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CME Article

Painless scrotal swelling: ultrasonographical features with pathological correlation

M Muttarak, B Chaiwun

ABSTRACT

Scrotal swelling may be due to extratesticular and intratesticular lesions. The majority of extratesticular lesions are benign while the majority of intratesticular lesions are malignant. Ultrasonography (US) is helpful in separating extra- from intratesticular lesions. US can show whether a mass is cystic, solid or complex, and also features such as associated calcifications, epididymal involvement, scrotal skin thickening and colour Doppler flow pattern. Extratesticular lesions include hydrocoele, spermatocoele, varicocoele, epididymal cyst, hernia and tumours of the epididymis and cord structures. Intratesticular lesions include primary tumour, metastases, lymphoma and leukaemia. Tuberculous epididymitis or epididymo-orchitis may also present with painless scrotal swelling. US features of these disease patterns, with pathological correlation, are presented in this pictorial essay.

Keywords: scrotum, testis, testicular abnormalities, testicular neoplasms, ultrasonography

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INTRODUCTION

A wide variety of scrotal conditions may cause a painless swelling of the scrotum. However, many of these conditions may appear similar on physical examination. High-resolution ultrasonography (US) is currently the best imaging modality for the evaluation of scrotal pathology. Its ability to determine whether a scrotal mass is extra- or intratesticular is important, since the majority of extratesticular lesions are benign while the majority of intratesticular lesions are malignant (Table I). Additional use of colour Doppler ultrasonography (CDUS) enhances diagnostic accuracy[1,2].

Table I. Classification of extra- and intratesticular lesions.

Extratesticular lesions
– Hydrocoele
– Hernia
– Epididymal cyst and spermatocoele
– Varicocoele
– Tumours of epididymis and cord structures (rare)
Intratesticular lesions
– Primary testicular tumour
– Metastases, lymphoma and leukaemia
– Testicular cysts and epidermoid cysts
Combination of extra- and intratesticular lesions
– Tuberculous epididymo-orchitis

HYDROCOELE AND HERNIA

As a testis descends into the scrotum during foetal life, it slides behind an extension of the peritoneal cavity, the processus vaginalis (Figs. 1a-b). The upper part of the processus vaginalis usually becomes obliterated at or shortly after birth, whereas the lower portion persists as the tunica vaginalis (Fig. 1c). Incomplete obliteration of processus vaginalis results in a congenital hydrocoele (Fig. 1d) or encysted hydrocoele[3] (Fig. 1e). Although this cavity usually closes completely, it remains as a potential mechanical weak point. With straining, it may open and allow the herniation of abdominal contents into the scrotum (Figs. 1f-g).

Hydrocoele is seen on US as an anechoic collection surrounding the testis (Fig. 2). Scattered echoes due to cholesterol or calculi may be seen. Encysted hydrocoele appears as a focal anechoic collection superior to the testis and epididymis[4] (Fig. 3). Intraperitoneal contents, including omentum and bowel, may herniate through a patent processus vaginalis. The loops of bowel with peristaltic movements, and omentum are usually easily recognised during US (Fig. 4).

EPIDIDYMAL CYST AND SPERMATOCOELE

Epididymal cysts contain serous fluid while spermatocoeles contain spermatozoa. Epididymal cysts can occur anywhere within the epididymis but spermatoceles occur in the epididymal head. Both appear as anechoic masses with posterior acoustic

