

ULTRASOUND ASSESSMENT OF COMMON PENILE PROBLEMS

Emmanuel Abiola Babington and Dr. Rosemina Ahmad
The Royal Wolverhampton NHS Trust
University Hospitals of Leicester NHS Trust

Introduction

Ultrasound is a valuable tool for examining the penis. A high frequency linear transducer clearly delineates the penile anatomy as well as its pathological appearances. Colour and spectral Doppler play key roles in assessing blood flow and monitoring the different phases of erection in patients with erectile dysfunction (ED), while B-mode imaging is essential for evaluating the anatomy of the corporal bodies and the tunica albuginea, thereby assisting in the detection of traumatic and non-traumatic pathologies.

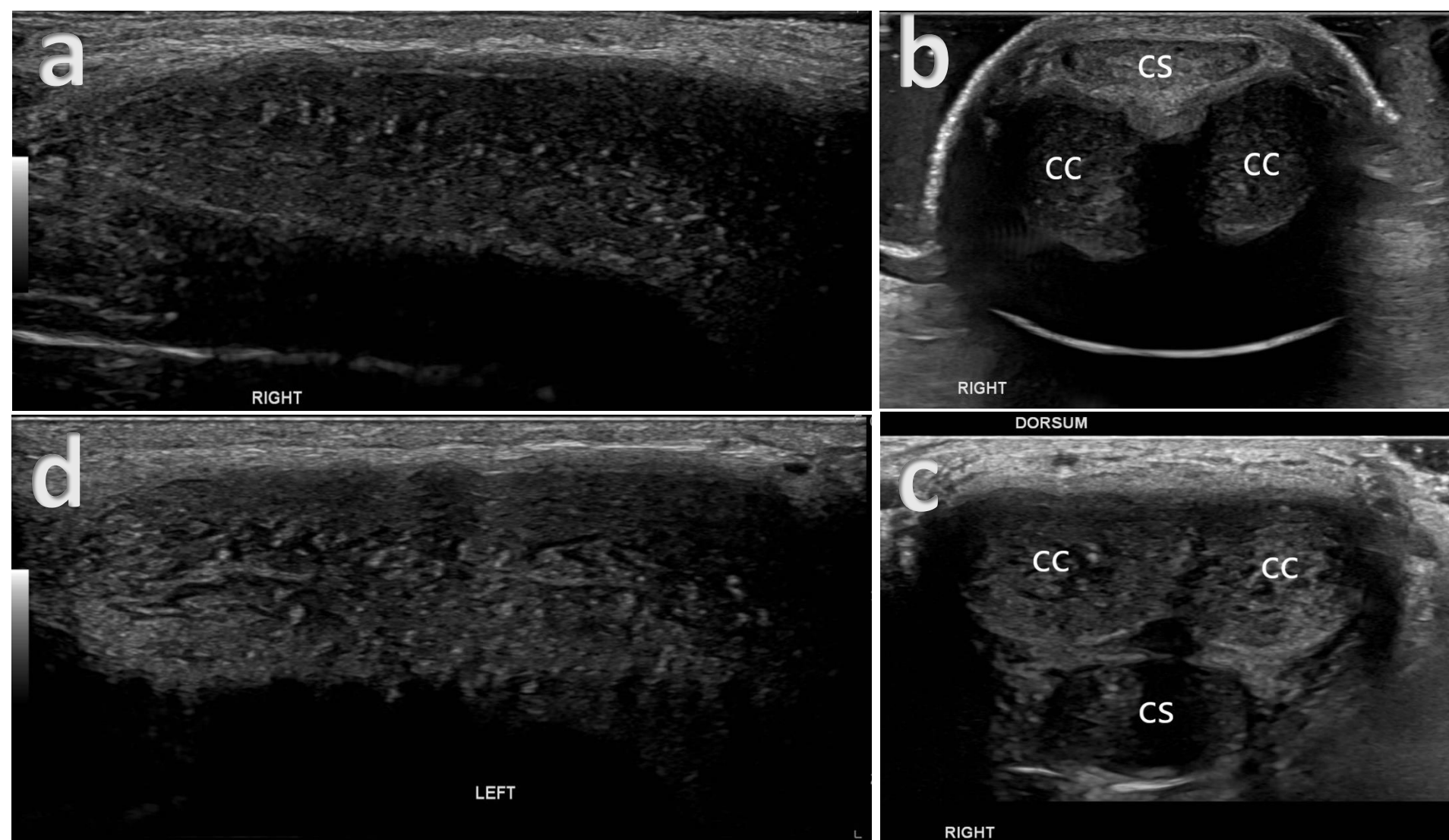


Fig. 1 B-mode ultrasound of the penis depicting the cavernosal bodies. (a) and (d) showing longitudinal sonograms of the right and left corpora cavernosa (CC). (b) and (c) depicting an axial segment of the penis; with the ultrasound probe placed ventrally (b), while (c) was acquired dorsally where the corpus spongiosum (CS) appears posterior to the corpora cavernosa (CC).

Penile anatomy

The penis is made up of three homogeneous cylindrical corporal bodies; paired corpora cavernosa (CC) and the single corpus spongiosum (CS). The CC contain numerous sinusoids that expand from the centre out in response to erectile stimuli. The CC are encased by the tunica albuginea, a stretchable fibrous sheath, that partitions medially forming the penile septum.

The arterial supply of the penis is by the common penile artery; which gives off the cavernosal arteries. The latter gives off the helicine arterioles within the CC.

The venous drainage of the penis is primarily via the superficial and deep dorsal veins.

