

# High-frequency Ultrasound in Peyronie's Disease: A Case Series

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## Abstract

Peyronie's disease (PD) is a well-known penile condition that primarily affects adult males. Patients with PD typically present with a palpable nodule in the penis. However, there has now been evidence of young males being affected thus making early identification important. Imaging has crucial role in the localization, characterization, and confirming the diagnosis of the disease. Ultrasonography is the most preferred modality. The disease has two stages: early and late, with chances of improvement when treated early. We present varied imaging findings associated with PD based on the classification of Bekos *et al.* with the use of color Doppler investigation whenever necessary.

**Keywords:** Nesbit technique, papaverine study, Peyronie's disease, venous leak

## INTRODUCTION

Peyronie's disease (PD) is a physically and mentally crippling condition. It develops when a fibrous, inelastic plaque, or calcified plaque grows in the tunica albuginea. This can lead to penile deformity such as penile curvature, narrowing, and shortening. These patients can also present with palpable or nonpalpable penile nodules in the flaccid condition which are the main cause behind the penile deformity.<sup>[1]</sup> PD is assumed to mostly affect older men, but evidence indicates that it can also affect younger men, necessitating more aggressive treatment. According to the estimates, the disease affects 0.3%–13.1% of men worldwide. This condition was previously known as Induratio penis plastica. In 1743, Francois de la Peyronie, a physician first described this to King Ludwig XIV.<sup>[2]</sup> The diagnosis of the disease can be suspected by a history and a thorough examination. The examination should be followed by the imaging of the penis. Currently, high-frequency ultrasonography remains the most preferred modality, due to the ease, availability, and its ability to allow the characterization of the lesion.<sup>[2]</sup> Bekos *et al.* carried out a study to characterize the lesions on the basis of ultrasonographic features and classified the lesions into three types, thus aiding the characterization of plaques according to the natural history.<sup>[3]</sup> The patient's complaints, clinical findings, and imaging provide a wholesome

approach to the disease diagnosis. Early diagnosis and prompt medical management play the crucial role in treating the patient; however, in late stages of the disease, patient might require surgical management.

## CASES

All the patients referred to the department of radiodiagnosis and imaging having complaints of a palpable nodule or painful erection or bent erect penis likely suggestive of PD were included. High-frequency ultrasonography was performed using 3–12 MHz linear transducer to examine the penis. This was supplemented with color Doppler examination whenever required.

### Case 1

#### Type A: Peyronie's disease with fibrosis

A 38-year-old patient presented with complaints of pain on erection; however, no any palpable nodule or mass was noted on a flaccid state. He underwent a high-frequency ultrasonography examination. A hyperechoic region suggestive of fibrosis was found at the intercorporeal septum [Figure 1a and b]. This

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hyperechoic lesion showed no posterior shadowing. According to the classification suggested by Bekos *et al.*,<sup>[3]</sup> this was labeled as a type A plaque.

### Case 2

#### *Type B: Peyronie's disease with moderately hyperechoic lesions or scattered calcifications*

A 45-year-old patient complained of painful erection and underwent high-frequency ultrasonography. Multiple tiny hyperechoic foci were noted on the dorsal aspect of penis peripherally in the tunica albuginea and few were noted in both corpora cavernosa. Sagittal and axial sections showing hyperechoic foci [Figure 2a and b]. This was a type B plaque according to Bekos *et al.*<sup>[3]</sup>

### Case 3

#### *Type B: Peyronie's disease with moderately hyperechoic foci or scattered calcifications*

A 48-year-old patient had complaints of erectile dysfunction with left-sided deviation of the penis on erection. On ultrasonographic evaluation, multiple tiny hyperechoic foci were noted in left corpora cavernosa [Figure 3a]. The patient was then taken consent of papaverine study. 2 cc (60 mg) of papaverine was injected in each corpora cavernosum and the Doppler study was done. Both the cavernosal arteries showed normal velocities before and after the papaverine injection. There was normal response after injection in form of significant increase in systolic as well as diastolic flow velocities in the initial phase with gradual reduction in the end diastolic flow [Figure 3b]. There was no evidence of venous leak.