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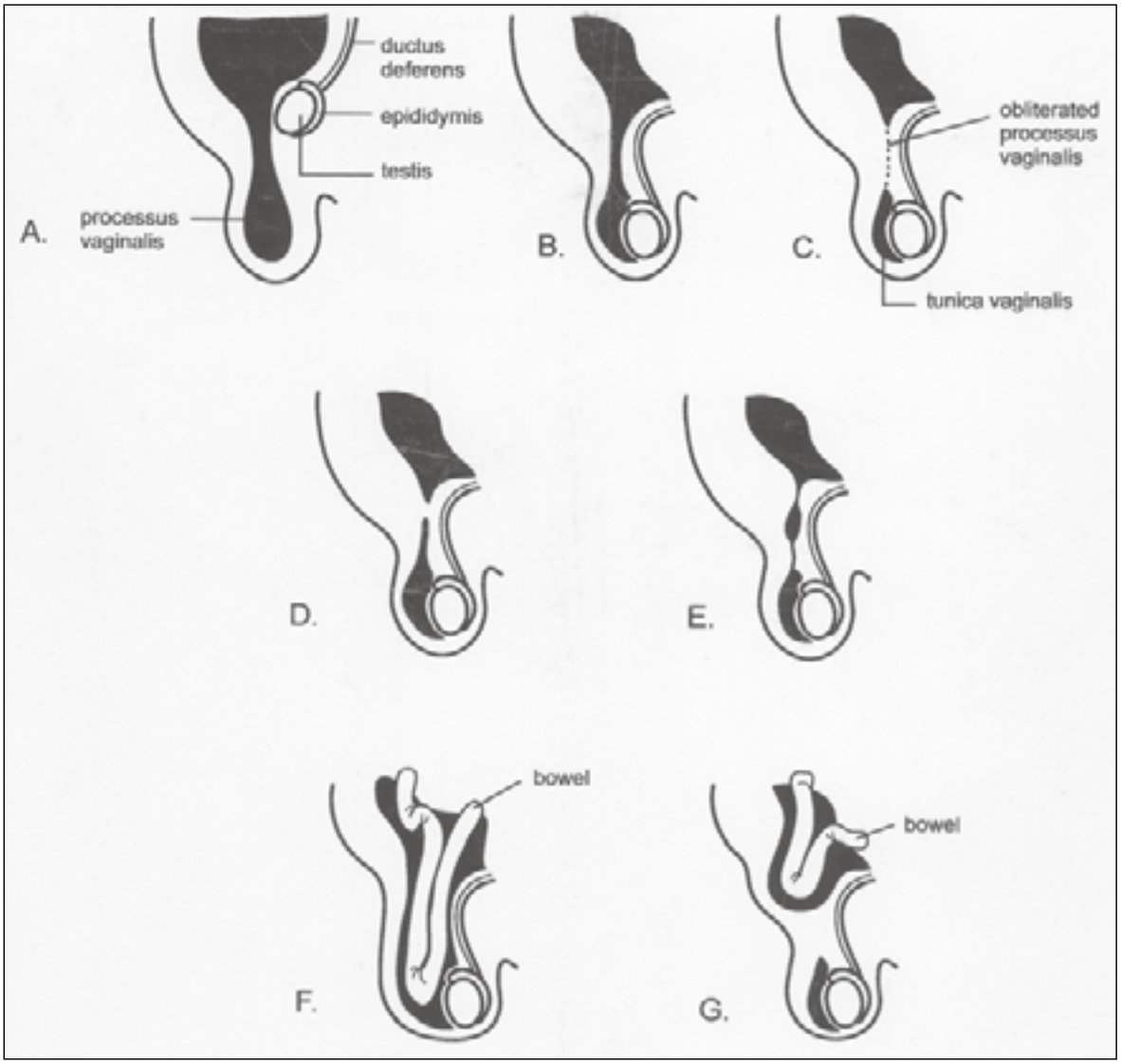


Fig. 1 Diagrams show (a-c) normal development of the processus vaginalis, and various developmental anomalies, (d) hydrocoele, (e) encysted hydrocoele, (f-g) indirect inguinal hernia.

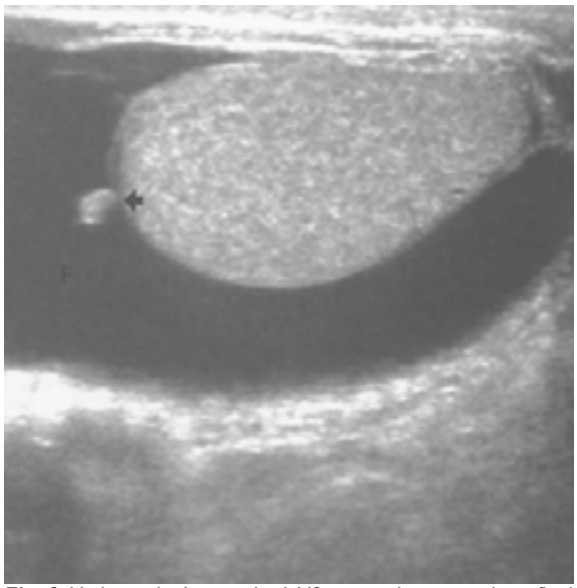
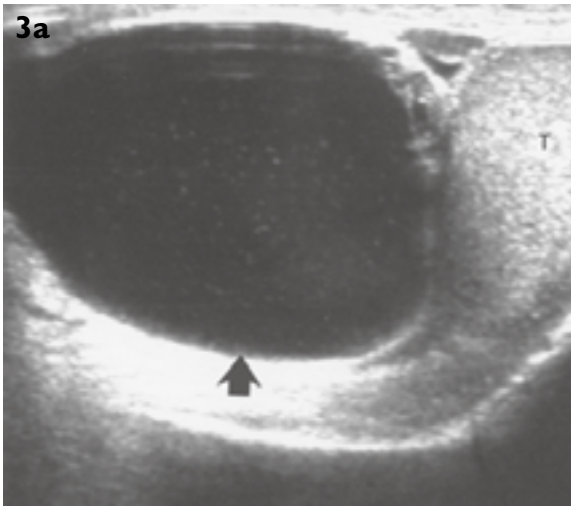


