Sonographic assessment of the scrotum

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Introduction
Ultrasound is often both the first line and the most diagnostically useful modality in assessing the scrotum. Given its superficial location and small size, a thorough assessment can be made in appropriate clinical settings. The main benefits are that it is a short procedure, well tolerated and non-invasive, with a high diagnostic yield.

Techniques
The procedure is performed with the patient lying supine. The scrotum may be lifted up with a towel. A high frequency linear probe is used (7.5-10MHz). A systematic assessment involves scanning each testis and epididymis, as well as the surrounding connective tissue. If the patient is concerned about any palpable abnormalities, targeted ultrasound of this region should also be included. As well as a structural assessment, there is an important role for use of Doppler ultrasound.

Anatomy
There are two symmetrical compartments within the scrotal sac, each containing a testis and associated structures. A normal adult testis measures approximately 5 x 3 x 2cm and is rounded, smooth in outline and homogenously isoechoic throughout. The epididymis is a triangular shaped structure draped around the testis, consisting of a head, body and tail. It is usually in a postero-lateral location, and is isoechoic or slightly hyperechoic to the testis.

Normal variants
A commonly seen variant is an appendix related to the testis (figure 1). The relevance of this structure is that its normal appearance should be recognised so it is not mistaken for a neoplasm. Acute torsion presenting with pain can also be of the appendix rather than the testis itself, and does not require surgical intervention. There may also be an appendix related to the epididymis, most commonly visualised when fluid is present in the scrotal sac.

Vascular supply
Arterial supply is mainly from the testicular arteries, arising directly from the aorta. The pampiniform venous plexus drains the testicular arteries, leading into the testicular veins, which enter the renal vein on the left, and the inferior vena cava directly on the right.

Pathology
The most common clinical findings with which patients sent for scrotal ultrasound present are acute pain, and diffuse or focal swellings. There is also an important role in paediatrics in assessing testicular descent. The commonest pathologies involved and their sonographic appearances will be discussed in further detail.

Diffuse swelling
Varicocele
The clinical presentation is of scrotal swelling, often described as a 'bag of worms' on palpation. The underlying pathology is dilatation of the pampiniform plexus, which appears on imaging as a cluster of dilated tubular structures, measuring more than 2mm. There is vascular flow present in these structures, which becomes more prominent on Valsalva manoeuvre. A left-sided varicocele should raise the suspicion of a left renal tumour obstructing the venous drainage and causing downstream dilatation. In such cases, the examination should be completed by assessing the kidneys as well.

Hydrocele
This refers to fluid collecting within the scrotal sac, between the two layers of the tunica albuginea, which should have no mass effect on the underlying testes. In children, the commonest cause is a patent processus vaginalis, meaning there is a persistent connection with the abdomen, leading to fluid accumulation. In adults, it can be due to inflammation, trauma and tumours. Sonographic appearances are of anechoic fluid surrounding the testes.

Post-trauma
Sonography is also an important tool after trauma to the scrotum. Haematoceles appear similar to hydroceles, but with more complex fluid with low level echoes within. Focal haematomas can be intra or extra-testicular (figure 2). If within the testis, they should be followed up until resolution to ensure there is no underlying neoplasm. The most severe injury is testicular rupture, where the testis has an irregular margin and is not homogeneous in echotexture.

Focal swelling
Cysts
Cysts are most common within the epididymis, but can also be intra-testicular. An encysted hydrocele may also mimic a cyst. A cyst at the epididymal head can also represent a spermatocele. Rather than serous fluid, this is a collection of spermatic fluid, occurring due to blockage of the vas deferens, often seen post vasectomy. The differentiating sonographic feature is that the fluid within the spermatocele will contain low level echoes that move, representing sperm. Within the testis, epidermoid cysts are also common benign lesions, presenting with a classical onion-skin appearance on sonography.

Neoplastic lesions
An intra-testicular lesion is more suspicious for malignancy, whereas extra-testicular lesions are more likely to be benign. Testicular malignancies usually peak in a younger age group rather than increasing incidence with age. Lesions are usually hypoechoic compared to the surrounding normal testis. As well as imaging, biochemical and hormonal tumour markers play an important role in assessment and follow-up.