### Case 4

#### *Type B: Peyronie's disease with moderately hyperechoic foci or scattered calcifications*

A 52-year-old patient came with complaints of erectile dysfunction. The patient also had a history of sudden pain during

intercourse with bleeding per urethra. Physical examination was normal. On high-frequency ultrasonography, multiple tiny hyperechoic foci were noted in intercorporeal septum as well as few in bilateral corpora cavernosa [Figure 4a and b]. The patient was then injected papaverine for vascular evaluation.

On postpapaverine study, peak systolic velocity in left corpora cavernosa was less than normal<sup>[4]</sup> [Figure 4c] and unequal intumescence of the left and right cavernosa was noted [Figure 4d]. Right cavernosa was much bigger in size as compared to left, causing the deviation of the penis toward left.

### Case 5

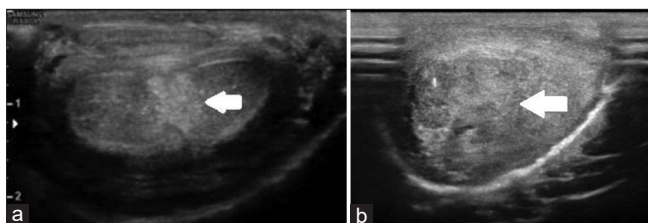
#### *Type C: Peyronie's disease with dense hyperechoic calcifications*

A 42-year-old patient came with complaints of discomfort during intercourse due to some palpable nodule in the shaft of the penis. On high-frequency ultrasonographic evaluation, multiple calcific foci were noted in the corpora cavernosa bilaterally giving dense posterior acoustic shadowing [Figure 5]. On basis of these ultrasonographic features, this was classified as type C case of PD according to the Bekos *et al.*

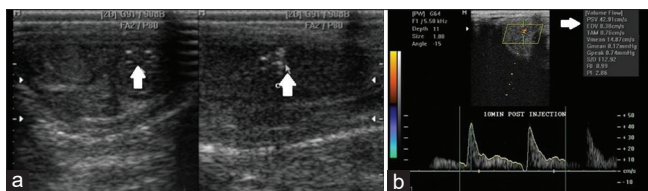
### Case 6

#### *Type C: Peyronie's disease with hyperechoic calcifications*

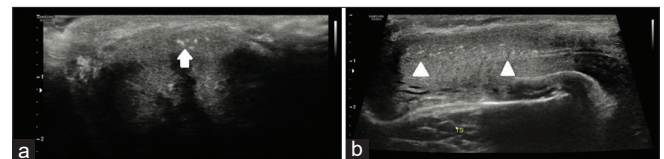
A 50-year-old patient came with complaints of palpable nodular swelling near glans. On high-frequency ultrasonographic evaluation, 2–3 calcific foci giving posterior acoustic



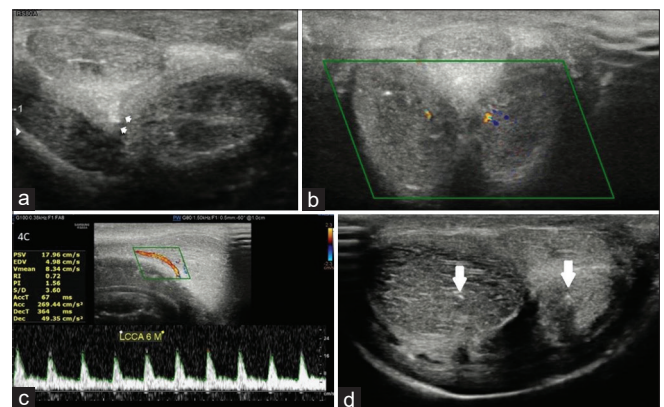
**Figure 1:** (a and b) B-mode ultrasonography showing hyperechoic region of fibrosis found at the intercorporeal septum (arrows)



**Figure 3:** B-mode ultrasonography showing multiple tiny hyperechoic foci noted in left corpora cavernosa (arrow in a) and Doppler velocities showing reduced velocity at 10 min post injection (arrow in b)



**Figure 2:** (a and b) Sagittal and axial sections in B-mode ultrasonography showing hyperechoic foci (arrowheads and arrows in a and b, respectively)