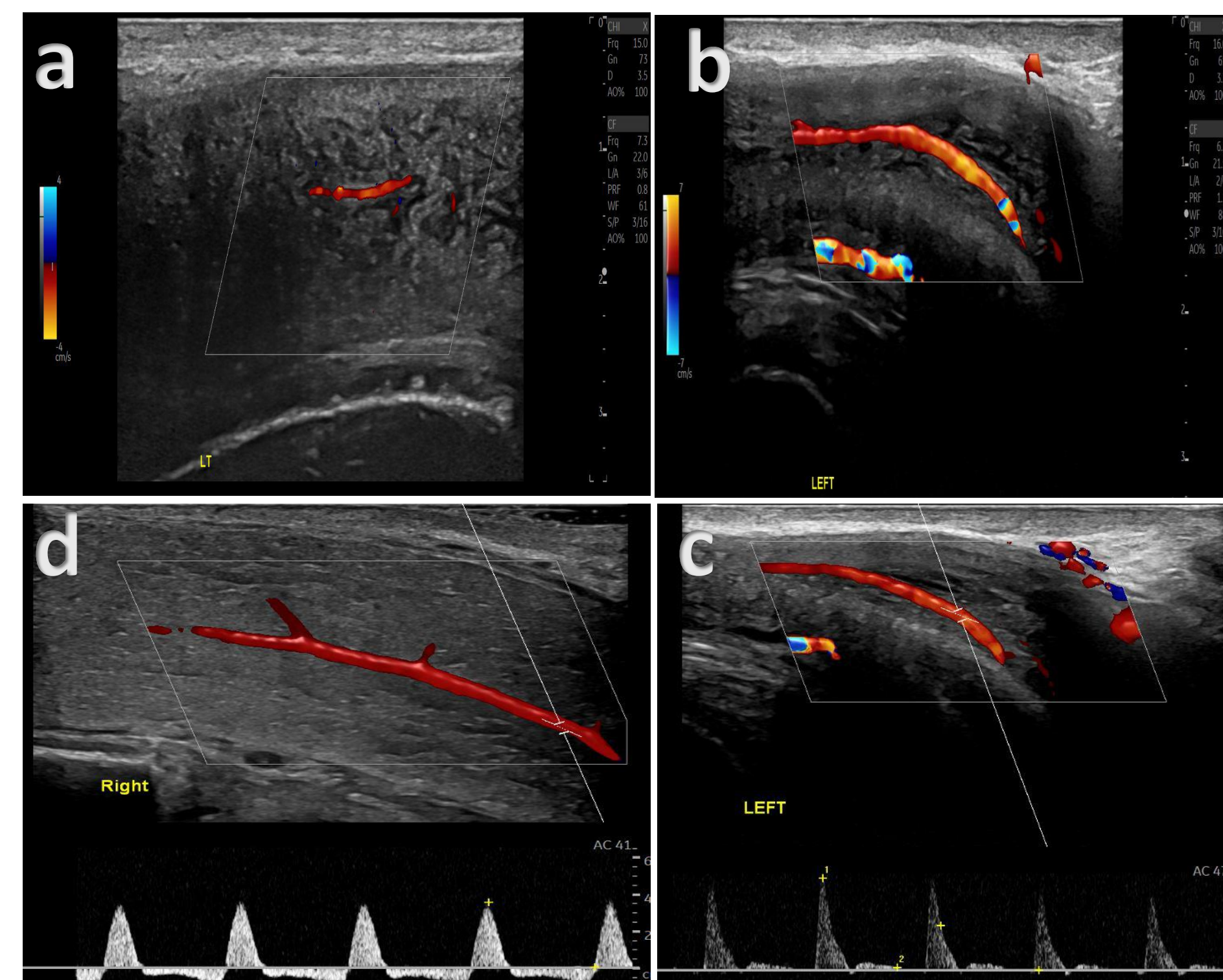


Fig. 2 Doppler ultrasound of the penis post Caverject injection. (a) depicts the expanding sinusoids of the left CC and a short segment of the cavernosal artery. (b) CDI of the cavernosal artery and the expanding sinusoids in response to the injection. (c) Left cavernosal artery post Caverject injection - spectral Doppler - PSV 45 cm/s EDV 1.4 cm/s - Good response to Caverject. (d) Reverse diastolic flow at full erection – an expected findings in a normal penis.

Scanning technique

Due to the sensitive nature, the examination should be conducted in a quiet and professional environment, with minimal personnel present. The patient should be in a supine position and asked to support the penis backwards; pointing cranially. In this position, the surface resting on the patient is the dorsum of the penis. A high frequency (15 - 20 MHz) linear-array transducer is required for the examination with a lot of ultrasound gel needed for adequate probe contact. The penile anatomy is examined from the base to the glans in axial and longitudinal orientations. The cavernosal and helicine arteries are examined longitudinally using colour and spectral Doppler imaging. An intracavernosal injection of 10 – 20 µg of Caverject and a 5 – 10 minutes interval scanning is commonly required in examining patients with erectile dysfunction.