Fig. 2 Hydrocoele. Longitudinal US image shows anechoic fluid (F) surrounding the testis. The appendix testis is seen projecting from the testis (arrow).

enhancement (Fig. 5) and cannot be differentiated from each other[4]. Occasionally, spermatocoeles may have internal echoes due to presence of spermatozoa.

VARICOCOELE

A varicocoele denotes an abnormal dilatation of venous pampiniform plexus, which is the main venous drainage of the testis. It presents in approximately 15% of healthy men, and has been implicated as a cause of infertility. More than 95% of varicocoeles are located on the left side. Bilateral varicocoeles are common in infertile men. Varcicocoeles are seen on grey-scale US as serpentine, tubular, elongated anechoic fluid collections in the spermatic cord, measuring more than 2 mm in diameter. These increase in calibre in a standing position or during a Valsava manoeuvre. CDUS demonstrates flow within the dilated spaces, and is diagnostic of a varicocoele[5] (Fig. 6).



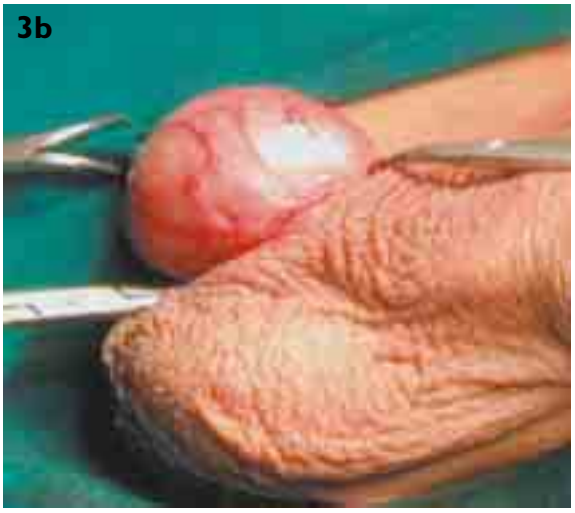


Fig. 3 Encysted hydrocoele of the spermatic cord. (a) Longitudinal US image shows a cystic mass (arrow) superior to and separates from the testis (T). (b) At operation, a cyst was excised.

Fig. 4 Hernia. Longitudinal US image shows loops of bowel (B) with surrounding fluid extending from the inguinal region into the scrotum. This structure was peristaltic (not shown). Associated varicocoele is also seen (arrow).

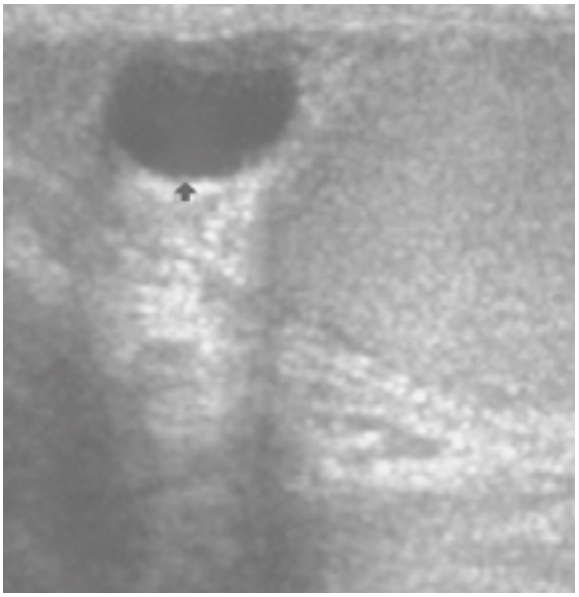
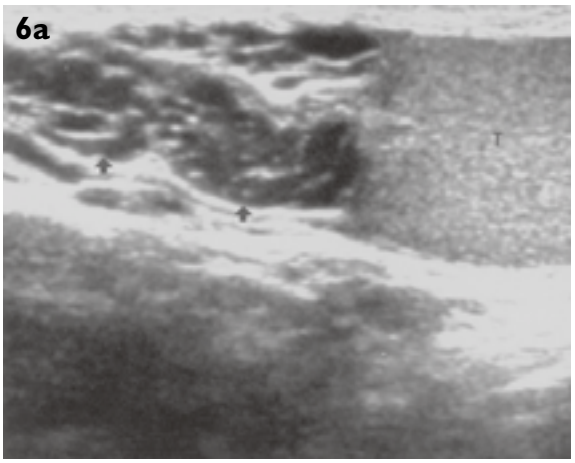


Fig. 5 Epididymal cyst. Longitudinal US image shows an anechoic mass (arrow) within the head of the epididymis.



