BRITISH JOURNAL OF HOSPITAL MEDICINE
MMC Modernising Medical Careers

MODERNISING MEDICAL CAREERS

IN NEXT MONTH'S MMC SUPPLEMENT

Laboratory medicine: a guide for foundation doctors

Time management 1: a guide for the foundation doctor

A guide for junior doctors working in a trauma unit

Ultrasound imaging of the scrotum

Introduction

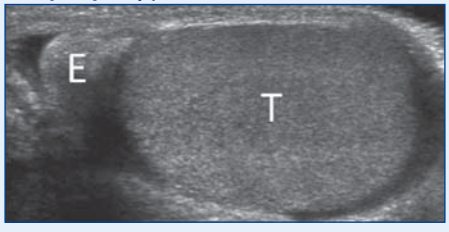
Although there is a wide variety of scrotal pathology, the clinical features are not always particularly discriminatory. These may include pain, generalized swelling or a focal mass. Ultrasound examination of the testes with a high-frequency linear transducer is the primary (and usually the only) diagnostic modality required for evaluation of the testes. This article outlines the technique of scrotal ultrasound and illustrates some of the more common testicular and extratesticular pathologies encountered.

Technique

An intimate examination of this nature should be preceded by some explanation to minimize patient anxiety. The examination begins with the patient in the supine position with the penis resting on the lower abdomen in the anatomical position. It is helpful if the patient provides some gentle traction in a cranial direction to elevate the scrotal contents. A rolled towel can be placed beneath the scrotum for additional comfort. A high frequency linear transducer (10–15 MHz) is used to provide high-resolution grey-scale images (*Figure 1*).

The testes and scrotal contents should be imaged fully in two planes. The size of the testis (approximately 5x3x2 cm is normal in the post-pubertal male) and epididymis should be compared with the contralateral side. The normal mediastinum testis is seen as an echogenic band extending obliquely in a craniocaudal direction within the testis. The normal appendix testis and appendix epididymis (embryonic ductal remnants) are generally only visible in the presence of a hydrocoele. The scrotal contents should also be assessed with colour Doppler and/or power Doppler with parameters optimized for detection of low-flow rates. It is important to compare the grey-scale echotexture and colour Doppler vascularity of both testes in a single transverse ('binocular view').

Figure 1. Longitudinal image of the normal testis (T) and epididymis (E).



Dr Jonathan L Hart *is Specialist Registrar in Radiology,* **Dr Claire Lloyd** *is Specialist Registrar in Radiology,*
Dr Sylwia Niewiarowski *is Specialist Registrar in Radiology and* **Dr Chris J Harvey** *is Consultant Radiologist, Imaging Department, Hammersmith Hospital (Imperial College Healthcare NHS Trust), London W12 0HS*

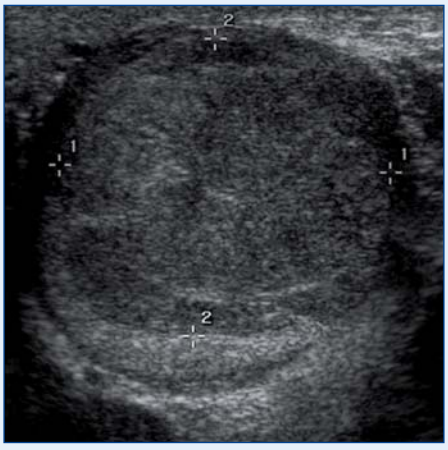
Correspondence to: Dr CJ Harvey

Testicular pathology

Tumour

The main role of ultrasound in the diagnosis of testicular tumours is to distinguish between intratesticular and extratesticular lesions. The majority of extratesticular lesions are benign, whereas intra-testicular abnormalities are more commonly malignant (Geraghty et al, 1998). Distinguishing seminoma from non-seminomatous subtypes is clinically important for treatment and prognosis, but it is usually not possible to make the distinction on ultrasound. Characteristically, seminomas are well-circumscribed, homogeneous and hypoechoic lesions (*Figure 2, Figures 3a* and *b*). Teratomas are more likely to be heterogeneous and classically contain cystic components and calcification (*Figure 4*).

Figure 2. Seminoma: the relatively hypoechoic seminoma (markers) is occupying the majority of the testis in this transverse image.



