Penis ultrasound: What can we expect?

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Learning objectives

Overview of the penis and its pathology studied with ultrasound.

Background

The penis is an easily accessible organ, so that ultrasound is the imaging technique of choice to study the anatomy, look for pathology and evaluate functional problems.

The main penis components are the two corpora cavernosa, responsible for erection, and the corpus spongiosum, which protects the urethra (Fig. 1). The former are surrounded by the tunica albuginea. The Buck and Colles fasciae lie superficially. [1-4]

Each corpus cavernosum has an artery and many sinusoidal spaces which eventually drain in the deep dorsal vein, which lies between the tunica albuginea and the Buck fascia. [1-5]

The superficial dorsal vein lies between the Buck and the Colles fasciae and collects blood from the skin and glans. [1]

Erection is achieved when the neurogenic impulse increases arterial flow and blood fills the sinusoidal spaces collapsing the efferent veins against the tunica albuginea preventing the drainage to the deep dorsal vein. [2,5]

The Doppler waveform changes from low systolic velocity (11-20 cm/s) with minimal diastolic flow in flaccid penis to a high systolic velocity (over 35 cm/s) and diastolic flow inversion in erection. [1,2,5,6]

The main reasons for seeking medical attention are: erectile dysfunction and penis deformity with palpable nodules. In the emergency setting the commonest problems result from traumatic events, infections and, less frequently, priapism.

Images for this section:
Fig. 1: Transverse ultrasound image along the dorsal aspect of the penis showing its main components: two corpora cavernosa (*) and corpus spongiosum (+)
Findings and procedure details

ERECTILE DYSFUNCTION

To assess the erectile function we inject a vasoactive drug in the corpora cavernosa and measure the systolic and diastolic velocities of each carvenosal artery every 5 minutes for 30 minutes. There are many etiologies of erectile dysfunction: vascular, psychogenic, neurologic, endocrinologic, pharmacologic, traumatic,… however the venous insufficiency is the main cause. [2,5,7]

In venous insufficiency the systolic velocity increases but there is no inversion of the diastolic flow after the injection of the vasodilator agent (Fig. 2). In arterial insufficiency the systolic velocity remains below 25 cm/s [2,7]

PENIS DEFORMITY AND NODULES

Peyronie disease is responsible for the majority of palpable nodules [6] (Fig. 3 and 4). The formation of fibrous plaques and calcification of the tunica albuginea causes pain and deformity during erection. Treatment depends on the severity of the disease [6,8-10].

Non-venereal sclerosing lymphangitis is a nodule in the sulcus coronarius of unknown etiology, although it is thought to be traumatic (Fig. 5). It may cause pain during erection and disappears in 3-6 weeks without any treatment. [11,12]

Tumours: they can be primary, normally squamous, or metastasis from pulmonary, bladder or prostate carcinomas. [6] (Fig. 6)

Rarely, in patients with terminal renal disease we can find calciphylaxis, a diffuse calcification of arteries and tunica albuginea. [6]

We may also find other nodules such as periuretral cysts (Fig. 7).

EMERGENCY

Superficial vein thrombosis (Mondor syndrome) is caused by a repeated traumatisms. It typically occurs after 24-48 hours of prolonged sexual intercourse. There is a painful
indurated tract on the dorsal face of the penis. Ultrasound shows an enlarged, non compressible, superficial dorsal vein with echogenic material and with no color flow (Fig. 8). [4,6,13,14] It normally resolves after 6-8 weeks. [13,15]

**Hematoma** after a traumatism is seen as an heterogeneous hypoechoic collection. (Fig. 9)

**Penile fracture** may occur during sexual intercourse with pain followed by detumescence, inflammation and deformity. The tunica albuginea of the corpus cavernosum breaks (Fig. 10, 11 and 12) and if the Buck’s fascia is also broken the hematoma extends to the scrotum and perineum [16]. Surgery is mandatory to prevent complications. [4,6] The corpus spongiosum may also break (Fig. 13), but it is much less common.

Other traumatic injuries can occur such as: corporal thrombosis, the corpus cavernosum is enlarged with no flow on Doppler ultrasound; high-flow priapism with an arteriovenous fistula; fracture of the suspensory ligament, a gap exists between the pubis and the corpora cavernosa; fracture of penile prosthesis with prosthesis’ fluid extravasation (Fig. 14);.... [6,16]

**Infections**: they occur after surgery or urethral manipulation and in diabetic patients after injection of vasoactive drugs. [6]

- Cellulitis: thickening of the superficial tissue with hyperemia (Fig. 15). [6]
- Cavernositis increases the vascularity of the corpora, there is oedema and microabscesses.
- Abscess: hypoechoic collection with debris or gas (Fig. 16). It needs surgical treatment. [6]