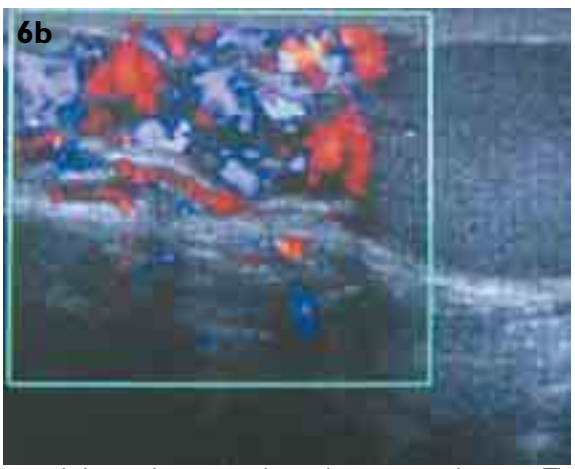


Fig. 6 Varicocoele. (a) Longitudinal US image shows multiple, serpentine, tubular anechoic spaces (arrows) superior to the testis (T). (b) CDUS shows prominent blood flow within these spaces.

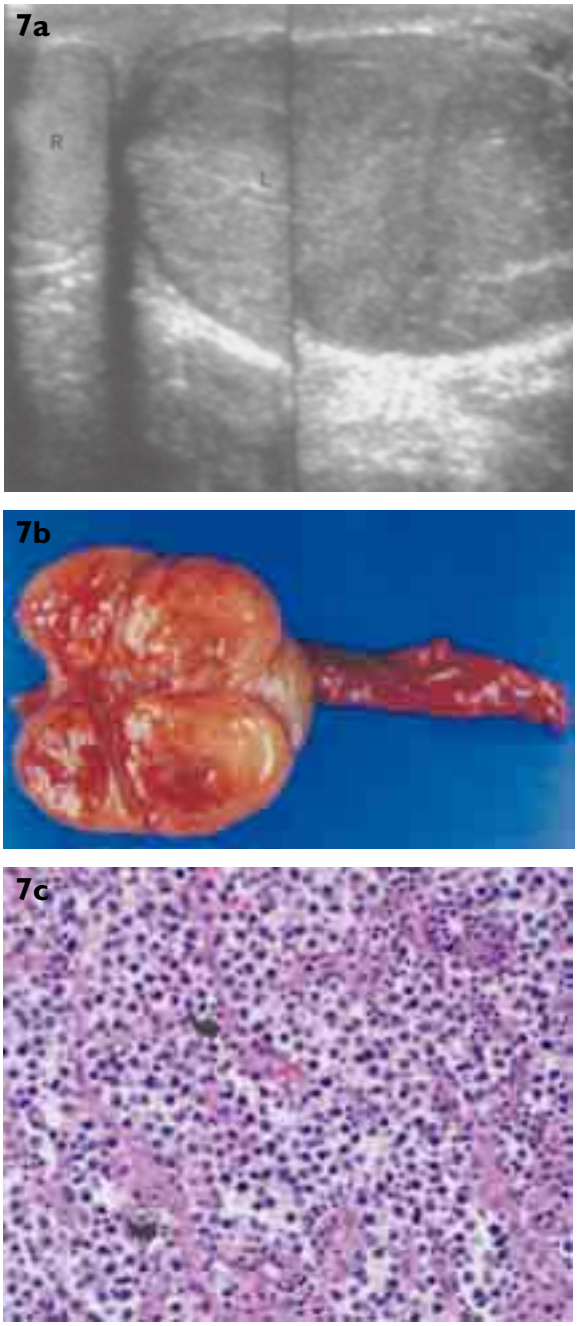


Fig. 7 Seminoma. (a) Longitudinal US image of both hemiscrotums shows a normal right testis (R) and a diffusely-enlarged, hypoechoic left testis (L). Note that the scrotal skin is normal bilaterally. (b) Gross specimen of the resected left testis shows an enlarged testis with a grayish-tan, rather homogeneous cut surface. (c) Photomicrograph shows sheets of uniform tumour cells, characterised by large polygonal cells with enlarged hyperchromatic nuclei and moderate amount of pale cystoplasm. Fibrous septae infiltrated (arrows) by mature lymphocytes are noted (Haematoxylin & eosin, x100).

