Looking for changes in testicular echotexture: review of pathology with diffuse alteration of testicular echogenicity.

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Authors: M. Atencia Ballesteros, A. Rodriguez Molina, A. Tapia Guerrero, J. A. Andrades Delgado, S. Moreno Manzano; Málaga/ES
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Learning objectives

- Know the scrotal anatomy and normal testicular echotexture.
- Review of the most frequent pathological disorders of the testicles with diffuse alteration in echogenicity.
- Determine ultrasound findings that orient the differential diagnosis.

Background

Ultrasound of the scrotum is the first image test we do to evaluate the testicular disease. US is a comfortable image modality and highly accurate in differentiation extratesticular and intratesticular, and between solid and cystic lesions. Thanks to US we can do a differential diagnosis in testicular patologhy and orient the treatment.

Findings and procedure details

ANATOMY

The two testes are ovoid glandular organs of approximately 5 x 3 x 2.5 cm in adults, smooth, separated by a partition and housed inside the scrotum.

The epididymis, tubular structure that takes the form of coma, is located in the posterior and lateral surface of the testis and consists of head, body and tail.

The testis and epididymis are contained in a fibrous, tough and adhered capsule, the tunica albuginea and partially surrounded by the visceral tunica vaginalis that joins the parietal vaginal tunic in the posterolateral portion of the testis, which are anchored to the scrotal wall. Between the both tunics there is usually small amount of fluid.

Testis, epididymis and vas deferens are enveloped completely by the internal spermatic fascia, the cremasteric fascia and the cremaster muscle or external spermatic fascia and are housed in the scrotal sac whose wall consists of skin and dartos.

Both testes are surrounded by a tough fibrous tunic attached, the tunica albuginea.

The back surface of the tunica projecting inwards to form the mediastinum testis.
From the mediastinum, numerous fibrous septae dividing the testes extend in lobes 250-400.

Each lobe contains: seminiferous tubules (containing cilia and smooth muscle that surrounds), Sertoli cells and spermatocytes. The seminiferous tubules drain through straight tubes in a dilated spaces within the mediastinum testis, rete testis. This epididymal drains through the efferent ducts (12 testis). At the head of the epididymis efferent ducts converge into one body and tail leading to the ductus deferens, located in the spermatic cord.

The scrotal appendages are embryologic remnants intraescrotales. There are four: hydatid of Morgagni or testicular, epididymal, paradidymis or body Girard and aberrant duct of the epididymis.

**SCROTAL ULTRASOUND**

(Image 1) (Image 2)

Scrotal US is performed with the patient in the supine position.

Optimal results are obtained with a 7-10-MHz high-frequency linear array transducer. The testes are examined in at least two planes, along the long and transverse axes.

The size and echogenicity of each testis and the epididymis are compared with those on the opposite side.

Scrotal skin thickness is evaluated.

Color Doppler and pulsed Doppler parameters are optimized to display low-flow velocities, to demonstrate blood flow in the testes and surrounding scrotal structures.

Power Doppler US may also be used to demonstrate intratesticular flow in patients with an acute scrotum.

In patients being evaluated for an acute scrotum, the asymptomatic side should be scanned initially in order to set the gray-scale and color Doppler gain settings to allow comparison with the affected side. Additional techniques such as use of the Valsalva maneuver or upright positioning can be used as needed for venous evaluation.

The scrotum is divided by the raphe into two halves, each half are contained in a testis, epididymis and spermatic cord.
The TESTICLE in neonates and children are sonographically shown as hypoechoic oval structure corresponding to the tunica albuginea hyperechoic halo. The echogenicity increases progressively with age presenting the testicular parenchyma granular and homogeneous echogenic typical pattern. Testicular longitudinal axis is between 40 and 50 mm ( adult ).

The posterior surface of the tunica albuginea is projected into the testis forming the MEDIASTINUM Testicular that ultrasound appears as a thick echogenic band partially through the testicle.

The EPIDIDYMIS is best viewed in the axial plane, consists of three parts, the head resting on the upper pole of the testis, pyramidal morphology, the body located on the back surface of the testis and the tail. The echogenicity of the epididymis although homogeneous and virtually isoechogenic regarding the testis shows a more granular pattern. Its size is variable but it seems that the maximum diameter of the head of the epididymis should not exceed 12 mm. (Image 3)

SPERMATIC CORD appears as a linear band echogenic with vessels inside the longitudinal section. In the transverse view it is seen as ovoid echogenic structure with glasses inside. (Image 4)

DIFFUSE TESTICULAR INVOLVEMENT

Ultrasound can differentiate those processes that require urgent surgical treatment (testicular torsion, testicular trauma and malignancy) of those who can be managed conservatively.

