



## Surgical Techniques and Pitfalls for Excision and Grafting

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### Abstract

**Purpose of Review** To highlight the surgical techniques of Peyronie plaque excision with grafting technique. We also sought to help the surgeon with important aspects of pre-operative and post-operative counseling.

**Recent Findings** The pre-operative discussion is imperative in setting expectations and goals of care. The ideal graft has yet to be developed, but improvements have been made with decreased risks of infection and contracture rates.

**Summary** We have learned that Peyronie's disease is still a surgically treatable disease. Excision and grafting is a complex procedure, but with an appropriate technique, complex curvatures can be managed in trained hands. Patient selection is imperative in deciding whether concomitant penile prosthesis should be placed. Graft choice is left up to the operating surgeon, but use of non-autologous grafts appears to be increasing.

**Keywords** Peyronie disease · Excision · Grafting · Patch graft

Peyronie's disease (PD) is a disorder of fibrotic plaque within the tunica albuginea surrounding the corpora cavernosum. While the exact cause of PD has yet to be elicited, experts conclude it is likely a result of some degree of trauma with an abnormal healing response. Whether the inciting event is microtrauma or more severe such as a penile fracture, the abnormal healing process is proposed cause of plaque formation. Transforming growth factor-B1 (TGFB1) has been implicated in the pathogenesis of PD. El-Sakka et al. showed increase expression of this protein in 30 PD patients when compared with non-PD patient control [1]. TGFB1 plays two major roles in formation of PD. First, it attracts fibroblasts which then lie down the connective tissue involved in repair. Second, TGFB1 inhibits certain collagenase leading to unregulated deposition of connective tissue and plaque formation. There has also been an association of PD with Dupuytren's contracture, and a genetic locus (WNT2) has been proposed as a genetic predisposition of both conditions [2]. The prevalence

of PD is likely higher than reported due to the lack of knowledge of the disease and the likelihood men underreport the condition. In epidemiologic studies, PD prevalence ranges from 0.39–20.3% [3]; men with comorbid diabetes or erectile dysfunction are at higher risk of PD [4].

Men presenting with PD usually complain of penile pain, penile curvature, or penile nodule with deformity being the most common [5]. Alongside physical deformities, questionnaire studies show approximately 77% of men reported psychological effects due to PD [6]. The disease is most common in men aged 40–59 years old. The disease process is separated into two phases, active and stable or quiescent phase. Pain is common in the active phase but seldom severe. Early studies demonstrated high spontaneous resolution rates although these studies are limited due to small sample size. In untreated men, it has been shown that 12% will show improvement, 40% remain stable, and 48% will have progression of curvature [7].

The evaluation of patients with PD relies heavily on patient-provided history including psychosexual history as well as physical exam. When taking the history, it is important to note the erectile status, use of erectogenic agents, degree of bother, and ability to engage in penetrative intercourse. A thorough description of the deformity should be elicited including perceived shortening, hourglass deformity, and degree of curvature. Physical exam should be performed in the flaccid and erect states, noting any palpable indurations on the

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corporal bodies. Measurement of penile stretched length is important as many men will have shortening due to the disease process. A penile duplex ultrasound with intracorporal injection of erectogenic agent should be used for objective measurement of penile curvature, plaque size, and calcification, and can aid in determining the etiology of concomitant erectile dysfunction.