TUMOURS OF EPIDIDYMIS AND CORD STRUCTURES

Extratesticular tumours are exceeding rare. The most frequently encountered benign epididymal tumour is the adenomatoid tumour, which accounts for approximately 30% of tumours arising from the paratesticular region. It is seen on US as a hypoechoic, isoechoic, or hyperechoic mass. Other rare tumours

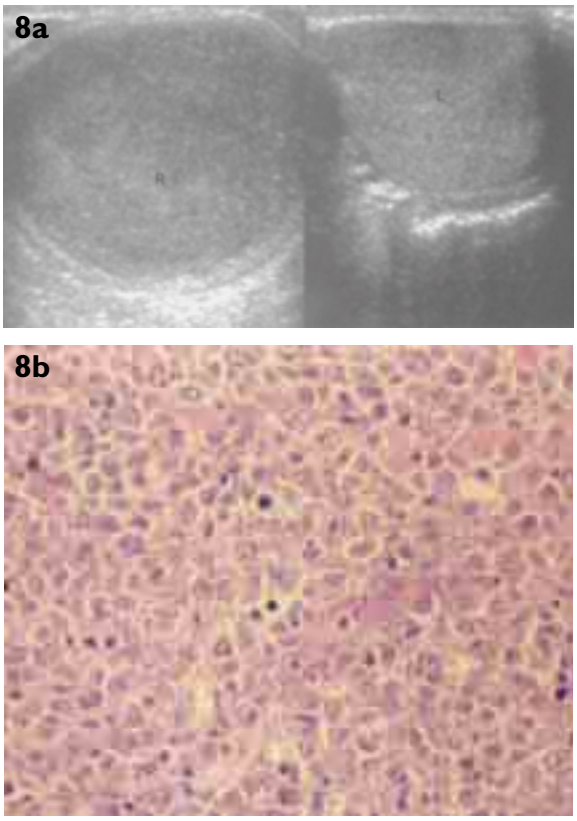


Fig. 8 Lymphoma. (a) Transverse US image of both hemiscrotums shows a diffuse-enlarged hypoechoic right testis (R) and a normal left testis (L). (b) Photomicrograph shows sheets of large round cells with enlarged round hyperchromatic nuceli. The cytoplasm is small in amount (Haematoxyling & eosin, x100).

in the cord include lipoma, leiomyoma, fibroma, adrenal rest, epidermoid inclusion cyst, liposarcoma, and leiomyosarcoma[2,5].

TESTICULAR TUMOURS

Testicular cancer accounts for approximately 1% of all male malignancies. It is common between the ages of 20 and 35 years. Patients usually present with a painless scrotal mass. Infarction or haemorrhage into the tumours may cause sudden painful scrotal swelling which may mimic testicular torsion or epididymo-orchitis. Tumours are classified as primary germ cell tumours, primary non-germ cell tumours, and secondary or metastatic tumours. Germ cell tumours constitute approximately 95% of testicular tumours. Of these, 40% to 50% are seminomas, and an additional 40% have a mixed histological pattern[2,5,6]. Non-germ cell tumours are generally benign. The most two common non-germ cell tumours are Leydig cell tumour and Sertoli cell tumour. The US features of these tumours are nonspecific and cannot be differentiated from germ cell tumours.

The testis is occasionally the site of metastatic lesions from tumours involving the prostate, kidney, lung, gastrointestinal tract, skin, myeloma, plasmacytoma, lymphoma and other primary sites[2,7]. They are commonly seen in men over 50 years of age, and are

