ORIGINAL RESEARCH—SURGERY

Penile Prosthesis Implantation in Cases of Fibrosis: Ultrasound-Guided Cavernotomy and Sheathed Trochar Excavation

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ABSTRACT

Introduction. Implantation of a penile prosthesis into fibrosed corpora cavernosa is a difficult and risky procedure. Specialized instruments that assist safer and more efficient excavation include Otis Urethrotome and various cavernotomes, all of which operate underneath the tunica albuginea, out of sight. The blind use of such instruments can result in perforation of the tunica albuginea or injury to the urethra.

Aim. This work describes the utility of ultrasonography for adding visual monitoring to any of the above-mentioned instruments, maintaining them in the mid-corpus cavernosum position to avoid perforation, and describes the application of alternative sheathed, sharp instruments that allow fast, efficient, and visually monitored drilling into fibrous tissue.

Main Outcome Measures. Clinical outcome data were examined.

Methods. Surgery was performed on five cases with extensive fibrosis of the penis. Initial blunt dilatation by Hegar dilators faced considerable resistance. An ultrasound probe was applied to the ventral aspect of the penis. A laparoscopy sheath was advanced under ultrasound guidance up to the fibrous tissue. A sharp laparoscopy trochar was inserted through the sheath. Its tip was oriented in the mid-corpus cavernosum by longitudinal and transverse sonography sections, as it drilled into the fibrous tissue. Laparoscopy scissors were used in the same fashion to cut fibrous tissue lumps. After full excavation, penile prosthesis was implanted.

Results. All implants survived adequately. No complications occurred following implantation. Operative time ranged from 50 to 60 minutes. No difficulty was encountered at excavation.

Conclusion. Ultrasound guidance can be a handy adjunct to any of the available techniques developed for excavating the fibrosed corpora cavernosa, with a possible decrease in difficulty and complication rate of the procedure. Utility of sheathed, sharp instruments guided by sonography is an alternative to the cavernotomes, allowing fast and efficient drilling into fibrous tissue. **Shaeer O. Penile prosthesis implantation in cases of fibrosis: Ultrasound-guided cavernotomy and sheathed trochar excavation. J Sex Med 2007;4:809–814.**

Key Words. Penile Prosthesis; Ultrasound; Fibrosis; Re-Implantation; Peyronie's; Priapism

Introduction

Fibrosis of the corpora cavernosa may result from ischemic priapism, extensive Peyronie's disease, repeated intracorporal injection, irradiation, vascular insufficiency, or delayed re-implantation following extraction of an infected prosthesis.

Implantation of a penile prosthesis into corpora cavernosa that have been afflicted by fibrosis is a difficult and risky procedure, the outcome of which is at many times less than satisfactory. The

most difficult task for the implanter is to dilate the corpora cavernosa, whether through or alongside the fibrous tissue, while keeping the integrity of the tunica albuginea and protecting the urethra from injury. This is far from easy, considering that dilatation involves the use of force against resistance, mostly in a blind fashion. Many surgeons refrain from tackling these cases and instead refer them to the few tertiary referral centers with relevant experience.

Various surgical approaches and tools have been developed to decrease difficulty and complication rate of the procedure, including specialized instruments that allow controlled sharp resection rather than blunt dilatation, incisions that allow safer and easier access to the crura, or techniques that allow visual supervision of the process.

Instruments that permit sharp resection include Otis Urethrotome [1], Carrion-Rossello cavernotome [2], and Mooreville cavernotome [3]. The incision currently considered as a main stay for implantation procedures in such cases is the transverse scrotal incision, as it provides adequate exposure of the proximal corpora, which are often the most difficult to dilate [4]. Another approach is the utility of two counter incisions, one proximal and the other distal, providing access to the proximal and distal penis each half at a time through its neighboring incision, thereby shortening the distance that the dilator travels unseen [5].

The aforementioned techniques and approaches are conducted underneath the tunica albuginea, out of sight. The blinded use of sharp resection or blunt dilatation against resistance can result in perforation of the tunica albuginea and/or injury to the urethra.

Visually monitored excavation is possible either by open excavation, where the corpus cavernosum is incised along its whole length, and the fibrous tissue is removed by scissors [6], or by Shaeer's Technique [7]: "optical corporotomy and transcorporal resection," where fibrous tissue is incised by blade as in optical urethrotomy, and resected by the diathermy loop as in transurethral resection of the prostate, under visual guidance of a cystoscope inserted into the corpus cavernosum.