Treatment options vary based on complexity and phase of disease. Oral agents have been used in active phase disease with little literature to support their efficacy. The American Urologic Association guidelines on Peyronie's disease states that oral therapies with vitamin E, tamoxifen, procabazine, omega-3 fatty acids, or a combination of vitamin E with L-carnitine should not be offered [8]. Two oral agents have some supportive literature, these being pentoxifylline and phosphodiesterase type 5 inhibitors. A case-controlled study showed benefit of pentoxifylline orally with other antioxidants over no treatment. This study also showed some improvement in a group that treated with intralesional pentoxifylline [9]. One study showed that low-dose daily tadalafil resulted in resolution of septal scar in 69% of patient's vs only 10% of non-treatment arm [10]. Intralesional agents can be used during the active and stable phases. Agents such as interferon  $\alpha$ -2b, verapamil, and collagenase clostridium histolyticum have been used with varying degrees of success, but currently only collagenase has FDA approval. Indications for intralesional therapy include patients with stable disease with curvature > 30 degrees and < 90 degrees, without isolated hourglass deformity or calcified plaque or plaque located proximal to the base of the penis, and with intact erectile function [11]. Penile traction and vacuum erection aids have demonstrated improvements in small observational studies [12, 13]. Mechanical therapies are limited by application methods and demands. Compliance with traction has been a reason for dropout among studies with proposed protocols of 3–8 h each day. Trost et al. introduced a novel traction device that requires 30–90 min of device wear daily with significant improvements in curve reduction, length, and erectile function [14].

It has been proposed to delay any surgical correction until the active phase has resolved, usually characterized by lack of pain and stabilization of curvature. Once the decision for surgery has been made, the surgeon has multiple options based on the complexity of curvature. Tunical plication is employed typically for curvature < 60 degrees and in the absence of complex features such as hinge or hourglass deformities. Plaque incision and/or excision with grafting is reserved for more complex curvatures in men with good erectile status. Another surgical option includes placement of penile prosthesis with or without adjunct maneuvers. This review will focus on excision and grafting techniques.

Incision and grafting procedures are utilized in patients that have biplanar curvature, uniplanar curvature > 60 degrees, hourglass, hinge deformity or those with shortened phallic

length that may not be amenable to plication surgery. An extensive pre-operative counseling session is held for patients that are candidates for incision and grafting reconstruction. It is important to set expectations including defining "functionally straight," change in length, decrease in erectile function, and possible changes to sensation [15•]. Functionally straight has not been clearly defined, but experts cite residual deformity of 20 degrees or less is acceptable. Counseling on this point is imperative as recurrence rates are cited as high as 33% in the literature [16]. While some have termed incision and grafting "lengthening procedures," all surgical interventions have been associated with length loss and realistic expectations should be set prior to entering the operating room.

## Surgical Technique

Antibiotic prophylaxis of cefazolin or clindamycin as a single dose is chosen as per AUA guidelines [17]. Surgical incision is based on location of the curvature. Traditionally, a subcoronal incision with penile degloving is used to have access to the entire penile shaft. This incision can be associated with post-operative complications which include penile lymphedema, decrease in glans sensitivity, paraphimosis, and distal skin necrosis [18]. Alternatively, a vertical midline incision can be made on the dorsal or ventral surface. The vertical incision is best employed for uniplanar lateral incisions as it may not give access for complete elevation of the neurovascular bundle or corpora spongiosum [19]. Next assessment of the deformity with an artificial erection is performed; we prefer injection of a vasoactive agent such as alprostadil although saline injection has also been used. Evaluation of curvature including planar directions, any hourglass deformity, buckling, narrowing, and direct measurement of degree with a goniometer is performed.

Next for dorsal plaques, elevation of neurovascular bundle (NVB) is performed. This is done by making parallel longitudinal incisions in Bucks fascia lateral to the urethra on each side. Careful dissection is then performed to lift the tissue dorsally with a fine sharp instrument. It is imperative to minimize the risk of neuropraxia by avoiding trauma to the neurovascular bundle from excess traction or thermal damage. We avoid electrocautery at this point to minimize energy transfer to the neurovascular bundle. Dissection occurs from both parallel incisions until a window is created; it is important to stay directly on the tunica albuginea at this stage. A Penrose is used to provide traction and aid in complete elevation of the bundle; note that the NVB fibers begin to course more laterally as you move distal on the penile shaft. It is important to lift more of the bundle than just surrounding the plaque, as this will make lying your graft in easier and the NVB remains the limits of how much length can be obtained.

