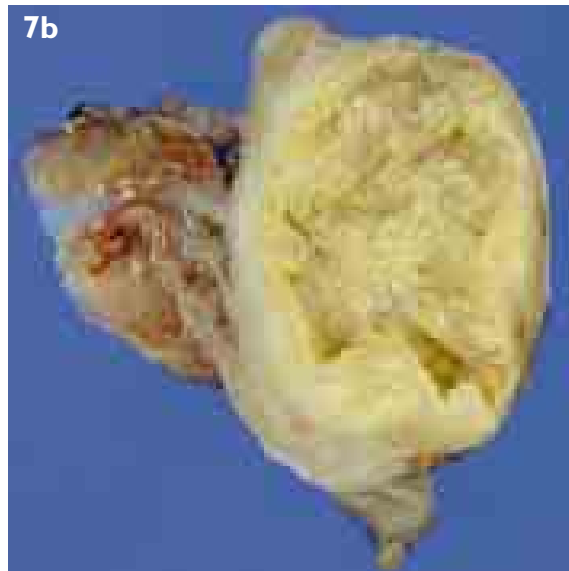
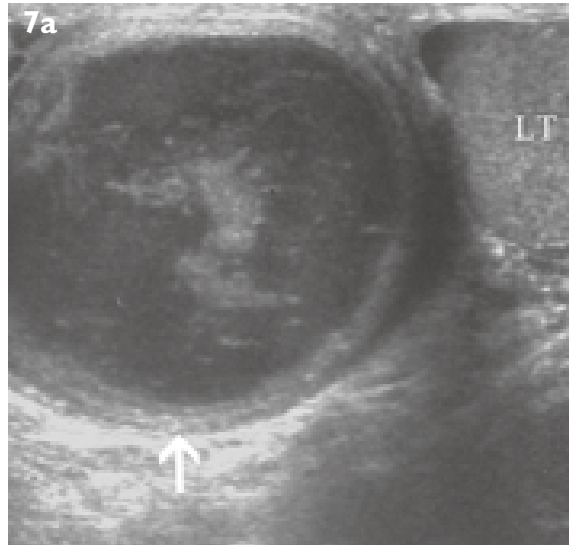


Fig. 7 Testicular abscess. 42-year-old man with HIV positivity who presented with a right scrotal pain and fever for two weeks. (a) Transverse US image of the scrotum shows a markedly enlarged inhomogeneously-hypoechoic right testis (arrow) and a normal left testis (LT). The right scrotal skin is thickened. (b) Photograph of the resected right testis shows destruction of all normal testicular tissue.

testicular tumour. Associated epididymal involvement and scrotal skin thickening are suggestive of infection rather than tumour.

CDUS may not be helpful in distinguishing orchitis from cancer because hypervascularity, compared with normal testicular tissue, can be observed in both diseases, particularly when the tumour is larger than 1.6 cm^(2,9). A severe epididymo-orchitis can cause ischaemia of the testis by extrinsic compression of the testicular vascular supply, leading to an erroneous diagnosis of testicular torsion. However, CDUS is helpful in detecting a compromised vascular supply and therefore suggest the need for surgical intervention.

Occasionally, infection of the scrotal wall occurs. It may be a complication of epididymo-orchitis (Fig. 8)

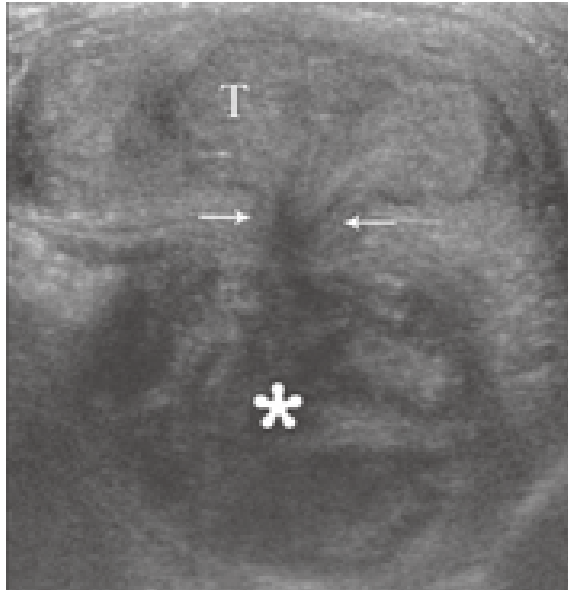


Fig. 8 Epididymo-orchitis with testicular and scrotal wall abscesses. 45-year-old man who presented with left scrotal pain and fever for one month. Longitudinal US image of the left hemiscrotum shows an enlarged inhomogeneously-echogenic testis and an inhomogeneously-hypoechoic tract (arrows) protruding from a testicular abscess (T) to form a scrotal wall abscess (*). The testis has lost its well-defined margin.