This work describes the utility of ultrasonography for adding visual monitoring to the currently available tools used in excavation of the fibrosed corpus cavernosum. In addition, corporal excavation with sheathed instruments with sharp tips, which allow fast and efficient visually monitored drilling into fibrous tissue, is described.

Figure 1 Excavation of the corpus cavernosum in the pendulous penis.

Methods

Surgery was performed on five cases with extensive fibrosis of the penis. Two cases were afflicted by fibrosis following removal of an infected penile prosthesis. Two cases suffered neglected priapism, and one had extensive Peyronie's disease. All five patients provided written informed consent explaining the possible outcomes and complications of surgery.

An oral quinolone was administered the night before surgery, followed by intravenous aminoglycoside and cefazolin intraoperatively and postoperatively. Bacitracin was added to the irrigation solution.

The excavation instruments were immersed in glutaraldehyde antiseptic solution for 24 hours and rinsed thoroughly with normal saline prior to use. The ultrasound probe was inserted into a powder-free sterile surgical glove that contained gel and was oriented to face the palm area of the glove. Its cable was passed through a cylindrical sterile drape (Figure 1).

Under general anesthesia, a urethral catheter was inserted. A transverse scrotal incision was cut, and bilateral 2- to 3-cm corporotomy was performed. Initial blunt dilatation by Hegar dilators faced considerable resistance.

A 7.5-MHz linear ultrasound probe was applied to the ventral aspect of the penis (Figure 1). The corpora cavernosa were inspected in the longitudinal and transverse sections. The contour of the corpora cavernosa was clearly outlined by the hyperechoic tunica albuginea in contrast to the surrounding fascia and skin. The urethra was also readily identified by the residing catheter.

Under ultrasound guidance, a 5-mm laparoscopy sheath was gently advanced as far as fibrosis

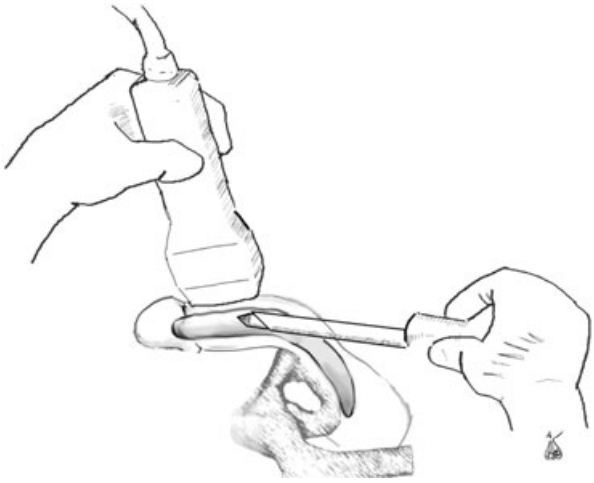

Figure 2 Ultrasound probe applied to the ventral aspect of the penis, with the sheath and trochar inserted into the corpus cavernosum.

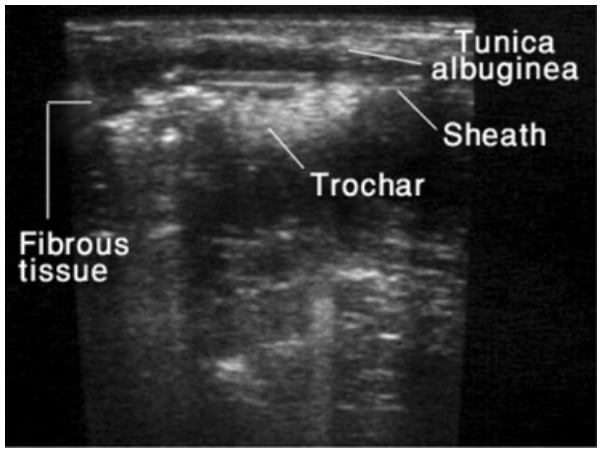

Figure 4 Longitudinal section showing the tip of the trochar, inserted through the sheath, in the middle of the corpus cavernosum.

permitted (Figure 1). A sharp-tipped laparoscopy trochar with side blades on the distal end was inserted through the sheath within the corpus cavernosum to emerge by the fibrous tissue (Figure 2). Ultrasound monitoring was focused on the distal outlet of the sheath as the trochar approached it, to ensure that the tip of the trochar emerged right in the middle of the corpus cavernosum, with alternating longitudinal sections (Figures 3 and 4) and transverse sections (Figures 5 and 6).