Ventral plaques are less commonly encountered with a reported incidence of 9% [20]. There is a paucity of data concerning incision and grafting for ventral plaques. Ventral plaque excision anecdotally has been avoided as there is an anatomical risk of urethral injury, stricture, and fistula. Regardless, there have been no reports of this in the literature after PD surgery. Data has been extracted from penile fracture repairs which four patients suffered concomitant urethral injury at time of ventral fracture repairs [21]. The urethra is mobilized after lateral incisions in Bucks fascia. The urethra sits in a groove between the two corporal bodies; remaining close to the cavernosa will make this dissection uncomplicated.

After mobilization, injection of vasoactive agent or saline is used again to delineate the curvature. The point of maximal curve is marked, and the incision is planned. This is the crucial step in the case because once incision is made it is difficult to identify the diseased area. Plaque incision is generally preferred as excision may lead to extremely large defects and higher rates of post-operative erectile dysfunction. In addition, incision with partial plaque excision may be performed. We have employed this maneuver with severely calcified plaques in which we would not be able to suture graft, or the patient would be left with a palpable deformity. There are multiple incision techniques available; original description of the technique involved the H or double Y [22]. The double Y creates a rectangular defect for which sizing the graft is easier. When performing a plaque incision, it is important to not disturb the delicate corporal tissue as this is what will preserve erectile function. We do this by incising sharply with a 15 blade and then carefully lifting the tunica off the corporal tissue scraping the delicate vasculature off the plaque. For dense calcifications, we will partially excise the densest of the tissue; often, these defects become larger than expected.

The choice of grafting material is based on the surgeon's experience and comfort. Various graft options are out there although most popular are non-autologous (allograft/xenografts) grafts. Synthetic grafts were previously used but were fraught with complications such as peri graft fibrosis, post-operative inflammation around the grafted site with subsequent recapitulation of the plaque, and possible further curvature [23]. Autologous grafts are associated with a secondary incision which can lead to longer operative times and potential morbidity. Autologous grafts used include saphenous vein, and buccal and lingual mucosa. Oral mucosa offers a nice option as the contracture rate is less, it is familiar to urologists who practice urethral reconstruction, and harvesting is usually associated with minimal morbidity [24]. Graft infection is rare with use of autologous, allografts or xenografts. Autologous grafts have potential risk of donor site infection. Synthetic grafts have been shown to have significantly higher rates of infection in both patients undergoing concomitant IPP or not [25, 26]. In our practice, we are most commonly using “off the

shelf” tissue-engineered grafts. Recent literature shows the increased use of non-autologous grafts. Two that have been popularized are cadaveric pericardium (Tutoplast, Coloplast) and porcine small intestinal submucosa (SIS, Stratasis, Cook Urological). Hellstrom et al. popularized the use of Tutoplast, a cadaveric pericardial tissue. The original series included 11 patients in which there were no reactions of complications related to the grafting material [27]. In our practice, we utilize this graft in patients receiving an inflatable penile prosthesis (IPP) and for those without erectile dysfunction. After measuring the defect with a full erection, graft is sized adding 5 mm to each side to account for potential contracture. The graft is soaked in antibiotic solution. We preplace 4-0 absorbable suture in each of the corners of the defect and then run each down securing the graft into place. This can be done with an IPP in place with great care to not puncture the cylinder. Porcine small intestine has been used with varying degrees of success [28, 29]. Brandes et al. suggest 4-ply SIS is more effective than 1-ply and this may account for some difference in the reported success rates [30]. Although other studies suggest increase contracture rate with 4-ply SIS [31]. A novel graft that has been popularized by Hatzichristodoulou is a self-adhesive collagen fleece graft (Tachosil, Baxter) [32]. The graft is coated with a tissue sealant and therefore does not require suturing; it is important that the graft overlaps the defect by 5 mm in all directions. The graft also has hemostatic effect as it is coated with fibrin and can aid with bleeding often seen once opening the tunica. A recent study compared the collagen fleece graft with small intestine in patients simultaneously receiving penile prosthesis. Outcomes were similar, and the only significant difference was operative time between the two groups as the collagen fleece did not require suturing [33]. One critique of using this type of graft is that induction of artificial erection after graft placement can disrupt the graft from tunica.