**Figure 4:** B-mode ultrasonography showing multiple tiny hyperechoic foci noted in intercorporeal septum as well as few in bilateral corpora cavernosa (arrows in a and b). Reduced postpapaverine peak systolic velocity in left corpora cavernosa (in c). Unequal intumescence of the left and right cavernosa was noted (arrows in d)

shadowing [Figure 6a and b] were noted on the dorsal aspect of glans of the penis and peripheral in location. This was a type C case according to Bekos *et al.*

### Case 7

#### Type C: Peyronie's disease with dense hyperechoic calcifications

A 49-year-old patient presented with complaints of insufficient erection and shortened penile length. On high-frequency ultrasonography evaluation, multiple linear dense calcific foci were noted in the intercorporeal septum giving posterior acoustic shadowing [Figure 7a and b]. On color Doppler evaluation in the flaccid state, the arteries showed normal flow velocities [Figure 7c]. This case was type C of Bekos *et al.* types of plaque.

### Case 8

#### Type C: Peyronie's disease with dense hyperechoic calcifications

A 56-year-old patient came with complaints of erectile dysfunction and palpable nodules in the shaft of penis and was advised high-frequency ultrasonography. On ultrasonography, multiple dense calcific foci were noted involving the bilateral corpora cavernosa and intercavernosal septum [Figure 8a]. These showed posterior acoustic shadowing and were classified

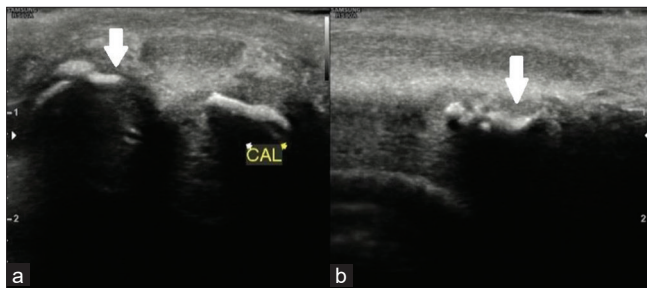
as Type C according to Bekos *et al.* The patient was then injected papaverine for vascular evaluation.

Postpapaverine the increase in peak systolic velocities was in normal range (more than >35 cm/sec). The end diastolic velocity (EDV) at 5 min [Figure 8b] and 15 min [Figure 8c] was 10.7 cm/sec and 7.5 cm/sec, respectively, which are higher than the normal posttumescent expected EDV velocity of 3–5 cm/sec. This was suggestive of a disturbed veno-occlusive mechanism due to venous leak.<sup>[4]</sup>

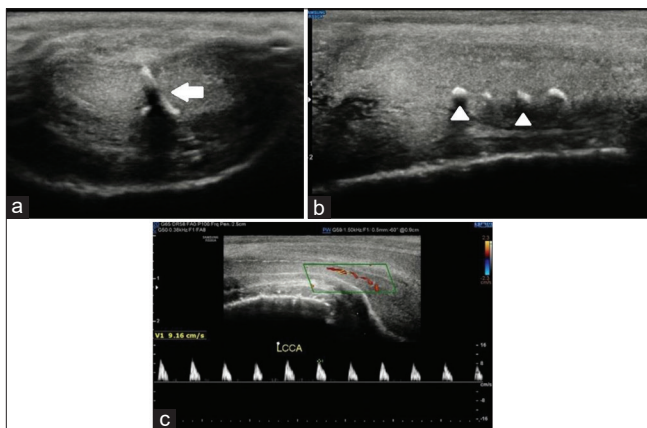
## DISCUSSION

PD is generally easy to diagnose and is based on the history. However, the specific pathophysiology and physical history of the disease remain unknown, posing therapeutic dilemmas, particularly whether the necessity for surgical treatment is certain.<sup>[3]</sup>

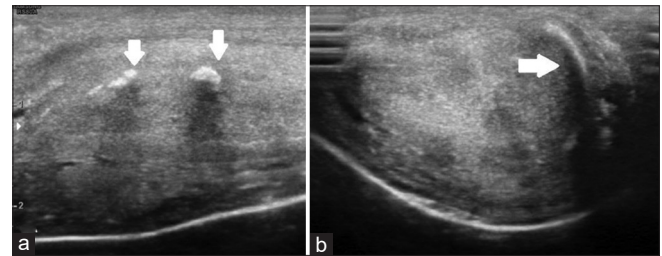
Patients with PD might present with penile erections that may be accompanied by localized pain in the early stages of the condition. Sometimes, the patient may not have any symptoms, and the lesion will only be seen during a physical exam (case 1).