The color Doppler and power Doppler ultrasound is essential for differential diagnosis between processes such as epididymitis and testicular torsion, although may present with similar clinical they have a completely different management (conservative in orcyoepididymitis and surgical in torsion). Also, in the case of diffuse testicular involvement, there are sonographic findings that will allow us to orient the diagnosis towards neoplastic infiltration or inflammatory infectious process based on aspects such as:

- The increase in testicular size.

- Morphology and testicular contour.

- Alteration of testicular echogenicity.

- Afectation of the epididymis and scrotal covered.
A. INFLAMMATORY Testicular INVOLVEMENT: increased mild/moderate testicular size, oval shape and smooth contours preserved echostucture homogeneous and regular secondary thickening of the epididymis and scrotal covered.

B. Testicular NEOPLASIC INVOLVEMENT: increased moderate/severe testicular size, teste of globular morphology and lobed outline, heterogeneous echostructure with epididymis and scrotal usually covered respected.

Epididymo-orchitis

Epididymo-orchitis and epididymitis are common causes of acute scrotal pain in adolescent boys and adults.

Clinically, scrotal pain associated with epididymitis is usually relieved when the testes are elevated over the symphysis pubis (the Prehn sign).

Gray-scale US findings of acute epididymitis include an enlarged hypoechoic or hyperechoic epididymis (presumably secondary to hemorrhage). (Image 5)

Indirect signs of inflammation, such as reactive hydrocele or pyocele with scrotal wall thickening, are present in most cases.

The epididymis is the organ primarily involved in epididymo-orchitis, with orchitis developing in 20%-40% of cases due to direct spread of infection.

Diffuse testicular involvement is confirmed by the presence of testicular enlargement and an inhomogeneous testicular echotexture.

Gray-scale US findings are nonspecific, but acute epididymo-orchitis is the most common disorder with this combination of findings.

At color and power Doppler US, the hallmark of scrotal infection is hyperemia of the epididymis, testis, or both. (Image 6) (Image 7)

(Image 8)

Complications:

- Chronic pain
- Infarct (Image 9)
- Abscess (Image 10)
- Necrosis
Testicular Torsion

It represents a surgical emergency where the elapsed time is critical to preserve the testicular viability.

Establishing a maximum of 6 hours for the establishment of infarction with subsequent loss of the organ. It is crucial not to delay the ultrasound examination in suspected testicular torsion.

Two types of torsion have been described: extravaginal and intravaginal.

INTRAVAGINAL TORSION

It is the most common (95%) and it can occur at any age but it is most common in adolescence.

Intravaginal torsion occurs within the tunica vaginalis.

The predisposing factors include a long and narrow mesentery or a bell-clapper deformity, in which the tunica vaginalis completely encircles the epididymis, distal spermatic cord, and testis rather than attaches to the posterolateral aspect of the testis. The deformity leaves the testis free to swing and rotate within the tunica vaginalis much like a clapper inside a bell.

The sonographic findings depend on the time course and degree of torsion of the spermatic cord:

- ACUTE PHASE (< 6h): enlargement of the testicle that may appear diffusely hypoechoic or normal echogenicity. No flow. The scrotal echogenicity preserved with slight testicular enlargement suggest viability, whereas a marked increase in testicular size with heterogeneous parenchyma and hypervascularization of the scrotum with edema and reactive hydrocele are signs of infarction and necrosis. (Image 11)

- SUBACUTE PHASE (1-10 days): teste enlarged, preserving oval morphology and smooth contours, diffusely heterogeneous echogenicity by vascular congestion and/ or hemorrhage and infarction.

- CHRONIC PHASE: hydrocele and atrophic testis.
**EXTRAVAGINAL TORSION (5%)**

Extravaginal testicular torsion occurs exclusively in newborns.

Torsion occurs outside the tunica vaginalis when the testes and gubernacula are not fixed and are free to rotate.

The affected neonate presents with swelling, discoloration of the scrotum on the affected side, and a firm painless mass in the scrotum.

The testis is typically infarcted and necrotic at birth.

US findings include an enlarged heterogeneous testis, ipsilateral hydrocele, skin thickening, and no color Doppler flow signal in the testis or spermatic cord.

The treatment is orchiectomy.

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**Trauma testicular**

There is trauma history.

The degree of testicular involvement will depend on the degree of intensity of impact.

Contusion, hematoma or testicular rupture can be appreciated.

Testicular rupture is a urological emergency and over 80% of the testicle can be saved if it is in the first 72 hours post-trauma.