Once the graft is placed, curvature is reassessed with artificial erection. If persistent curvature is present, a plication procedure is performed. Bucks fascia is then closed with absorbable suture, the dartos fascia is reapproximated, and the circumcision incision is closed. We typically place a small closed suction drain below the dartos which is brought through a stab incision through the skin. A ring block is provided with a mixture of short- and long-acting local anesthesia. Xeroform is placed around the incision followed by a light compressive dressing and Coban. Patients are typically discharged to home from recovery room.

Inflatable penile prosthesis is the preferred treatment in patients with combined erectile dysfunction and PD. Residual curvature after IPP placement can be managed with molding, plication, or incision/excision with grafting. For patients in which an incision and grafting is planned, we will approach penile prosthesis via subcoronal approach. The IPP will be placed, and relaxing incision is made. The incision is

done with electrocautery on a setting of 20 W to not cause damage to the underlying implant. Most surgeons recommend placing a graft on any defect where there is greater than 2 cm of exposed cylinders. No graft has been shown to be superior although use of self-adhesive collagen fleece is attractive as no suturing in the proximity of the implant is necessary.

## Post-operative Management

Patients are instructed to stretch and massage the grafted area after 7 days. At this time, they are also instructed to begin PDE5i rehabilitation. This has been shown to enhance nocturnal erections, stretch the tissue, encourage nourishment of the graft, and possibly reduce the risk of post-operative ED [34]. Traction after circumcision incision is healed has been shown to help decrease the perception of length loss [35]. If a penile implant was placed at the time, they are taught to cycle at 2 weeks and encouraged to cycle daily.

## Complications/Pitfalls

Erectile dysfunction is the most encountered post-operative complication. It has been reported as high as 67% in one series [36]. Post-operative ED can be from the surgical procedure (i.e., NVB manipulation) or as a result of poor pre-operative evaluation. Ways to minimize risks of surgical causes include using bipolar electrocautery around the NVB, careful incision of tunica maintaining cavernosal tissue, and minimizing defect size. Most importantly though is selection of patients. Penile hypoesthesia or diminished sensation has been reported in 3–31% of patients undergoing this procedure [37, 38]. The majority of patients will still be able to reach orgasm, and full recovery may take several months. Loss of length is seen in most patients undergoing surgical correction for PD. This needs to be discussed pre-operatively as their length loss is due to the scarring from the disease process.

## Conclusion

Peyronie's disease remains a surgically correctable disease. The pre-operative evaluation and counseling are crucial in managing patients' expectations for length, sensation, and defining residual curvature. Patients with concomitant erectile dysfunction should undergo penile prosthesis surgery with adjuvant procedures as necessary. Plaque incision or excision procedures are indicated for curvatures greater than 60 degrees, complex curvature, hinge or hourglass deformities. Surgery requires delicate dissection of the neurovascular bundle or urethra. Incision is preferred over excision to minimize defect size. The ideal graft has yet to be created; graft should

be chosen by comfort of surgeon. New synthetic grafts may have less contracture rates and may reduce operative time. The key to performing this surgery is pre-operative counseling and setting realistic expectations.

## Compliance with Ethical Standards

**Conflict of Interest** Rafael Carrion reports serving as a consultant for Coloplast and Endo, outside of submitted work.

Justin Parker reports serving as a consultant for Coloplast, and a Speaker for Baxter, outside of submitted work.

Lorenzo DiGiorgio and Melissa Mendez each declare no potential conflicts of interest.

**Human and Animal Rights and Informed Consent** This article does not contain any studies with human or animal subjects performed by any of the authors.

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