**Priapism** refers to a prolonged pathologic erection with no relation to sexual stimuli [17].

- Low-flow priapism is an emergency which consists on prolonged painful erection with absence of flow in the cavernosal arteries due to inadequate venous outflow leading to necrosis and dysfunction [3-5,17]. Diagnosis is based on clinical findings, but ultrasound may show changes in corpora cavernosa with blood stasis with fluid-fluid level [6]. It is important to note that the superficial dorsal vein may have flow. (Fig. 17)
- High-flow priapism is not painful and it is mainly due to a traumatic event with formation of an arterial-lacunar fistula [3-5,17] Treatment of choice is still controverted [17], with some authors recommending embolization [4,5] and others conservative management [3].
Fig. 2: A patient with erectile dysfunction due to venous insufficiency. After the injection of a vasodilator agent, the systolic velocity increases but the diastolic flow remains present.

Fig. 3: Peyronie’s disease in two patients with palpable nodules and penis deformity. There are calcified plaques of the tunica albuginea. They are more frequently located on
the dorsal aspect of the penis (Fig. 3), but they can be found elsewhere as in Fig. 4 in which the disease affects the septum.

**Fig. 4:** Peyronie’s disease in two patients with palpable nodules and penis deformity. There are calcified plaques of the tunica albuginea. They are more frequently located on the dorsal aspect of the penis (Fig. 3), but they can be found elsewhere as in Fig. 4 in which the disease affects the septum.
**Fig. 5:** Non veneral sclerosing lymphangitis in a patient with a nodule in the sulcus coronarius, with no flow on Doppler ultrasound.

**Fig. 6:** This patient was referred for a palpable bump on the distal penis. On the transverse ultrasound image there is a solid nodule which corresponds to a primary tumour.
**Fig. 7:** This patient was referred for a palpable bump on the distal penis. On the transverse ultrasound image there is a cystic structure which corresponds to a periuretral cyst.

**Fig. 8:** Superficial vein thrombosis. The left transverse Doppler image along the dorsal aspect of the penis shows an enlarged superficial dorsal vein with echogenic material and no flow. The right transverse Doppler image of the same patient two weeks later shows partial recanalization of the superficial dorsal vein.
**Fig. 9:** Transverse ultrasound image along the dorsal aspect of the penis after a traumatism shows an hypoechoic collection (marks) in the subcutaneous tissue in relation to an hematoma.
**Fig. 10:** Penile fracture. Transverse ultrasound image along the ventral aspect of the penis showing disruption of the tunica albuginea at the ventral side of the left corpus cavernosum with an hematoma.
Fig. 11: Penile fracture: Transverse Doppler image along the ventral aspect of the penis showing disruption of the tunica albuginea of lateral aspect of the right corpus cavernosum with a vascular communication between the corpus cavernosum and the subcutaneous tissue with hematoma.
Fig. 12: Transverse ultrasound image along the ventral side of the penis in a patient with erectile dysfunction several months after an important traumatism without medical attention shows the right corpus cavernosum with an hyperecogenic rim in relation to fibrosis. This patient probably had a fracture of the right corpus cavernosum which was improperly treated.
Fig. 13: Penile fracture. Transverse ultrasound image along the ventral side of the penis showing an important hypoechogenic collection around the corpus spongiosum indicating its fracture.
**Fig. 14:** Penile prosthesis fracture. A patient with non functioning penis prosthesis and swelling. Transverse ultrasound image showing a penile prosthesis with its components in the corpora cavernosa and surrounding anechoic collection with echogenic foci corresponding to extravasation of the fluid of the prosthesis.

![Image of ultrasound showing penile prosthesis fracture](image)

**Fig. 15:** On this transverse Doppler image there is thickening of the superficial tissue with hyperemia in a patient with cellulitis.
Fig. 16: Transverse ultrasound image showing two hypoechoic collections with debris and hyperechoic dots of gas in relation to abscesses.
**Fig. 17:** Low-flow priapism. Transverse Doppler ultrasound image of a patient with priapism with no flow in the cavernosal arteries. This situation needs urgent surgical treatment to prevent necrosis of the corpora cavernosa with loss of the erectile function.
Conclusion

We should be familiar with the penis pathology to make the correct diagnosis as it will help the management of the patient.

Venous insufficiency is the main cause of penile dysfunction and can be assessed with Doppler ultrasound. Peyronie disease is responsible for the majority of palpable bumps, although there are other entities which we should have in mind. Traumatisms should be assessed carefully as a corpus cavernosum fracture needs urgent surgical treatment, as occurs with low-flow priapism, to preserve erectile function.

Personal information

References