Gentle and steady side-to-side rotation of the trochar started, shaving off fibrous tissue and drilling into the corpus cavernosum, constantly making sure that the tip of the trochar was in the middle of the corpus cavernosum. The work field was limited to 1–2 cm at a time. When a segment was cleared, the ultrasound probe was shifted forward and the set was advanced deeper into the corpus to excavate the tunnel further along the penis, still maintaining the tip of the trochar in the mid-corpus position.

If a point of nonyielding resistance or a localized lump of fibrous tissue was met, laparoscopic scissors with an insulated shaft were introduced to cut the fibrous tissue directly, with or without a diathermy current. If diathermy was to be applied, the shaft of the penis was laid flat on the abdomen to dissipate the current.

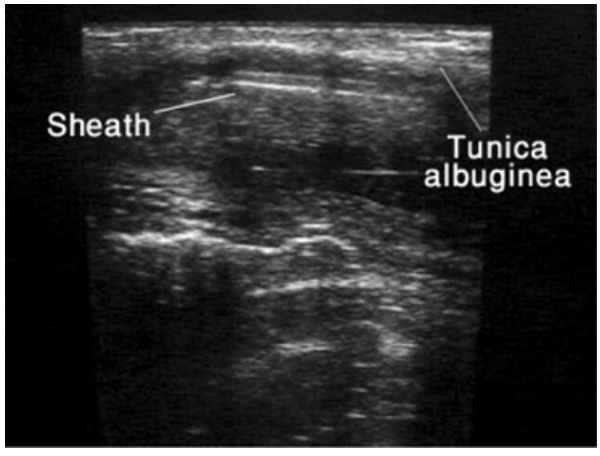

Figure 3 Longitudinal section showing the empty sheath inside the corpus cavernosum.

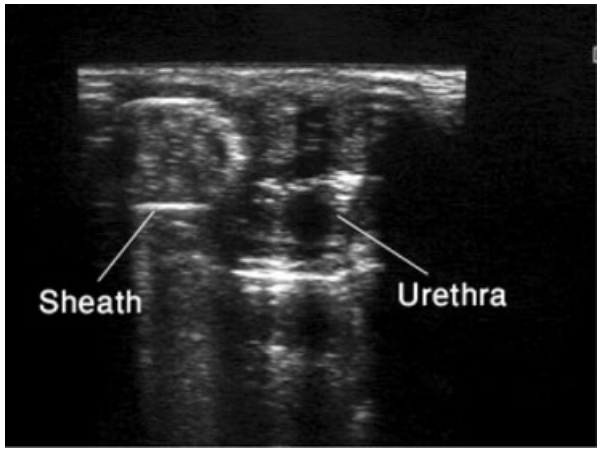

Figure 5 Transverse section showing the empty sheath inside the corpus cavernosum. The urethra is clearly visible.

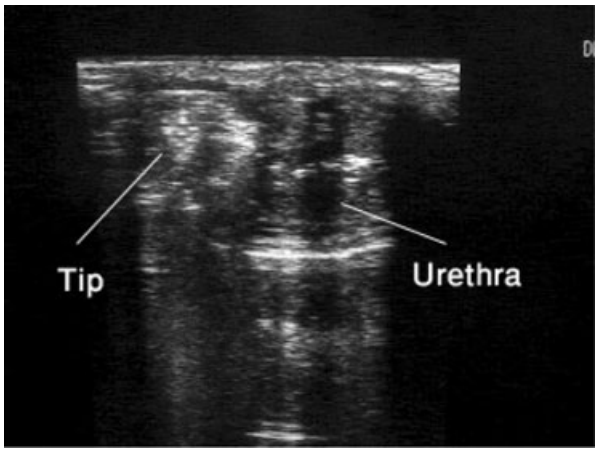

Figure 6 Transverse section showing the tip of the trochar within the sheath, in the midst of the corpus cavernosum.

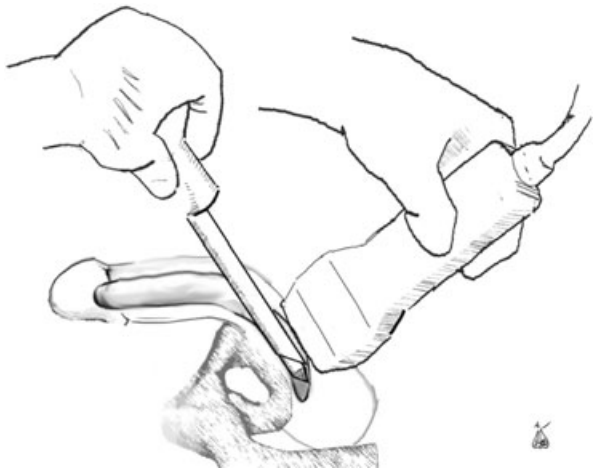

Figure 7 Excavation of the crus of the penis.

