Sonography of the scrotum: still the best!

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Learning objectives

To focus on ultrasound scanning with a pictorial review of scrotum anatomy and its contents.

To describe and to illustrate the various scrotal pathologic conditions.
Background

- The scrotum consists of a thin layer of skin (<3mm) and underlying fascia (fig.1). Each hemiscrotum contains a testis with its coverings, epididymis, and spermatic cord.

- A normal testis measures 5 × 3 × 2 cm in size.

- In healthy young men the ovoid testis measures 15 to 25 mL in volume.

- The testicular parenchyma consists of multiple lobules, each of which is composed of many seminiferous tubules that lead via the tubuli recti to dilated spaces, called the rete testis within the mediastinum.

Scrotal US is performed with the patient lying in a supine position and with the scrotum supported by a towel placed between the thighs.

- The superficial location of the testis allows the use of a high-frequency transducer (7 - 14 MHz), which produces excellent spatial resolution.

- The testes are evaluated in longitudinal and transverse planes (fig.2 and 3).

- The size and echogenicity of each testis and epididymis should be compared with those of the controlateral testis and epididymis.

- At the upper pole of the testis is the appendix testis, a small pedunculated or sessile body similar in appearance to the appendix of the epididymis (fig.4).

- Transverse scrotal imaging to depict both the testes is extremely important, allowing a comparison of their gray-scale and color Doppler appearances.

- The addition of color Doppler sonography provides simultaneous display of morphology and blood flow.

- Normal intratesticular arterial blood flow is consistently detected with power or color Doppler (fig.5).

- Power Doppler ultrasound yields a higher gain and is therefore more sensitive for detecting low flow.

- Pulsed Doppler is used to quantify blood flow.

- Sonography is highly accurate in differentiating intratesticular from extratesticular disease and in the detection of intratesticular pathology. In US examination, Empirical formula of Lambert (L × W × H × 0.71) is the most accurate. The prolate ellipsoid formula (LxWxHx0.52) is also used.
Imaging findings OR Procedure details

SCROTAL PATHLOGY

Congenital anomalies:

Anomaly of testicular migration

- Testicular ectopy (fig.6), cryptorchidism, anorchidy, and retractile testis are very common anomalies of testicular migration
- They can be included in polymalformative entities.
- Infertility and cancer are the two major risks of cryptorchidism.

Anomaly of closure of the processus vaginalis (fig.7)

Anomaly of closure of the processus vaginalis may result in a communicating hydrocele (a), hydrocele (b), cyst of the cord (c and fig.8), a congenital inguinal hernia (d) or congenital inguinoscrotal hernia (e and 9).

Inflammatory Disease:

- Primary epididymitis is generally caused by a bacterial infection. Orchitis is representing a direct extension of the inflammation. Isolated orchitis is unusual and generally is viral or posttraumatic.
- The US finding of acute epididymitis is enlargement of the epididymis with hypoechogenicity (fig.10). It may be focally or diffusely involved.
- When orchitis is also present, the testis appears enlarged with decreased echogenicity.
- Reactive hydroceles and scrotal wall thickening are often found with epididymo-orchitis.
- The inflamed epididymis and testis display increased flow (fig.11) and low-resistance pattern (RI < 0.5) (fig.12).
- It may be difficult to differentiate focal orchitis or abscess from testicular tumour. Associated epididymal involvement and scrotal skin thickening are suggestive of infection rather than tumour.
- Advanced or untreated cases of epididymo-orchitis may result in abscess formation, pyocele, and testicular ischemia.
- In the chronic stage, the echogenicity of the epididymis and testis may be increased with or without calcifications.

Testicular torsion:

- Testicular torsion is a surgical emergency
- Occlusion of the testicular artery causes necrosis of the testis after approximately 6 h.
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.
- After that, appears hemorrhage and necrotic lesions.
- Flow within the torsed testis is reduced or absent. In missed torsion, lack of intratesticular flow and increase of blood flow in the peritesticular tissues are seen (fig.13).
- The presence of Doppler signal in a patient with clinical suggestion of testicular torsion does not exclude torsion (incomplete torsion!) (fig.14).
- Diagnosis of spontaneous detorsion should be considered in a patient with acute scrotal pain and resolves spontaneously with hyperaemia of the testis. It can simulate epididymo-orchitis.