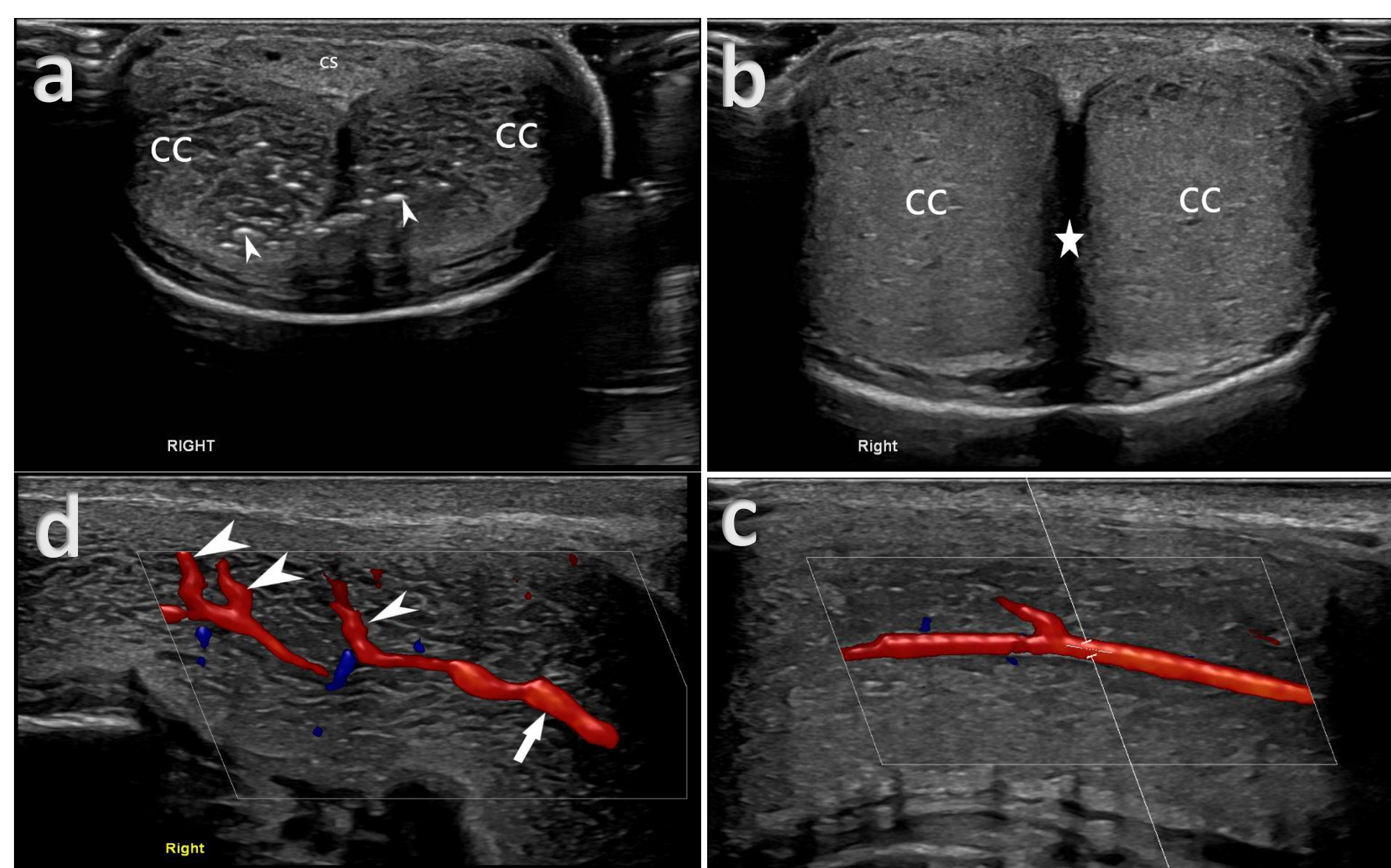


Fig. 3 Penile ultrasound anatomy post Caverject injection. (a) Normal penile ultrasound anatomy showing the echogenic flecks of the Caverject bubbles (2 arrow heads) travelling within the sinusoids of the CC with some secondary sinusoidal. (b) B-mode ultrasound of the erect penis in axial orientation, note the shadowing from the penile septum (star). (c) CDI of the cavernosal artery and (d) CDI showing the cavernosal artery (arrow) and the helicine arterioles (3 arrow heads)

Erectile dysfunction

Erectile dysfunction (ED) is the persistent inability to attain or maintain penile rigidity adequate for sexual intercourse.

The physiology of erection primarily involves the nervous, arterial, and venous systems. Upon stimulation, an array of neural events lead to an increased blood flow into the penis that gets trapped in the helicine arterioles by the engorged sinusoids within the CC. The venous complex is compressed against the tunica albuginea, leading to a physiological occlusion that ensures erection is maintained. The role of ultrasound is to establish an arterial or venous insufficiency by evaluating the PSV, EDV, and spectral flow pattern within the cavernosal arteries.