Non-Hodgkin's lymphoma is the commonest cause of a focal intratesticular mass in those over 60 years of age. It involves the testes in up to 20% of patients and may be the primary site. Discrete multi-focal lesions, sometimes seen bilaterally, are typical (*Figures 5a* and *b*). Testicular involvement in leukaemia is common but usually clinically silent. The testis is a common site for relapse following chemotherapy.

Benign testicular lesions

Benign focal intratesticular lesions are rare. Presumption of malignancy until proved otherwise by surgery has been advocated by some (Krone et al, 1985). However, the majority of intratesticular cystic lesions are benign, and recognition of this can mean unnecessary testicular surgical exploration is avoided. A cystic teratoma may cause diagnostic uncertainty and a careful urological evaluation, correlation with tumour markers and surgical exploration with excisional biopsy may all be required to confidently establish the diagnosis.

Table 1 lists some benign focal intratesticular lesions which may be encountered in ultrasound examination of the scrotum. Dilatation of the rete testis is common and mostly seen in patients over 50 years of age (Rouviere et al, 1999). It is often associated with post-infectious or post-traumatic epididymal obstruction (including post-vasectomy). It is important to distinguish this finding from pathology; unnecessary orchidectomy has been carried out on the basis of these appearances. Some of the rarer entities are discussed in detail in a pictorial review article by Stewart and Sidhu (2007).

Figure 3. Seminoma: (a) the hypoechoic seminoma shows hypervascularity on power Doppler imaging. b. Some foci of microcalcification are also shown.

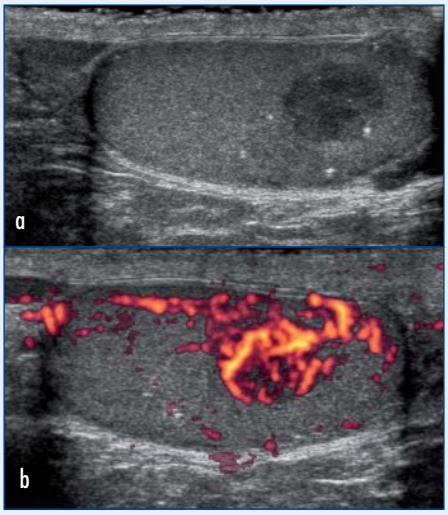


Figure 4. Teratoma: the typical features of a calcified (partially) cystic lesion are demonstrated.

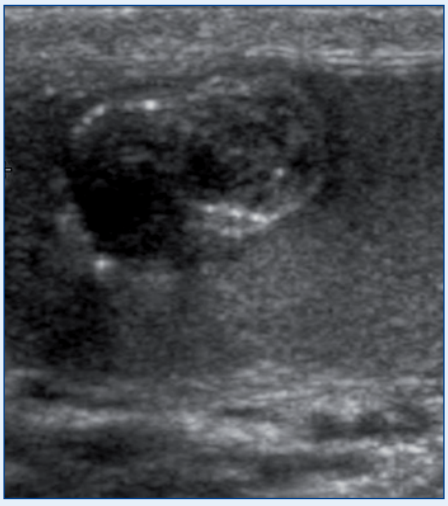
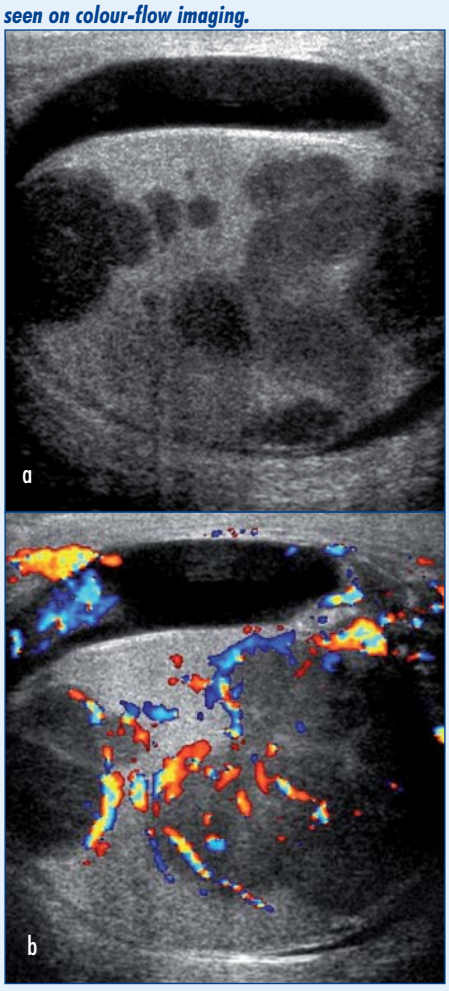


Figure 5. Lymphoma: (a) multiple well-circumscribed hypoechoic lesions are present. b. Vascularity is seen on colour-flow imaging.