Ultrasonography findings:

- Patchy areas of altered echogenicity secondary to hematoma and/or infarction. (Image 12)

- Thickening of the scrotal wall and hematocele. (Image 13)

- It is important to visualize the integrity of the tunica albuginea as its absence indicates testicular outbreak of the testis that has to be surgically corrected. (Image 14)

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**TESTICULAR TUMORS**

Testicular tumors can be circumscribed and focal or diffusely infiltrative.

The rigid and fibrous nature of the tunica albuginea prevents neoplastic capsular invasion.
Both history and clinical patient and ultrasound findings guide the etiologic diagnosis of diffuse infiltration allowing differentiation between testicular neoplasia, diffuse orchitis and testicular infarct.

Testicular cancer accounts for 1% of all malignancies in men. However in the age group among men aged 20-35 years is the most frequent neoplasia. The testicular tumors are classified into primary, germ or no germ lineage primary, and metastasis.

Germ cell tumors constitute 95% of testicular tumors. Of those between 40 and 50% are seminomas and 40% are mixed germ cell tumors. (Image 15)

Among the non-germ derivatives Leydig cells are the most common.

His way of common presentation is as complex solid nodule.

The sonographic signs are nonspecific and can not predict the histological type.

Testicular metastases are diagnosed in patients over 50 years.

Testicular lesions manifest pattern of diffuse testicular involvement most often are: lymphomas and leukemia. (Image 16)

Diffuse involvement both lymphoma and leukemia may manifest as diffuse hypoechoic heterogeneous or striated pattern, with hyperechoic and hypoechoic alternatively nonspecific bands. This presentation is rare in germinal neoplasms.

The involvement by leukemia or lymphoma of the testis is an indication of orchiectomy.

TESTICULAR MICROLITHIASIS (MT)

It consists of deposits in the lumen of the seminiferous tubules, resulting in hyperechoic points 1-3 mm without further shadow on the ultrasound. (Image 17)

The concomitant with neoplasia intra - or extratesticular is particularly striking, occurring with a frequency ranging between 6 and 45%. This suggests that coexistence is not a coincidence. Therefore in patients with testicular microlithiasis attention should be paid to discard focal testicular lesions by ultrasound.

Monitoring of patients with MT depends on the existence of testicular neoplasia. To patients with MT annual physical examination and palpation is recommended. The effectiveness of monitoring is questioned today by annual ultrasound of patients with testicular microlithiasis in the absence of a history of malignancy.
In a patient with unilateral testicular neoplasia and the incidence of contralateral microlithiasis intratubular germ cell neoplasia is very high.

Intratubular neoplasia is equivalent to carcinoma "in situ" testicular. If neoplasia is not demonstrated in this group of patients with microlithiasis follow up is indicated.

At 5 years, 50% of patients with intratubular neoplasia develop a germ cell tumor.

BURN OUT TUMOR

It is rarely see. In most cases the scrotal ultrasound can explain extrascrotal injury.

It consists of metastatic germ cell tumors without evidence of gonadal neoplasia or intratubular neoplasia.

It represents a spontaneous and complete regression of a testicular tumor.

(Image 18)

Images for this section:
Fig. 1
Fig. 2: Mediastinum testis
Fig. 3: Epididymis
Fig. 4: Spermatic cord
**Fig. 5:** Enlargement and diffuse and homogeneous hypoechoicity of the right testis with oval morphology and smooth contours.
Fig. 6: Increased vascularity of the right testis compared to the contralateral
Fig. 7: Comparative study both testes with inflammatory changes in the right one with normal left testicle.
Fig. 8: Right epididymis thickened, diffusely hypoechoic and hypervascularized
Fig. 10

Fig. 11: Torsion left testicle: left teste hypoechoic, with internal serration and absence of vascularization. Comparative study with contralateral teste.
**Fig. 14:** Patient with right testicular trauma. Ultrasound diffuse and patched hypoechoic testicular involvement with preserved tunica and vascular paths with regard to testicular contusion. Thickening associated scrotal covered.
**Fig. 15:** Testicular diffuse seminoma. Testicular diffuse neoplastic infiltration of the right testis appreciate enlarged relative to the contralateral testicle, heterogeneous, with loss of oval morphology and lobulated contours.

**Fig. 16:** Lymphoma
Fig. 17
**Fig. 18:** 40 year old patient with hyperechoic liver metastases of choriocarcinoma. The scrotal ultrasound shows atrophic testis with peripherally calcified nodule in relation to testicular choriocarcinoma with gonadal level regression but with liver metastases.
Conclusion

Ultrasound is the imaging modality of choice in the evaluation and screening of testicular pathology (inflammatory, traumatic, ischemic and neoplastic testicular involvement may primarily cause focal or diffuse alteration in the testicular parenchyma).

Personal information

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