Let’s see beyond the testicle: paratesticular pathology (anatomy, ultrasound findings and clinical-radiologic interpretation).

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Learning objectives

- Remember the anatomy of paratesticular structures.
- Check normal sonographic anatomy of the paratesticular structures.
- Know the different processes affect this region.

Background

We review the anatomy of the structures that make up the paratesticular region. We make a detailed description of the clinical and sonographic appearance of various paratesticular pathologies dividing paratesticular scrotal pathology according to their location and dividing them in infectious-inflammatory pathology, benign and malignant neoplastic lesions and other conditions that affect paratesticular region (varicocele, inguinal scrotal hernia, spermatoceles and epididymal cysts, etc.), providing images of cases from our experience.

Findings and procedure details

PARATESTICULAR ANATOMY

The paratesticular structures include:

- Epididymis.
- Spermatic cord
- Scrotal covered
- Scrotal appendices

(Image 1)

EPIDIDYMIS

The epididymis has three parts, the head resting on the upper pole of the testis, of pyramidal morphology, the body located on the back surface of the testis and tail curved structure corresponding to the lower pole of the testis. The echogenicity of the epididymis is homogeneous and virtually isoechogenic although shows a more granular pattern than the testis. (Image 2)
The lesions most often found in the epididymis are:

- Cyst epididymis: may appear throughout the epididymis.
- Spermatoceles: usually in the head of the epididymis.
- Mass OR Inflammatory Epididymitis: affects any part of the epididymis.
- TUMORS: they are more frequent in the tail of the epididymis.
- BENIGN NEOPLASMS, the most common: T. adenomatoid, leyomioma and papillary cystadenoma of the epididymis.
- MALIGNANT NEOPLASMS: sarcomas, metastases.

1) EPIDIDYMAL CYSTS

Anechoic and well-defined lesion with posterior reinforcement associated. Sometimes it can seem a hydrocele due to its large size. The cysts are filled with serous fluid and can be found in any portion of the epididymis.

(Image 3)

2) SPERMATOCELE

Spermatocele is the most common scrotal lesion, along with epididymal cysts. It is observed in 70% of the ultrasounds.

Spermatoceles are filled with fluid and sperm.

They are anechoic with some echoes inside and are located in the head of the epididymis. When they are anechoic are indistinguishable from cysts. When its presentation is typical follow up is not required.

(Image 4)

3) EPIDIDYMITIS

Focal or diffuse inflammatory thickening of the epididymis

ACUTE: enlarged and diffusely hypoechoic epididymis showing hyperemia and usually associated thickening of covers and reactive hydrocele

CHRONIC: enlargement of the epididymis, with hyper- or hypoechoic heterogeneous echogenicity and calcifications.
4) NEOPLASMS

Benign Neoplasms

Adenomatoid Tumor

Adenomatoid tumors are the most common tumors of the epididymis.

Although these tumors are typically epididymal, they can occur in the testicular tunica and testis and, on rare occasions, arise from the spermatic cord.

The epididymis is 4 times more often originates in the tail than in the rest of the epididymis. It is usually unilateral and more frequent left.

1/3 assumes all Paratesticular neoplasms.

Although adenomatoid tumors may affect patients of any age, they most commonly affect men 20 years old or older.

Patients are generally asymptomatic, and only 30% present with pain. It exhibits slow growth.

The US appearance of adenomatoid tumors is nonspecific and variable, although the majority of tumors are isoechoic relative to the adjacent normal epididymis. However, they may also appear predominantly cystic. They are usually oval when arising from the epididymis and round when arising from the testicle.

Leiomyoma

Second most frequent neoplasm of the epididymis (6% of cases). More often from the second decade of life.

Clinically, it manifests as slow growing nodule, measuring up to 1.4 cm.

This tumor has a variable US appearance, depending on whether it is predominantly solid or cystic, and may contain calcifications. Transition zones may account for multiple recurrent shadows.

Leiomyomas frequently involve the glomus major and may be associated with a hydrocele in 50% of cases.
**Papillary Cystadenoma**

Appears in 60% of patients with the disease von-Hippel-Lindau.