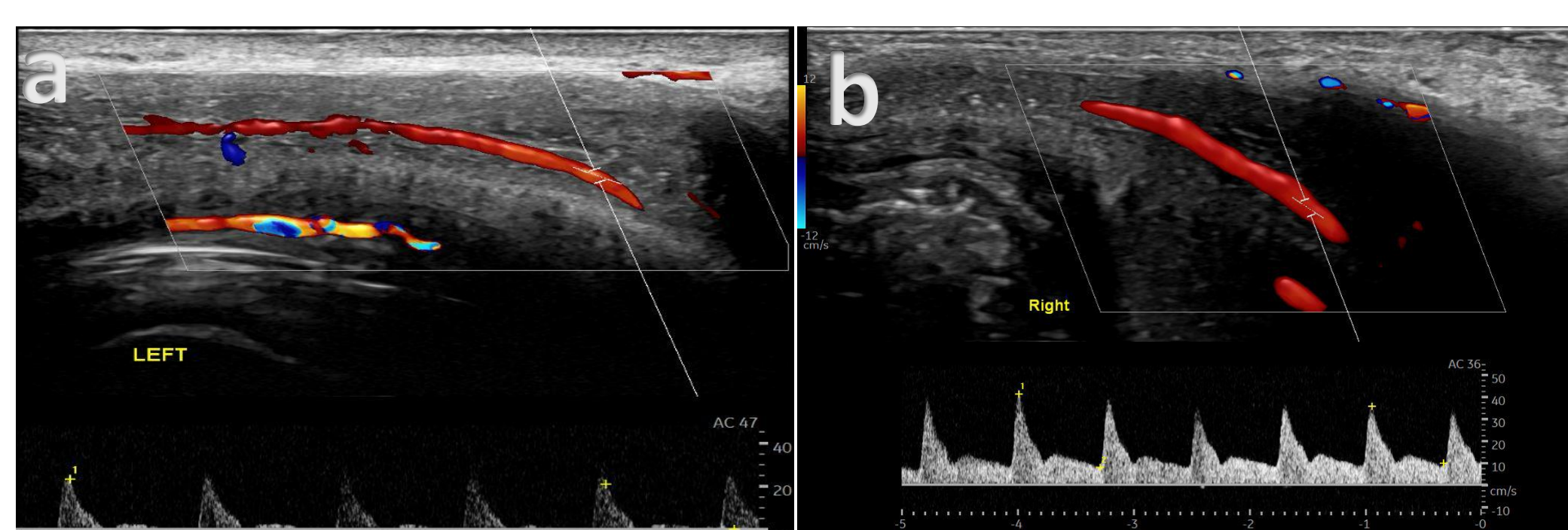


Fig. 4 Erectile dysfunction. (a) Spectral Doppler of the penis acquired 25 mins post injection with the PSV being 23.6 cm/s. (b) Venous leak - 20 mins post injection with a PSV of 41 cm/s and a persistently elevated EDV of 10 cm/s.

Priapism

Priapism is the onset of painful and prolonged erection that lasts > 4 hours. Its aetiology can be idiopathic, iatrogenic, or from a prior history of substance abuse. It can also be a side effect of vasoactive drugs for inducing erection. Priapism can be either low-flow or high flow priapism. Ultrasound helps detect the presence of arteriovenous malformations in patients with priapism.

Peyronie's disease

Peyronie's disease (PD), described in 1743 by François Gigot de la Peyronie, is the focal fibrosis of the tunica albuginea. It commonly presents as a painful or painless palpable lump on the penis. PD can lead to an abnormal curvature of the penis with the potential of eliciting pain during erection. Although of an unclear aetiology; PD can be either post-traumatic or idiopathic. Ultrasound helps to confirm the presence and extent of the pathology. On ultrasound, PD appears as an area of focal thickening of the tunica albuginea, particularly during its acute onset. Overtime, it becomes calcified, as seen below.