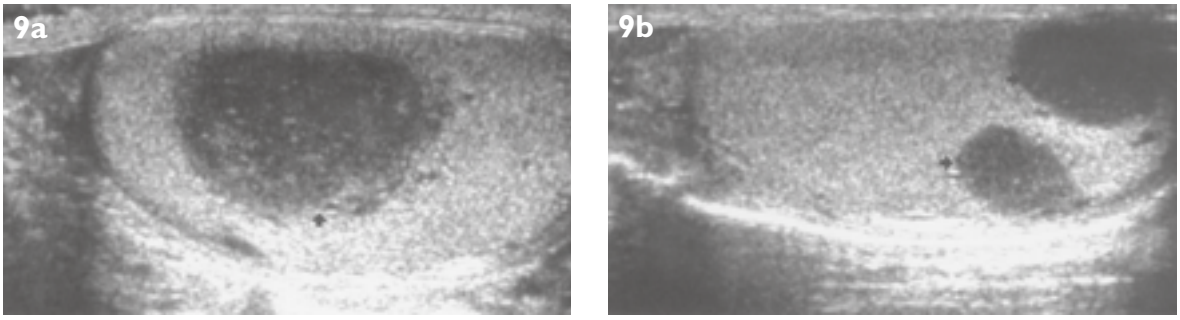


Fig. 9 Multiple myeloma. 43-year-old man with known multiple myeloma presenting with painless scrotal swelling. Longitudinal US images of the (a) right and (b) left testes show multiple circumscribed hyopoechoic masses (arrows).

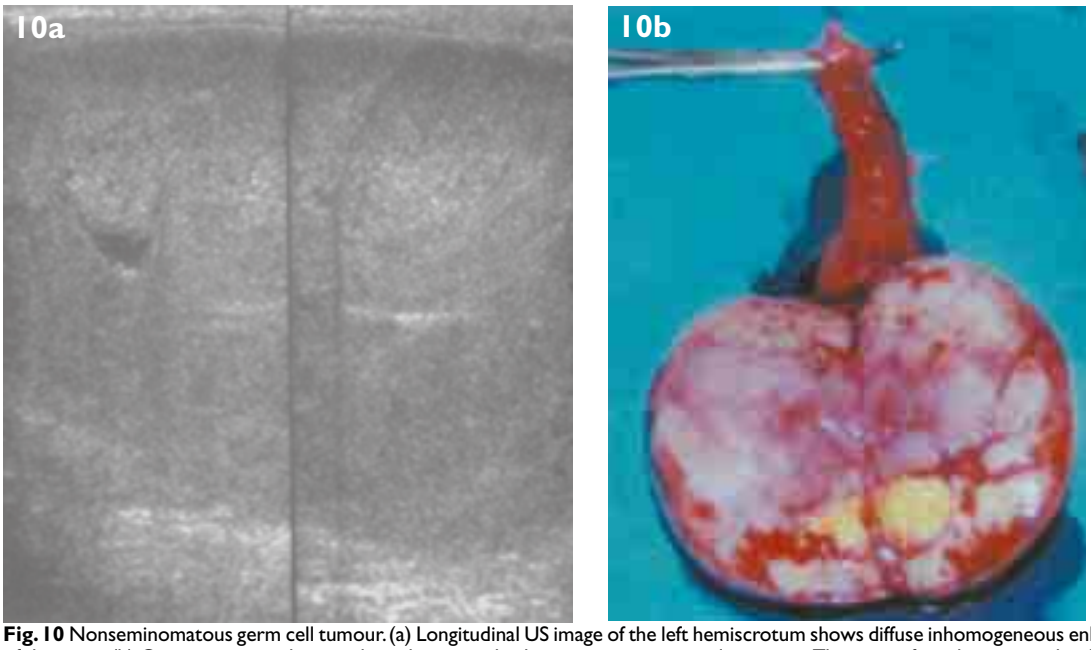


Fig. 10 Nonseminomatous germ cell tumour. (a) Longitudinal US image of the left hemiscrotum shows diffuse inhomogeneous enlargement of the testis. (b) Gross specimen shows enlarged testis with a heterogeneous internal structure. The cut surface shows grayish-white tissue with focal areas of haemorrhage and necrosis. Histology revealed mixed embryonal cell carcinoma and seminoma.

often multiple and bilateral. Testicular lymphoma accounts for 1-7% of all testicular neoplasms. It is the most common testicular tumour in men over the age of 60 years[2,6,8]. It may be primary in the testis without nodal or systemic involvement, or it may be a complication of systemic disease. Approximately 10-25% are bilateral.

On US, testicular tumours are usually hypoechoic compared to normal testicular tissue. However, some features are considered more characteristic of a certain tumour. Seminoma, lymphoma, plasmacytoma, myeloma, and metastases usually present as focal or diffuse areas of homogeneous hypoechogenicity with sharply-demarcated intratesticular borders (Figs. 7-9). Non-seminomatous germ cell tumours and mixed histologic tumours have a heterogeneous echogenicity and less distinct margins (Fig. 10). CDUS shows hypervascularity in the majority of the malignant tumours[2]. Other benign intratesticular lesions such as orchitis, abscess, haematoma and infarct may have similar US findings and differentiation from tumours may be difficult. Associated findings such as enlargement of epididymis, scrotal skin thickening and hydrocoele are suggestive of a benign lesion rather than tumour[1].