The sporadic form usually occurs in middle-aged patients; when associated with von Hippel Lindau occurs at earlier ages.

Their size ranges from 9mm to 4 cm.

Ultrasonography shows variable appearance, from predominantly cystic lesion with small papillary projections to predominantly solid lesion with small cystic oval spaces. The most frequent sonographic appearance is as solid oval lesion with small cystic spaces in the head of the epididymis.

Most epididymal papillary cystadenomas are managed conservatively, with serial US used to document their growth.

**Malignant neoplasms**

Paratesticular primary malignant neoplasms in the epididymis are extremely rare (they are more frequent in the spermatic cord) and the most common are sarcomas.

Metastases account for less than 8% of neoplasms of the epididymis.

Metastases most commonly originate from testicular, renal, prostate, and gastrointestinal primary tumors.

**SPERMATIC CORD**

1) **VARICOCELE**

Varicocele involves abnormal dilatation of veins in the pampiniform plexus of the spermatic cord and is relatively common, accounting for 20.5% of cases in our series.

Most cases are idiopathic; varicoceles are found mainly in adolescents and young adults and are more frequent on the left side.

At sonography, the dilated veins appear as tortuous, anechoic, tubular structures along the spermatic cord. On color and pulsed-wave Doppler images, venous flow is better demonstrated during the Valsalva maneuver. Varicocele may affect testicular growth; hence, testicular volumes should be systematically measured and asymmetries assessed with US.
Treatment of varicoceles is controversial. Surgical treatment is generally reserved for adolescents with testicular growth arrest, cases of highgrade varicocele with abnormal results at semen analysis, adolescents with symptoms (pain, heaviness, swelling), and those with bilateral varicoceles.

(Image 7)

2) INGUINAL-SCROTAL HERNIA

Inguinal-scrotal hernia is defined as the passage of intestinal loops and/or omentum into the scrotal cavity. The prevalence of inguinal hernia is higher in preterm neonates, especially at 32 weeks gestation.

The hernia is more frequently located on the right side, since the right processus vaginalis closes later than the left.

At gray-scale US, the scrotum is partially occupied by one or more round structures containing air bubbles or fluid. The diagnosis of hernia is achieved by visualization of air bubble movement and/or intestinal peristalsis during the real-time examination. The herniated omentum is seen as a highly echogenic structure.

US examination should include both inguinal canals, since a clinically inapparent contralateral hernia can be found in 88% of cases.

Inguinal rings larger than 4 mm are an indication for prophylactic herniorrhaphy.

Urgent surgery is indicated in patients with an akinetic dilated bowel loop (a sign of strangulation) or impaired testicular perfusion.

3) FUNDICULITIS
Inflammatory involvement of the spermatic cord, usually associated with epididymitis. On physical examination swollen and painful palpable cord. Spermatic cord sonographically enlarged with ectasic and serpiginous vessels of pampiniform plexus.

(Image 8)

4) HEMATOMAS OF THE SPERMATIC CORD
Image: Anechoic lesion with internal echoes and thickness of the cord in relation to the spermatic cord arranged in a patient with history of trauma.

(Image 9)
5) BENIGN NEOPLASMS

Lipoma
Lipoma is the most common benign neoplasm of the paratesticular tissues and spermatic cord, comprising 45% of paratesticular masses. This tumor most often manifests as an incidentally discovered nontender scrotal mass and affects patients over a wide age range.
At US, lipomas have a homogeneous hyperechoic appearance and vary in size. Transformation to liposarcoma is possible but is thought to be unlikely. Symptoms determine treatment.

(Image 10)

Hemangioma
Scrotal hemangiomas are extremely rare, comprising less than 1% of all hemangiomas. They usually manifest in infants, and occasionally in later childhood or adolescence. Most patients are asymptomatic. It may not be possible to distinguish a hemangioma from a varicocele at conventional or color Doppler US, but US may be useful in delineating the extent of the mass. Hemangiomas are slightly hyperintense relative to muscle on T1-weighted MR images and markedly hyperintense on T2-weighted images.

6) MALIGNANT NEOPLASMS

Rhabdomyosarcoma
Rhabdomyosarcoma is the most frequently seen sarcoma of the spermatic cord, accounting for 40% of all malignant paratesticular neoplasms.