The most common paediatric tumour is a yolk sac tumour, presenting as a heterogeneous mass with scattered echogenic foci, which are areas of haemorrhage. In middle-aged men, the most prevalent lesion is usually a seminoma, the most common of all testicular tumours, presenting as a focal homogeneous hypoechoic mass (figure 3). In men greater than 60 years, lymphoma is usually the most common neoplastic cause. Being a classically infiltrating lesion, this often presents as an enlarged testis rather than a focal mass.

Epididymal tumours are rare entities, the most common being an adenomatoid tumour, which is a benign lesion. These may be incidental lesions or found on palpation.
Appearances are of a solid mass within the epididymis, with homogeneous echotexture (figure 4).

**Non-palpable testes**

*Crypt-orchidism*

This refers to lack of normal descent of one or both testes, so they are not found in the normal location within the scrotal sac. Embryological development is within the abdomen and descent occurs along the inguinal canal. An undescended testis can lie anywhere along this path and sonographic assessment of these areas should be carried out if it is not seen within the scrotum. As well as infertility, the condition predisposes to intra-testicular malignancy, with the risk increasing with the length of time the testis is outside the scrotum. If the condition is unilateral, the testis is usually removed, and if bilateral, orchiopexy to fix the testis within the scrotum is carried out.

**Acute pain**

*Epididymo-orchitis*

Infection usually reaches the scrotum retrogradely, either from the urinary tract or a sexually transmitted pathogen. Clinical presentation is of pain, swelling and infective symptoms. Sonographic appearances are of an enlarged testis, with hypoechoic and hypervascular parenchyma (figure 5). If there is focal abnormality, interval ultrasound follow-up should be carried out until complete resolution to ensure the abnormality is not neoplastic. Hydroceles and scrotal skin thickening may also be present. If the echotexture of the epididymis and testis is more heterogeneous, tuberculosis should be considered as a cause of infection.

**Testicular torsion**

This is a surgical emergency, most often seen in teenagers, although possible in any age group, presenting with acute severe pain. Sonographic appearances can be normal and a normal ultrasound does not rule out torsion. If true torsion is suspected within the timeframe where the testis can be salvaged prior to ischaemia, the patient should be taken to theatre without spending valuable time performing an ultrasound assessment. Early features are a reduction in Doppler flow compared to the contralateral side, and abnormal lie of the testis. Late features, by which time the testis is rarely salvageable, are usually a hypoechoic and enlarged testis, with either reduced Doppler flow or increased flow if hypervascularity has developed.

**Other**

*Testicular micro lithiasis*

This simply refers to micro-calcification within the testes, presenting as multiple bilateral hyperechoic foci (figure 6). The list of causes of this appearance is extensive, including previous cryptorchidism, Down’s syndrome and Klinefelter’s syndrome. Some cases are purely idiopathic with no clear cause identified. Follow-up of incidental micro lithiasis has been under debate, as there is an association with malignancy. The most recent guidelines suggest follow-up in patients who have other coexisting risk factors for malignancy such as a family history and previous history of cryptorchidism.

**Conclusion**

Ultrasound is an excellent, cost-effective and non-invasive technique for assessing the scrotum. Practitioners carrying out the procedure should be aware of normal appearances and variants as well as the range of pathologies that can affect it. In particular, conditions with the greatest clinical impact on the patient such as cryptorchidism and neoplasms should be recognised and appropriately managed. Awareness that intra-testicular lesions are more likely to be malignant than extra-testicular scrotal lesions is crucial, with any focal intra-testicular abnormality being followed-up appropriately to ensure resolution. Acute testicular pain should also be correctly managed, and true suspicions of torsion presenting with short histories should not be too reliant on sonography and the diagnosis should instead be made urgently through clinical suspicion.

**References**

Figure 4
Adenomatoid tumour – a solid lesion within the epididymis of homogeneous echotexture.

Figure 5
Enlarged hypervascular testis in keeping with acute infection.

Figure 6
Multiple echogenic foci of calcium representing extensive testicular microlithiasis.

Figure 7
Appendix related to epididymis with an incidental small simple cyst.

Figure 8
Varicocele – a collection of tubular structures that demonstrate flow.

Figure 9
Hydrocele. Doppler also demonstrates normal flow within the testis.

Figure 10
Spermatocele – epididymal lesion with low level internal echoes.