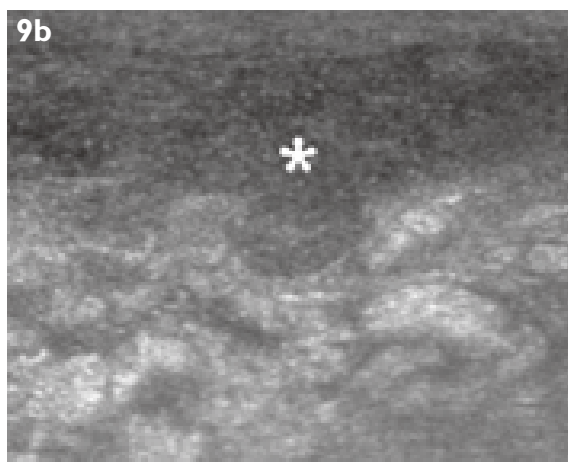
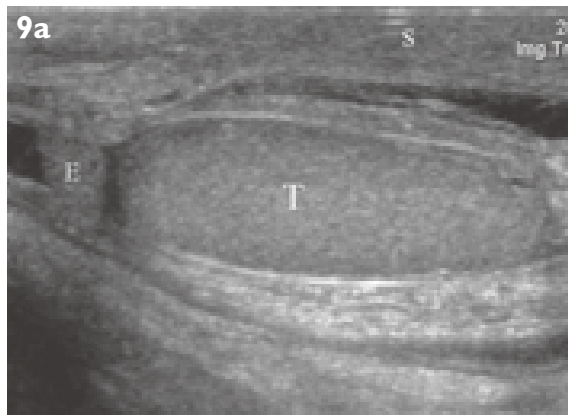


Fig. 9 Scrotal wall abscess from skin infection. 58-year-old man who presented with scrotal skin abrasion, pain and fever for one week. (a) Longitudinal US image of the left hemiscrotum shows a normal sized epididymis (E) and testis (T). The scrotal skin (S) is thickened. (b) Transverse US image taken at the lower part of the scrotum shows a markedly thickened scrotal wall with complex echogenicity of an abscess (*).

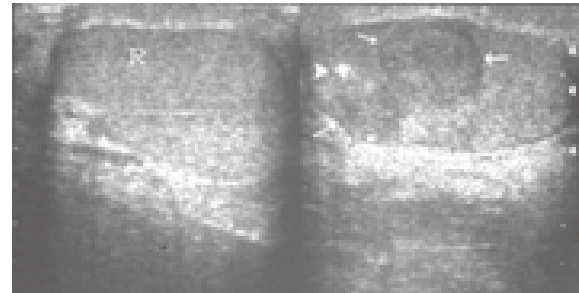


Fig. 10 Mixed germ cell tumour. 17-year-old man who presented with left scrotal pain for 3 days. Longitudinal US image of the scrotum shows a normal right testis (R), a lobulated inhomogeneously-echogenic mass (arrows) in the left testis with calcification (arrowhead). Note that the scrotal skin is normal on both sides.

or may result from infection or trauma to the scrotum that extends deep to the skin (Fig. 9). US is helpful to delineate swelling of the scrotal wall and helps diagnose or exclude inflammation of the epididymis or testis. In rare cases, gas bubbles may be present in the abscess cavity, appearing as an area of focal hyperechogenicity with posterior shadowing.

TESTICULAR TUMOUR

Testicular tumours account for approximately 1% of all malignant neoplasms in men. They can be classified into germ cell and non-germ cell tumours. Germ cell tumours include seminoma, embryonal cell carcinoma, choriocarcinoma, teratoma, and yolk sac tumours. They can be single or mixed cell type, and constitute approximately 95% of testicular tumours. Most patients present with a painless scrotal mass. Approximately 10% of the patients may present with acute scrotal pain due to haemorrhage or necrosis of the tumours, and may therefore mimic testicular torsion or epididymo-orchitis^(2,5,6).

On US, a testicular tumour appears as a focal or diffuse area of hypoechogenicity in an enlarged testis. Haemorrhage and necrosis in the tumour result in an area of heterogeneous echogenicity. Other benign intra-testicular lesions, including infarct, haematoma, abscess and orchitis, also appear as a hypoechoic lesion. The lack of epididymal enlargement and thickening of scrotal skin are suggestive of tumour rather than infection (Fig. 10).