It most commonly occurs in infants and children, who present with mild discomfort. Patient age distribution is bimodal, with peaks at 5 and 16 years, the median age at diagnosis being 7 years.

Patients most commonly present with a painless mass. Tumor size varies greatly (1-20 cm).

Rhabdomyosarcoma is an extremely aggressive tumor, and 40% manifest with metastases.

US and MR imaging findings are nonspecific. CT provides pelvic staging for definitive surgical treatment.
Treatment includes radical orchiectomy, retroperitoneal lymph node dissection, and aggressive adjuvant chemotherapy.

**Liposarcoma**

Liposarcoma is a rare neoplasm -that usually arises from the spermatic cord. Liposarcomas are usually low-grade, well-differentiated lesions that spread by local extension.

Patients most commonly present with firm, painless, slow-growing fluctuant masses.

US demonstrates a predominantly hyperechoic area, although echogenicity may vary.

CT and MR imaging aid in the staging of this neoplasm and help distinguish the fatty and soft-tissue components of the tumor.

Liposarcoma is the most radiosensitive sarcoma, and treatment with radical orchiectomy includes adjuvant radiation therapy for intermediate or high-grade lesions. Positive lymph nodes are seen in nearly 40% of cases. Postoperative adjuvant chemotherapy is also used.

**Leiomyosarcoma**

Leiomyosarcoma rarely occurs in the spermatic cord, where it arises from the smooth muscle.

US demonstrates a predominantly hypoechoic area, although echogenicity may vary. These tumors are typically located in the scrotal part of the spermatic cord; in contrast, their benign counterpart, the leiomyoma, is most commonly located in the inguinal part of the spermatic cord. CT and MR imaging aid in the staging of this neoplasm.

Locoregional recurrence is common.

Treatment consists of transinguinal radical orchiectomy, with adjuvant radiation therapy to reduce recurrence and chemotherapy for high-grade lesions and distal metastases.

**Malignant Schwannoma**

Malignant schwannoma is an extremely rare highly malignant lesion that is most commonly associated with neurofibromatosis.

**Malignant Fibrous Histiocytoma**
Malignant fibrous histiocytoma is a rare, highly malignant connective tissue tumor that typically occurs in late adulthood.

This tumor most commonly involves the skeletal muscles and the retroperitoneum.

Involvement of the male adnexa is rare and usually manifests as a paratesticular growth arising from the testicular tunica or spermatic cord.

The scrotal wall is rarely affected. Patients present with a painless but fast-growing mass.

At conventional US, malignant fibrous histiocytoma has a variable appearance. It may appear hypoechoic with multiple small, echogenic foci and acoustic shadowing consistent with flecks of calcification. A heterogeneous appearance with lack of acoustic shadowing or calcification has also been described. At color Doppler US, the mass demonstrates increased flow with hypervascularity.

The growth of paratesticular malignant fibrous histiocytoma is more obvious than growth at other sites, so that patients present earlier and have a slightly more favorable prognosis.

**Metastases**

Metastases most commonly originate from testicular, renal, prostate, and gastrointestinal primary tumors.

The most primary tumor site is the prostate gland, followed (in order of decreasing frequency) by the kidney, stomach, colon, ileum (carcinoid tumor), and pancreas.

Clinical and imaging features are nonspecific.

(Image 11)

**SCROTUM**

The scrotum is composed of seven layers lining the testicles: skin, dartos muscle, external spermatic fascia, cremasteric fascia, internal spermatic fascia and tunica vaginalis (parietal and visceral). The outer sheaths, from the skin to the vaginal wall, are seen as a single layer which typically has a thickness less than 6 mm. We can appreciate the vaginal cavity and virtually always present minimum amount of fluid inside (physiological hydrocele).

The testis and epididymis are contained in an fibrous, hard and adhered capsule, the tunica albuginea.
1) HYDROCELE

Hydrocele, an abnormal collection of fluid between the visceral and parietal layers of the tunica vaginalis and/or along the spermatic cord, is the most common cause of painless scrotal swelling in children.