Torsion

Ultrasound may be useful to differentiate epididymo-orchitis from torsion, but a normal ultrasound does not exclude torsion and must not delay surgical exploration. Testicular salvage rates are closely related to time to diagnosis: salvage rates of 80% in the first 6 hours fall to 20% if surgery is delayed for 24 hours (Donohue and Utley, 1978). Ultrasound findings vary with the duration of the torsion and grey-scale findings are non-specific. Testicular swelling and decreased echogenicity are the most commonly demonstrated early findings. Later, the testis develops a heterogenous echotexture as venous congestion and infarction occurs. Colour-flow may not be reduced or may be absent (Lerner et al, 1990).

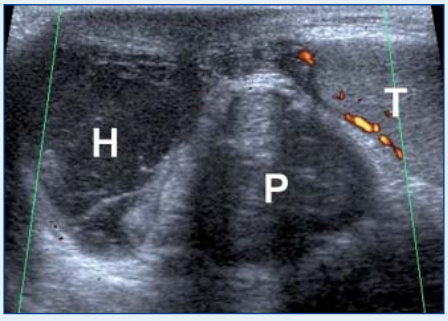
Trauma

The key distinction which must be made is between a ruptured and non-ruptured testis as this determines the need for surgical exploration. An isolated testicular haematoma with an intact tunica albuginea may be observed without surgery (*Figure 6*).

Table 1. Benign focal intratesticular lesions

Cystic	Cyst of the tunica albuginea
	Simple cyst
	Intratesticular spermatocoele
	Epidermoid cysts
Solid	Focal infarction
	Haematoma
	Infection/focal orchitis
	Idiopathic granulomatous orchitis

Figure 6. Traumatic haematoma: the extratesticular haematoma (H) has displaced the testis superiorly. The normal contralateral testis (T) and base of the penis (P) are shown.



Non-palpable testis

Cryptorchidism is the failure of the intra-abdominal testis to descend appropriately along the normal pathway to the scrotum. A testis may also be impalpable if it is congenitally absent, ectopic, atrophic or retractile (in neonates). Locating an undescended testis is important because of the considerably increased risk of malignancy (which also applies to the normal testis) and the relationship with subfertility and torsion. Ultrasound is helpful in demonstrating the 70% of such testes which lie in the inguinal region (Nguyen et al, 1999). They are sometimes difficult to identify, since they are usually smaller and less echogenic than a normal testis.

Testicular calcifications

Testicular microcalcification is usually identified incidentally on ultrasound as multiple echogenic foci with no associated acoustic shadowing (*Figure 7*). It is deemed abnormal if there are five or more foci within one testis. There has been considerable debate regarding the association of testicular microlithiasis with testicular tumour and the appropriate management of incidentally detected microlithiasis.

Current available data suggest that in the context of otherwise normal testes, the risk of developing a tumour is low. The role of ultrasound in follow up of these patients is diminishing with increased emphasis on frequent self-examination (Costabile, 2007; Jaganathan et al, 2007). Macrocalcification within the testis may be a consequence of trauma but should also raise suspicion of a calcifying Sertoli cell tumour or burnt-out germ cell tumour.

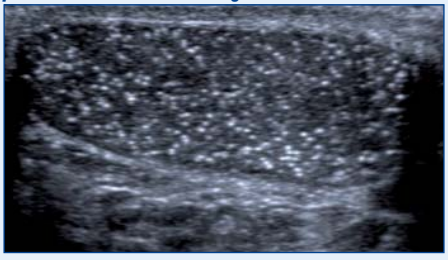
Extratesticular pathology

Varicocoele

The majority of varicocoeles are detected incidentally during scrotal ultrasound performed for other indications and are present in approximately 15% of the male population. They may present with pain and swelling or be detected during the work-up for male infertility (although there is some controversy regarding the merits of treatment in this context). The majority are extratesticular but intratesticular varicocoeles are also described. The preponderance of left-sided idiopathic varicocoeles is thought to be related to the perpendicular entry of the left spermatic vein into the left renal vein.