TESTICULAR CYSTS AND EPIDERMOID CYSTS

The incidence of testicular cysts ranges from 8% to 10%. There are two types of testicular cysts. The first type is located in the tunica albuginea. These cysts are palpable as masses measuring a few mm in diameter that are located at the periphery of the testis. The second type is intratesticular cysts, which tend to occur near the mediastinum testis. This type is mostly non-palpable. The cause of testicular cysts is usually idiopathic, but they may also form secondary to prior inflammation, surgery or trauma. Cysts appear on US as well-defined anechoic lesions with increased through-transmission[2,6].

Epidermoid cysts, also known as keratocysts, comprise approximately 1% of all testicular tumours. A typical presentation is a painless testicular mass that is incidentally discovered during physical examination. They may result from monodermal development of a teratoma, or alternatively, they may be the result of

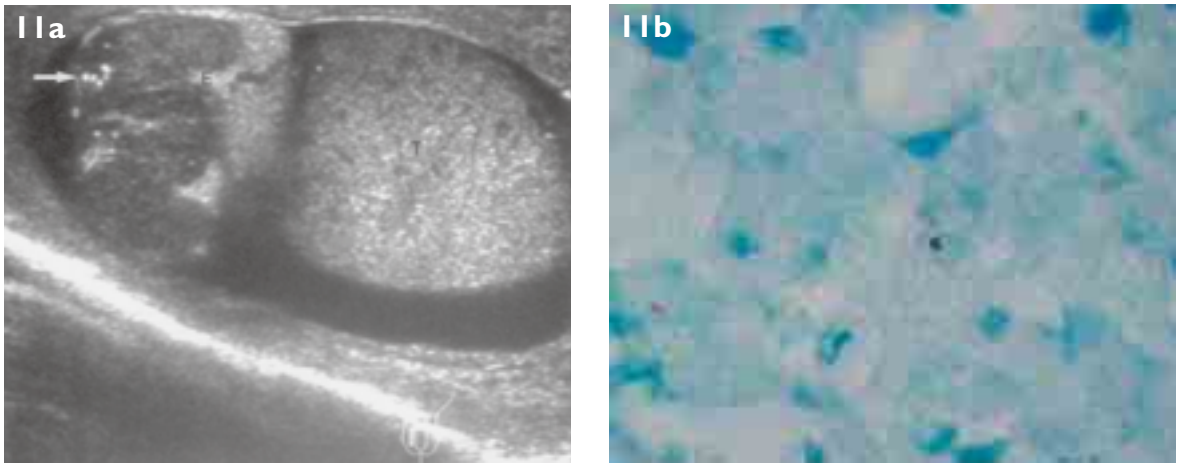


Fig. 11 Tuberculous epididymo-orchitis. (a) Longitudinal US scan of the left hemiscrotum shows an enlarged inhomogeneous epididymis (E) and testis (T) with calcifications (arrow) in the epididymis and a small hydrocoele. (b) Photomicrograph shows acid fast bacillus (arrow) among necrotic material (AFB stain, x500).

squamous metaplasis of surface mesothelium. Currently, the World Health Organisation classifies testicular epidermoid cysts as "tumour-like lesions"[6,9]. The cysts are composed of keratinising, stratified, squamous epithelium with a well-defined fibrous wall. They appear on US as a well-circumscribed mass with a hyperechoic wall that is sometimes calcified. The mass contains concentric rings of alternating hypo- and hyperechogenicity (the so-called "onion-ring" appearance) corresponding to the histological findings of alternating layers of compacted keratin and loosely-arranged desquamated squamous cells[9].

TUBERCULOUS EPIDIDYMO-ORCHITIS

Worldwide tuberculosis (TB) is now becoming the most common opportunistic infection in patients with HIV infection. Reported cases of extrapulmonary TB are increasing, with the genitourinary tract being the most common affected site. TB epididymo-orchitis may present with painless or slightly painful enlargement of the scrotum and can mimic various common conditions such as tumour and bacterial epididymo-orchitis. When clinical features mimic those of a tumour, the diagnosis of TB infection may easily be missed. Initially, infection usually involves the epididymis alone. Secondary involvement of the ipsilateral testis occurs later, especially if the patients do not receive appropriate treatment.