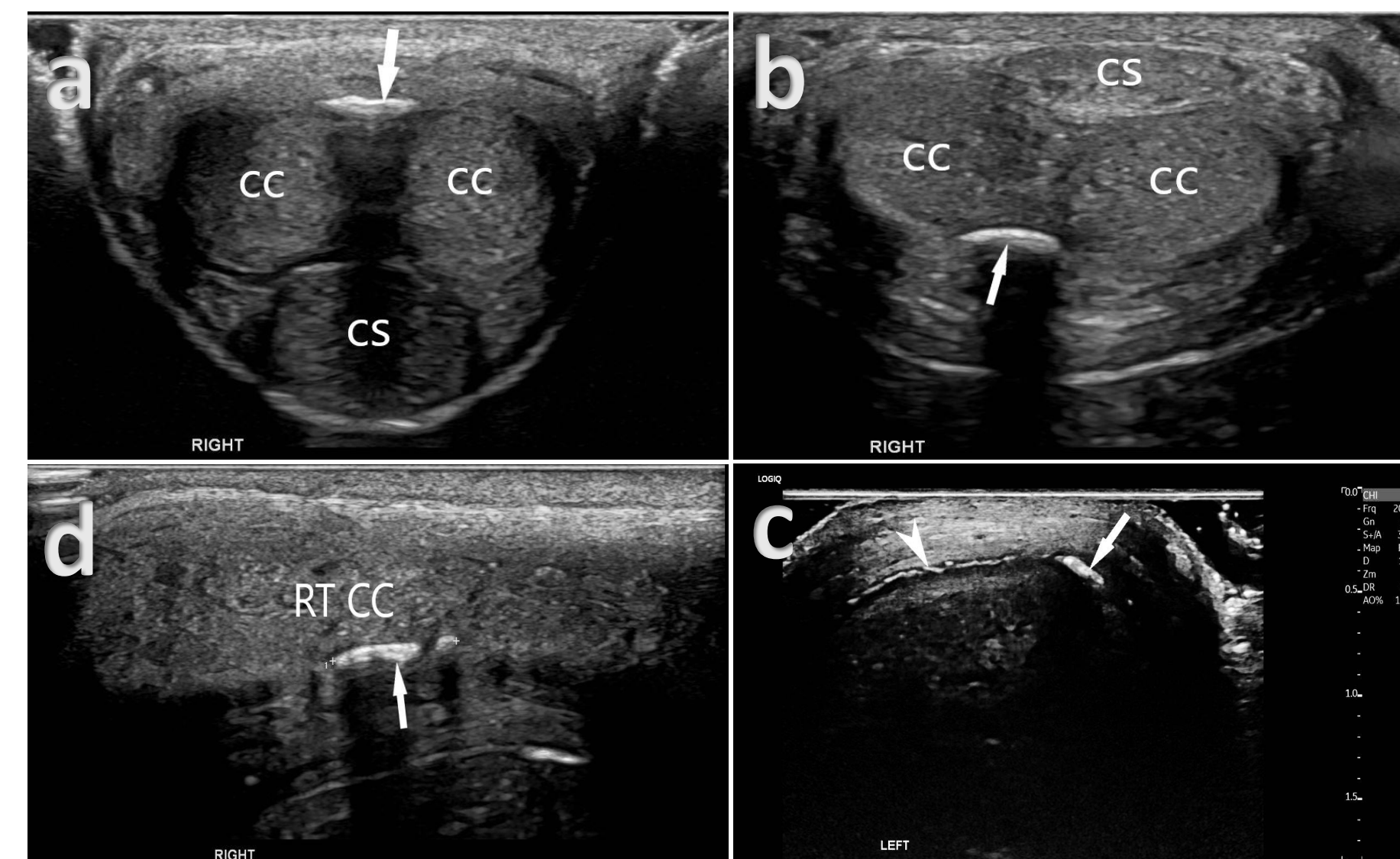


Fig. 5 Peyronie's Disease. (a) Echogenic plaque (arrow) within the tunica albuginea of the dorsum of the penis, between the CCs. (b) Plaque (arrow) - posterior to the right CC. (c) Using the 'Hockey stick' (20 MHz) probe - note the clear delineation of the tunica (arrow-head) and the localisation of the plaque (arrow). (d) Plaque (arrow) in the tunica of the posterior right CC - ventral view - longitudinal

Penile fracture

Penile fracture occurs due to trauma to the erect penis, predominantly during sexual activities. Patient's often report hearing a snap or cracking sound accompanied by detumescence then corresponding swelling and severe pain. This is a urological emergency that is often diagnosed clinically, with imaging required to deduce its extent. On ultrasound, it appears as a hypoechoic area of discontinuity of the thin echogenic tunica albuginea; better appreciable with the probe in a longitudinal orientation. Frequently, a hypoechoic area of haematoma can be visualised within the subcutaneous layer of the penis adjacent to the site of fracture.

References

- Varela CG, Yeguas LA, Rodríguez IC, Vila MD. Penile Doppler ultrasound for erectile dysfunction: technique and interpretation. American Journal of Roentgenology. 2020 May;214(5):1112-21.
- Bertolotto M, editor. Color Doppler US of the penis. Berlin: Springer; 2008 Jan 1.