The ultrasound criteria for diagnosis include prominence of at least two or three veins with diameter greater than 2–3 mm (supine) (*Figure 8a*). Valsalva manoeuvres increase the vessel size and some varicocoeles will only be visible with the patient standing. Colour-flow imaging is a useful adjunct (*Figure 8b*). Ultrasound has a sensitivity and specificity of 98% and 100% respectively compared with the gold standard of venography (Hamm et al, 1986). Venography is now generally confined to patients being considered for treatment with embolization.

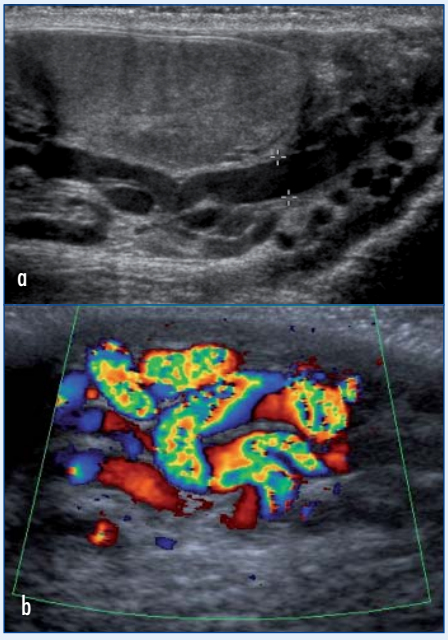
Figure 7. Testicular microcalcification: florid, punctate calcification throughout the testis.



Extratesticular cysts

These may be seen in the epididymis or tunica vaginalis and are much commoner than intratesticular cystic lesions. Spermatocoeles are cystic (usually unilocular) dilatations of the tubules in the epididymal head which appear as hypoechoic, well-circumscribed round lesions on ultrasound (*Figure 9*). They may contain internal echoes if spermatozoa or cellular debris are present within them and there is an association with prior vasectomy. Epididymal cysts are indistinguishable from spermatocoeles on ultrasound but may be located anywhere in the epididymis.

Figure 8. Varicocoele: (a) grey-scale and (b) colour-flow images of a large varicocoele. There are multiple dilated (markers) vessels posterior to the testis.



Epididymitis (epididymo-orchitis)

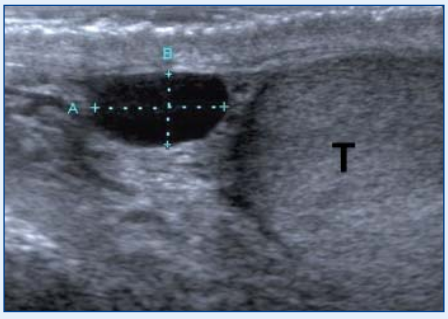
Epididymitis and epididymo-orchitis are common causes of scrotal pain in young males. The causative organism is most commonly *Escherichia coli* or *Proteus* spp. in the pre-pubescent or older male. In young sexually active males, *Neisseria gonorrhoeae* or Chlamydial infection is more likely. The grey-scale ultrasound findings of epididymal or testicular enlargement and heterogeneity, reactive hydrocoele and scrotal wall thickening are typical but not specific (*Figure 10a*). The diagnosis can be made more confidently if colour-flow imaging shows hyperaemia in the epididymis and testis (*Figure 10b*). Chronic epididymo-orchitis is characterized by an enlarged hyperechoic epididymis which often contains calcifications.

Isolated orchitis is comparatively rare but may result from infection with human immunodeficiency virus or the mumps virus.

Hydrocoele

A hydrocoele is the commonest cause of painless scrotal swelling and usually manifests as an anechoic fluid collection surrounding the anterolateral aspect of the testis (*Figure 11*). Occasionally there are internal echoes indicating high protein

Figure 9. Epididymal cyst (spermatocoele): there is a simple cyst (markers) in the head of the epididymis. The upper pole of the testis is also shown (T).



content (Collings et al, 1994). Haematocoeles (secondary to trauma or neoplasm) and pyocoeles are rare and may be distinguished from a simple hydrocoele by the identification of internal septae and loculations. Causes of a testicular hydrocoele are listed in *Table 2*. BJHM

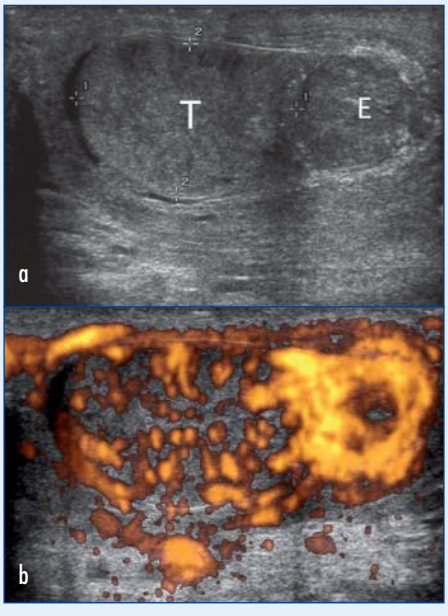
Conflict of interest: none.