US features of TB epididymo-orchitis include diffusely-enlarged heterogeneously hypoechoic, diffusely-enlarged homogeneously hypoechoic, and nodular enlarged heterogeneously hypoechoic epididymis and testis[10]. Other associated findings suggestive of TB epididymo-orchitis are intrascrotal calcifications and scrotal sinus tract. It is important to differentiate TB epididymitis/epididymo-orchitis from tumour as management differs. Epididymal enlargement and scrotal skin thickening are suggestive of infection rather than tumour[1,10]. Patients with TB epididymitis/epididymo-orchitis usually respond to anti-tuberculous therapy, but surgery may be required in severe cases. TB epididymo-orchitis should be considered, especially if patients are immunocompromised or have TB elsewhere in the body.

CONCLUSION

US is a useful imaging technique for evaluating patients with a painless scrotal swelling. Extratesticular lesions are usually benign, while intratesticular lesions are usually malignant. Intratesticular lesions associated with epididymal enlargement and scrotal skin thickening are suggestive of infection rather than tumour.

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REFERENCES

1. Muttarak M. Anatomy and diseases of the scrotum. J Hong Kong Coll Radiologists 2000; 3:83-93.
2. Dogra VS, Gottlieb RH, Oka M, Rubens DJ. Sonography of the scrotum. Radiology 2003; 227:18-36.
3. O'Rahilly R, Muller F. Human embryology and teratology. 3rd ed. New York, Wiley-Liss, 2001:334-7.
4. Chung SE, Frush DP, Fordham LA. Sonographic appearances of extratesticular fluid and fluid-containing scrotal masses in infants and children: clues to diagnosis. Am J Roentgenol 1999; 173:741-5.
5. Hamm B. Differential diagnosis of scrotal mass. Eur Radiol 1997; 7:668-79.
6. Woodward PJ, Sohaey R, O'Donoghue MJ, Green DE. From the archives of the AFIP: tumors and tumorlike lesions of the testis: radiologic-pathologic correlation. Radiographics 2002; 22:189-216.
7. Entwisle KG, Ayers AB. Imaging of the scrotum and testes. Imaging 1992; 4:107-16.
8. Mazzu D, Jeffrey RB, Ralls PW. Lymphoma and leukemia involving the testicles: findings on gray-scale and color Doppler sonography. Am J Roentgenol 1995; 164:645-7.
9. Leuchtmann PL, Morton AW, Wong-You-Cheong J. Clinical quiz. Applied Radiology 2001; 30:32-4.
10. Muttarak M, Peh WCG, Lojanapiwat B, Chaiwun B. Tuberculous epididymitis and epididymo-orchitis: sonographic appearances. Am J Roentgenol 2001; 176:1459-66.

SINGAPORE MEDICAL COUNCIL CATEGORY 3B CME PROGRAMME

Multiple Choice Questions (Code SMJ 200504B)

	True	False
Question 1. Ultrasonography (US) is the investigation of choice for a scrotal swelling because:		
(a) It is noninvasive.	❑	❑
(b) A definitive diagnosis is difficult on physical examination.	❑	❑
(c) It can differentiate an extratesticular lesion from an intratesticular lesion.	❑	❑
(d) US contrast enhancement is helpful in the differential diagnosis.	❑	❑
Question 2. The following statements are correct:		
(a) The processus vaginalis is an extension of peritoneal cavity.	❑	❑
(b) The processus vaginalis usually becomes obliterated at the 9th month of foetal life.	❑	❑
(c) Incomplete obliteration of the processus vaginalis results in a congenital hydrocoele and hernia.	❑	❑
(d) Tunica vaginalis is a part of processus vaginalis.	❑	❑
Question 3. Regarding varicocoele:		
(a) It is an abnormal dilatation of venous pampiniform plexus.	❑	❑
(b) The calibre of dilated veins increases during a Valsava manoeuvre.	❑	❑
(c) It can cause infertility.	❑	❑
(d) Most of varicocoeles are located on the right side.	❑	❑
Question 4. Concerning testicular tumours:		
(a) Most are malignant.	❑	❑
(b) Seminoma and lymphoma may have similar features on US.	❑	❑
(c) Patients usually present with a painful scrotum due to necrosis and haemorrhage.	❑	❑
(d) The most common primary tumour that metastasises to the testis is osteogenic sarcoma.	❑	❑
Question 5. The following statements are correct:		
(a) The prevalence of tuberculosis (TB) is increasing worldwide due to HIV infection.	❑	❑
(b) Gastrointestinal tract is the most common site of extrapulmonary TB.	❑	❑
(c) Clinically, TB epididymo-orchitis may mimic testicular tumour.	❑	❑
(d) Epididymal involvement and scrotal skin thickening are suggestive of infection rather than tumour.	❑	❑

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Submission instructions:

A. Using this answer form

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2. Indicate your responses by marking the "True" or "False" box ☑
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