**Varicocele:**

Varicocele is a dilatation of veins of pampiniform plexus > 2-3 mm in diameter. (fig.15)

- US findings: Tortuous anechoic tubular structures adjacent to the testis, expand with Valsalva manoeuvre and upright position.
- Colour Doppler Reflux in the spermatic vein, which increases with Valsalva manoeuvre, may be identified. (fig.16)
- Doppler sonography grading venous reflux: (fig.17)
  - physiological (grade I) < 2 sec
  - intermittent (grade II) 4-5 sec
  - continuous (grade III) > 6 sec

**Testicular Trauma:**

- It varies from a small hematocele requiring conservative management to a testicular rupture demanding immediate surgical intervention.
- Testicular rupture (fig.18): heterogeneous echotexture within the testis, testicular contour abnormality, and disruption of the tunica albuginea.
- Testicular Fracture (fig.19): identified at US as a linear hypoechoic and avascular area within the testis. May or may not be associated with a tunica albuginea rupture.
- Intratesticular Hematoma (fig.20): Hyperacute and acute hematomas are sometimes difficult to identify, as they may appear isoechoic to the surrounding testicular parenchyma or may have a diffusely heterogeneous echotexture.
- Suspected acute hematomas must be reexamined within 12-24 hours after the initial US evaluation.
- Traumatic epididymitis may also be revealed as enlargement and hyperemia of the affected epididymis on color Doppler images.

**Testicular solid tumors:**
Testicular cancers are relatively rare, but are the most common solid tumor in males aged 15-35.

Seminomas (fig.21) are usually well-defined, hypoechoic, solid ± lobulation. They don't have calcification nor tunica invasion. Most seminomas demonstrate increased flow on color Doppler examination.

The nonseminomatous germ-cell neoplasms (fig.22) demonstrate a heterogeneous echotexture with irregular or ill-defined margins. Echogenic foci within the substance of the tumors represent areas of hemorrhage, calcification, or fibrosis. They frequently have cystic components, consistent with regions of necrosis.

Embryonal cell carcinomas (fig.23) tend to distort the testicle and frequently invade the tunica albuginea.

Approximately 10% of the patients may present testicular tumor with acute scrotal pain, it may mimic epididymo-orchitis.

**Testicular and epididymal cysts**:

- Simple epididymal cyst (fig.24): Well-defined and anechoic cyst containing clear fluid, it may be seen throughout epididymis.
- Differential diagnosis: Tubular Ectasia of Rete Testis.
- Tunica albuginea cyst

**Scrotal calcifications**:

- Testicular microlithiasis (TM) (fig.25) corresponds to intratubular calcifications resulting from degenerating cells within the seminiferous tubules.
- The typical US appearance of TM is of multiple non-shadowing echogenic foci measuring 2-3 mm and randomly scattered throughout the testicular parenchyma.
- While microcalcifications do exist in roughly 50% of germ cell tumors.
- Men with testicular microlithiasis must have regular US and Tests for tumor markers.
Images for this section:

Fig. 1

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Fig. 19

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**Fig. 20:** Intratesicular hematoma (H)

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**Fig. 21:** Seminoma

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Fig. 22: Yolk sac Tumor

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**Fig. 23:** Choriocarcinoma

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Fig. 24: Epididymal cyst

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Fig. 16

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Fig. 14

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Fig. 6

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Fig. 7
Fig. 8: Cyst of the cord
Fig. 9: Congenital inguinoscrotal hernia

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Fig. 10

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Fig. 11

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Fig. 12

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Fig. 13

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Fig. 25: Testicular microlithiasis

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Conclusion

• In the pediatric population, ultrasonography is essential in the diagnosis of developmental abnormalities, epididymitis, testicular torsion, and testicular neoplasms.
• In adults, scrotal sonography is helpful in the evaluation of male infertility and in differentiating cysts from solid neoplasms. Doppler technology enables the assessment of vascular physiologic characteristics, flow, and perfusion mainly in acute scrotum.
• High-resolution real-time sonography has a high degree of accuracy and sensitivity in the detection, characterization, and localization of scrotal lesions, making it the undisputed modality of choice for imaging the scrotum.
References