Collings C, Cronan JJ, Grusmark J (1994) Diffuse echoes within a simple hydrocoele: an imaging caveat. *J Ultrasound Med* **13:** 439–42

Costabile RA (2007) How worrisome is testicular microlithiasis? *Curr Opin Urol* **17:** 419–23

Donohue RE, Utley WL (1978) Torsion of the Spermatic cord. *Urology* **11:** 33–6

Figure 10. a. Acute epididymo-orchitis: the testis (T) and epididymis (E) are enlarged and heterogeneous. There is marked oedema of the surrounding scrotal soft tissues and skin. b. Power Doppler imaging shows hypervascularity, particularly striking in the epididymis.



Geraghty MJ, Lee FT, Bernsten SA et al (1998) Sonography of testicular tumours and tumour-like conditions: a radiologic-pathologic correlation. *Crit Rev Diagn Imaging* **39:** 1–63

Hamm B, Fobbe F, Sorenson R, Felsenberg D (1986) Varicocoeles: combined thermography and sonography in diagnosis and post therapeutic evaluation. *Radiology* **160:** 419–24

Jaganathan K, Ahmed S, Henderson A, Rane A (2007) Current management strategies for testicular microlithiasis. *Nat Clin Pract Urol* **4:** 492–7

Krone KD, Carroll BA (1985) Scrotal ultrasound. *Radiol Clin North Am* **23:** 121–39

Lerner RM, Mevorach RA, Hulbert WC et al (1990) Color Doppler US in the evaluation of acute scrotal disease. *Radiology* **176:** 355–8

Nguyen HT, Coakley F, Hricak H (1999) Cryptorchidism: strategies in detection. *Eur Radiol* **9:** 336–43

Rouviere O, Bouvier R, Pangaud C et al (1999) Tubular ectasia of the rete testis: a potential pitfall in scrotal imaging. *Eur Radiol* **9:** 1862–8

Stewart VR, Sidhu PS (2007) The testis: the unusual, the rare and the bizarre. *Clin Radiol* **62:** 289–302

Figure 11. Hydrocoele: the anechoic hydrocoele (H) surrounds the testis on this transverse image. The hypoechoic intratesticular lesion (arrow) proved malignant.

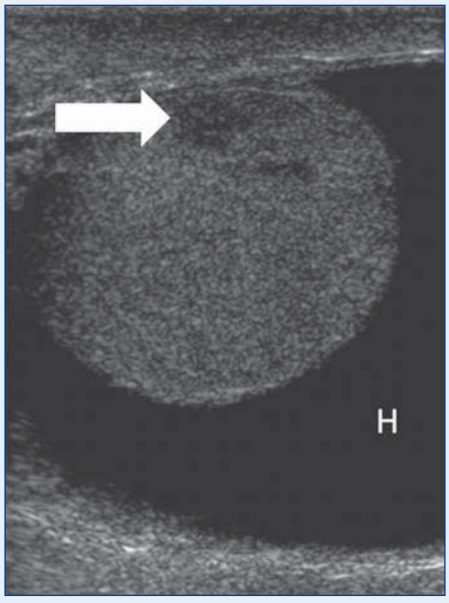


Table 2. Causes of a hydrocoele

Congenital	Patent processus vaginalis
Acquired	Idiopathic
	Trauma
	Infection
	Tumour
	Torsion
Others	Radiotherapy
	Post-renal transplant

KEY POINTS

- Ultrasound is the primary (and usually sole) imaging technique used to evaluate scrotal pathology. High-frequency linear transducers produce excellent quality, high resolution images of the scrotal contents.
- Distinguishing intratesticular (usually malignant) from extratesticular lesions (usually benign) is a diagnostic priority.
- Colour Doppler imaging may provide further useful information. Hypervascularity is common in the context of inflammation or infection and in some tumours.
- Ultrasound examination should not delay surgical exploration of a clinically suspected torsion. False-negative colour Doppler examinations are described in the context of testicular torsion.