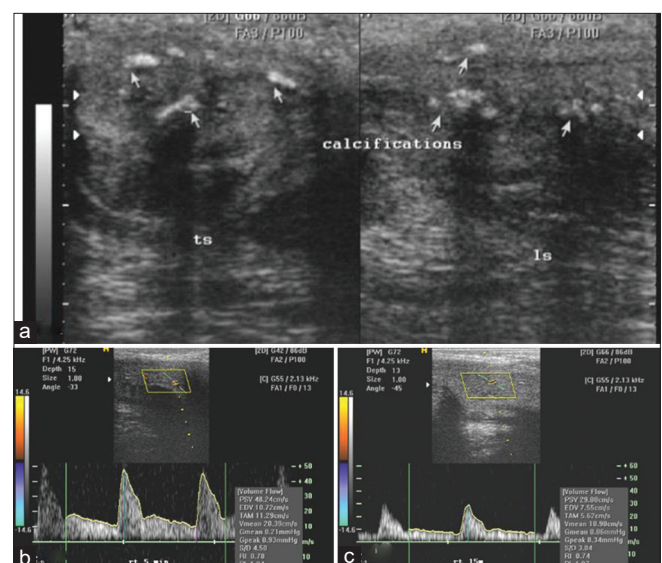
**Figure 5:** (a) (axial) B mode ultrasonography showing multiple dense calcific foci were noted in the corpora cavernosa bilaterally giving dense posterior acoustic shadowing (arrow). (b) (sagittal) Dense calcific foci of right corpora cavernosa. (arrow)



**Figure 7:** B-mode ultrasonography showing multiple linear dense calcific foci in the intercorporeal septum giving posterior acoustic shadowing (arrows and arrowheads in a and b). Left cavernosal artery showing normal velocity in the flaccid state (in c)



**Figure 6:** B-mode ultrasonography showing few (2–3) calcific foci in the dorsal aspect and peripheral aspect of glans giving posterior acoustic shadowing (arrows in a and b)



**Figure 8:** Multiple dense calcific foci involving the bilateral corpora cavernosa and intercavernosal septum (Small arrows in a). Higher than normal end diastolic velocity at 5 min and 15 min postpapaverine injection suggestive of venous leak (b and c)



The patient can also complaint of erectile dysfunction due to the discomfort caused by a bent penis on erection, which actually is due to inelastic side of the penis caused by fibrous plaques (case 3). Occasionally, patients might bring along a photograph of a bent erect penis.<sup>[2]</sup> On examination of the penis, palpable plaques are noted in most cases.

The dorsal side of the penis accounts for 77% of penile plaques in PD, while the ventral and lateral surfaces, including the inter-corporeal septum, are also possible locations (Case 2 and Case 7).<sup>[5]</sup> These plaques can range from minute intraseptal lesions which might remain unnoticed on the physical examination to large lesions which are easily palpable on examination. Furthermore, sometimes plaques with calcifications might not be palpable and escape physical examination and can lead to a poorer response to therapy.<sup>[6]</sup>

People having genetic susceptibility to abnormal wound healing or having connective tissue, autoimmune or vascular diseases are prone to develop the disease in case of sexual trauma. However, currently, the original hypothesis of the condition is caused by recurrent, mild sexual trauma is still regarded as the most likely explanation.<sup>[7]</sup>

The disease has an early active phase and a late stable phase. The early active inflammatory phase can cause pain and can be managed conservatively; however, late phase might need surgical management. Ultrasonography in early stages can help diagnose fibrous plaques (Case 1) and can aid the early detection of the condition, thus benefitting the patient.<sup>[1,2]</sup>