In the normal scrotum, 1-2 mL of serous fluid may be observed. Virtually all hydroceles are congenital in neonates and infants and associated with a patent processus vaginalis, which allows peritoneal fluid to enter the scrotal sac. In older children and adolescents, hydroceles are usually acquired and are the result of an inflammatory process, testicular torsion, trauma, or a tumor.

At sonography, congenital hydrocele appears as an anechoic fluid collection surrounding the anterolateral aspects of the testis and sometimes extending to the inguinal canal or as a fluid collection with low-level swirling echoes, which are related to protein aggregation or deposition of cholesterol crystals.

(Image 12)

2) FIBROUS PSEUDOTUMOR

Fibrous pseudotumor is not a neoplasm but a reactive fibrous proliferation of paratesticular tissue that can mimic a neoplasm and may produce a mass up to 8 cm in diameter.

Approximately 75% of cases arise from the tunica vaginalis.

Nearly 50% of affected patients have an associated hydrocele or hematocele, with 30% having a prior history of trauma or epididymo-orchitis.

The typical gross appearance is that of an irregular mass composed of multiple fibrous nodules and arising from the tunica vaginalis, epididymis, or spermatic cord.

Fibrous pseudotumor may appear at MR imaging as a lobulated soft-tissue mass with multiple frondlike projections that arise from the tunica vaginalis.

3) EPIDERMOID/DERMOID/SEBACEOUS CYST

It is not a cyst, it is a solid lesion.

Generally incidental finding on palpation or ultrasound.

Epidermoid are composed of keratin and surrounded by a fibrous capsule. The location in paratesticular structures is exceptional opposed to testicular location where it has a frequency 1-2% of benign testicular tumors.
Slow growth.

Treatment: surgical exploration via scrotal and total orchiectomy.

(Image 13) (Image 14)

**TESTICULAR APPENDAGES**

(Image 15)

There are five testicular appendages, which are the remnants of the mesonephric and paramesonephric ducts. Three can be identified at US and are particularly apparent in cases of hydrocele:

- The appendix testis, also known as the hydatid of Morgagni, is usually seen as an oval structure in the groove between the testis and epididymis and is isoechoic to the testis.

- The appendix epididymis, found at the head of the epididymis, is the same size and echogenicity as the appendix testis but is often pedunculated.

- The appendix of the epididymal tail is similar to the others but is less commonly identified.

**Torsion of the Testicular Appendages**

Torsion of the appendix testis occurs mainly in prepubertal boys (aged 7-14 years), is more frequent on the left side, and is a common cause of acute scrotum in this age group.

Affected patients typically present with gradual or sudden intense pain, usually localized in the upper pole of the testis.

In approximately onethird of patients, a nodule of the upper scrotum with bluish skin discoloration ("blue dot" sign) is palpated. This is a pathognomonic feature of this entity, and US examination is not necessarily required for the diagnosis when it is present.

At US, the twisted appendage is seen as a round extratesticular mass with high or mixed echogenicity depending on the evolution time. Associated findings include an enlarged epididymal head, reactive hydrocele, and scrotal skin thickening. There is no Doppler signal in the twisted appendage, and the epididymis and scrotal tunics are hypervascularized.

Management consists of bed rest and nonsteroidal anti-inflammatory agents.
Within days, the twisted appendix may calcify and become detached, leaving a scrotal calcification, known as a scrotolith.

Images for this section:
Fig. 1

Fig. 2: Right epididymis.

Fig. 3: Epididymal cysts
Fig. 6: Adenomatoid tumor in the tail of the epididymis
Fig. 7: Varicocele
Fig. 8

Fig. 9: Hematoma of the spermatic cord
Fig. 11: Metastases of hypernephroma in right kidney.
Fig. 14: Sebaceous cyst of the right scrotum
Conclusion

Ultrasound involves the imaging method of choice for studying the scrotal pathology and therefore paratesticular lesions. For their study and understanding is essential knowledge of the sonographic anatomy of these structures and the main findings of the various entities that affect this anatomic region. Although most lesions are benign paratesticular epididymis (cysts or spermatoceles), scrotal collections, inflammatory lesions or cystic lesions hernias, there is a low prevalence of solid neoplastic lesions that is also important to know.

Personal information

References