SCROTAL TRAUMA

Scrotal trauma is not uncommon and usually results from motor vehicle accident, athletic injury, and direct perineal injury with compression of scrotum against pubic bone or a straddle injury. Trauma results in contusion, haematoma, fracture or rupture of the testis. Prompt diagnosis of testicular rupture is important because the surgical testicular salvage rate drops from approximately 90% to 45% after

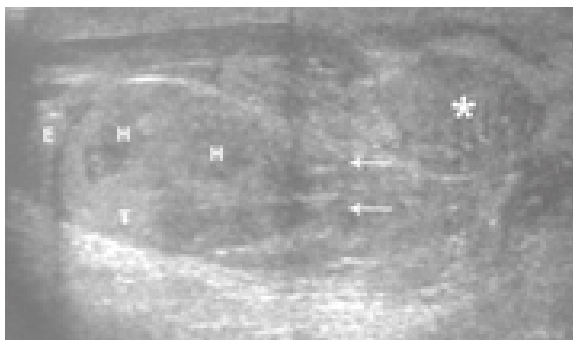


Fig. 11 Ruptured testis. 29-year-old man who had blunt trauma to the scrotum. Longitudinal US image of the right hemiscrotum shows an abnormally-shaped testis (T) with loss of definition of the lower border of the testis, multiple intratesticular haematomas (H), and scrotal haematoma (*).

72 hours. Untreated testicular injuries may result in ischaemic atrophy, chronic pain, or secondary infection^(3,6,8).

US is useful for evaluating testicular rupture. An irregular or indistinct testicular contour indicates a break in tunica albuginea and is suggestive of a testicular rupture (Fig. 11). A discrete fracture plane of the testis is the most common specific finding for testicular rupture but it is seen in only 17% of cases⁽¹⁰⁾. Haematocoeles are common after scrotal trauma but are nonspecific for testicular rupture. They can be seen with less severe forms of scrotal trauma.

Haematomas can be seen in the epididymis, testis and scrotal wall. US appearances of haematomas vary with time. Acute haematomas are hyperechoic and subsequently become hypoechoic. If the haematocoele and scrotal haematoma are large, they may displace the testis from the usual US field-of-view. If a thorough examination is not performed, it may lead to an erroneous diagnosis of ruptured testis. On the other hand, in cases of a less severe injury, US demonstrates an intact testis, and surgical exploration can thus be avoided.

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Multiple Choice Questions (Code SMJ 200507A)

	True	False
Question 1. The following conditions are causes of painful scrotum:		
(a) Testicular torsion.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Varicocele.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Epididymo-orchitis.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Tumor necrosis and hemorrhage.	<input type="checkbox"/>	<input type="checkbox"/>
Question 2. Concerning testicular torsion:		
(a) Extravaginal torsion is common in neonates.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Intravaginal torsion is common at puberty.	<input type="checkbox"/>	<input type="checkbox"/>
(c) The so-called 'bell-clapper anomaly' is associated with both intra- and extravaginal torsion.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Testicular salvage rate is almost 100% if surgery is performed between 12 and 24 hours.	<input type="checkbox"/>	<input type="checkbox"/>
Question 3. The following statements are correct:		
(a) Epididymitis and epididymo-orchitis are the most common cause of scrotal pain in adults.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Gray-scale US appearances of epididymo-orchitis and torsion are easily differentiated.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Isolated orchitis is more common than bacterial infection.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Severe epididymo-orchitis can cause ischemia of the testis.	<input type="checkbox"/>	<input type="checkbox"/>
Question 4. Concerning scrotal trauma:		
(a) Inhomogeneous testicular echoes indicate testicular fracture.	<input type="checkbox"/>	<input type="checkbox"/>
(b) The presence of haematocoele is pathognomonic for testicular fracture.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Untreated testicular injury may result in ischemic atrophy and chronic pain.	<input type="checkbox"/>	<input type="checkbox"/>
(d) US appearances of haematoma vary with times.	<input type="checkbox"/>	<input type="checkbox"/>
Question 5. The following statements are correct:		
(a) Scrotal wall abscess may result from skin infection or extension from epididymitis.	<input type="checkbox"/>	<input type="checkbox"/>
(b) Gas is seen as hyperechoic.	<input type="checkbox"/>	<input type="checkbox"/>
(c) Radionuclide scintigraphy can be used to assess testicular perfusion.	<input type="checkbox"/>	<input type="checkbox"/>
(d) Intratesticular flow is increased in case of missed torsion.	<input type="checkbox"/>	<input type="checkbox"/>

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