The use of high-frequency ultrasonography and color Doppler in PD patients provides an invaluable tool for the detection, objective measurement, and characterization of plaques (Case 3).<sup>[6]</sup> Penile ultrasonography proves more efficient than radiography because it allows for the detection of tiny, nonpalpable lesions and indicate the amount of fibrosis. It also specifies the number of plaques, their diameters, and the precise topography along with acoustic shadowing if any.<sup>[2]</sup>

Ultrasonography detects calcified plaques with 100% sensitivity, is simple to perform and does not expose patients to ionizing radiation, as do X-rays and computed tomography scans. Precise determination of plaque size also makes it an ideal tool for monitoring patients during conservative treatment or after surgery.<sup>[7]</sup>

In these cases, we used the classification based on the natural history of disease by Bekos *et al.* This helps the clinician decide the prognosis and stage of the disease and hence formulate the management of the patient in terms of medical or surgical treatment options. Bekos *et al.* used high-frequency ultrasonography data reflecting the various stages of PD to analyze the disease's natural history on serial ultrasonographic evaluation of the plaques. The ultrasonography findings were classified as type A, B, and C, with type A showing no calcification and no acoustic shadowing, type B showing multiple hyperechoic foci or scattered calcified lesions with acoustic shadowing, and type C exhibiting dense calcified plaques.<sup>[3]</sup>

Several potential reasons of penile bending and induration must be taken into account when doing an ultrasonography on patients who have been referred for PD. The following conditions are included in the differential diagnosis: a chordee with or without hypospadias, a congenitally curved penis and dorsal vein thrombosis.<sup>[1]</sup>

Ultrasonography is the most preferred modality in both early and late phases. However, in early phases and follow-up patients who have undergone clinical or surgical treatment, magnetic resonance imaging (MRI) can be advised in characterization of the plaque, especially when gadolinium-enhanced scans are done to show the hyperenhancement of plaques.<sup>[1,2]</sup>

In the early phase, conservative management is emphasized and practiced in the form of oral medications, intralesional injections, and topical treatments. Out of the various oral options such as Vitamin E, tamoxifen, Phosphodiesterase-5 (PDE5) inhibitors, colchicine, and Potassium para-aminobenzoate (Potoba), Potoba is helpful as it is antifibrotic and is seen to be effective in PD. Injections including clostridial collagenase, interferon, and steroids are also tried. There is verapamil cream available as the topical treatment of the patients with PD.

Patients nonresponsive to medical management and with those with calcified plaques are advised surgical management. Surgical management is usually timed at 6–12 months of disease. The surgical procedures fall into two main categories: penile lengthening procedures, which create a defect in tunica on the short (concave) side of the penis, which is covered by different kinds of grafts and penile shortening procedures, which typically apply the Nesbit technique as well as other plication techniques.<sup>[1]</sup> Patients undergoing medical management should be followed up to look for spontaneous regression and decrease in plaque size. The plaque enhancement following gadolinium injection in MRI or the hyperperfusion in power Doppler research can also be used to reveal inflammation in and around the plaques in follow-up cases.<sup>[1]</sup> In the above study, we have discussed multiple cases who came with a varied set of complaints pointing toward the disease. After B-mode examination, color Doppler was also used in some cases. Before and after intracorporeal injection, color Doppler ultrasonography provides a dynamic, minimally invasive and functional assessment of penile vasculature to evaluate erectile dysfunction. Thus, complete evaluation using the ultrasonography and color Doppler-based diagnosis and following up by appropriate management provides a holistic approach toward PD.

## CONCLUSION

PD is a condition that affects the penis, causing it to bend or curve during an erection. This condition can cause significant pain and discomfort as well as difficulty with sexual intercourse leading to significant mental trauma. PD can present with a varied nature of penile lesions from small nonpalpable to large calcified plaques. Ultrasonography is often used to evaluate the degree and location of plaque formation within the penis. This imaging technique can help clinicians determine the best

course of treatment for the individual patient and also helps in follow up imaging of the patient which can determine if the treatment plan is working or if adjustments need to be made. By providing detailed information about the extent of the condition and the location of plaque formation, imaging can help clinicians develop a targeted treatment plan that is tailored to the individual patient's needs.

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patients have given their consent for their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

### Conflicts of interest

There are no conflicts of interest.

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