When a tunnel was cleared through the whole length of the corpus cavernosum, a 10-mm sheath and trochar were introduced in the same way to excavate and widen the tunnel further.

Following excavation, the corpus was reassessed by ultrasound to check for fibrous tissue remnants that require elimination, and if found, they were removed by scissors under ultrasound guidance.

At all times, the tip of the instrument was observed by ultrasonography and maintained in the mid-corpus position. The pendulous penis was stretched along the axis of the sheath to prevent kinking that would possibly result in the tip of the instrument cutting through the tunica albuginea. Thus, perforation of the tunica and injury to the urethra were very unlikely.

For visualizing the crura, the inferior pubic rami were palpated and the ultrasound probe was placed parallel to the ramus (Figure 7). Excavation was carried on, flush with the pubic rami. Imaging of the crura was not as easy as imaging the pendulous penis, due to the overlying fat, especially in obese patients, and due to the underlying bone that may mimic the hyperechogenicity of fibrous tissue if fibrosis is extensive and calcification has set in. Nevertheless, the crura were completely visible in all cases (Figure 8).

Irrigation with saline through the sheath (by an irrigation/aspiration tip) was handy in defining planes—if needed. Being sono-lucent, saline created a black contour around the sheath and in the crura in B-mode, and a flow pattern in color duplex mode, discriminating the crura and the sheath within from the surrounding tissues.

Following excavation, the corpora were calibrated with Hegar dilators. Penile prosthesis implantation proceeded as usual. A two-piece inflatable prosthesis was implanted in one case, and because of financial considerations, the other four cases received malleable prostheses.

In order to assess satisfaction, all five patients completed the International Index of Erectile Function (IIEF) prior to surgery and the IIEF and Erectile Dysfunction Inventory of Treatment Satisfaction (EDITS) questionnaires at the sixth month postoperatively, accompanied by a global satisfaction question, in accordance with the method of evaluation proposed by Akin-Olugbade

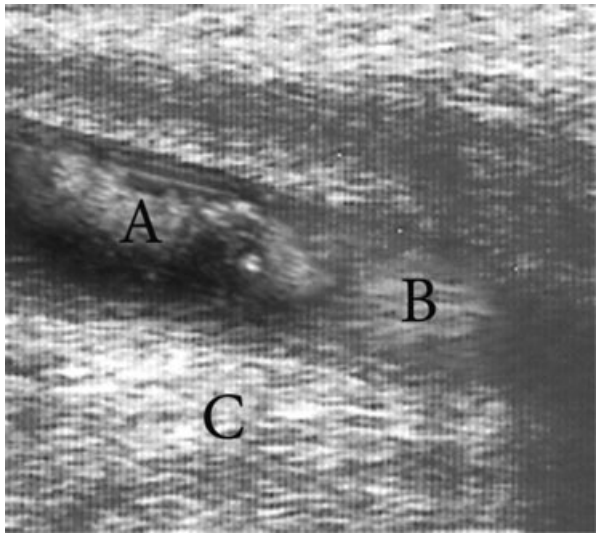

Figure 8 Longitudinal section showing the trochar and sheath (A), within the fibrosed crus (B), and adjacent to bone (C).

et al. [8]. In addition, patients and partners were asked about satisfaction with postimplantation length and girth.

Results

Patients were followed up for periods ranging from 6 months to 1 year. All implants survived adequately. No complications occurred following implantation, specifically mentioning extensive edema, injuries of the urethra, distal or posterior perforations, infections, or extrusions.

Patients and partners were satisfied with the outcome, as evaluated by the IIEF questionnaire, the EDITS questionnaire, a global satisfaction question, and a specific question about satisfaction with penile girth. The preoperative IIEF ranged from 5 to 8. The postoperative IIEF ranged from 22 to 24. As for the EDITS, all patients and partners reported grade "a" or "b" to all questions, with the exception of question 10 in the patient's questionnaire (how natural the process felt), where all patients marked "c": neither natural nor unnatural, and with the exception of question 3 in the partner's questionnaire (how the treatment affected the partner's sense of being sexually desirable), where all partners answered "c": It has had no impact on my sense of being sexually desirable.

Unfortunately, two out of five patients were dissatisfied with penile length that was already shortened by the fibrotic process prior to implantation.

In all five cases, the corpora were dilated to a caliber of 13 Hegar.

Excavation and implantation were straightforward and relatively easy, compared with our experience with alternative methods, including cavernotomes and blunt dilatation with Hegars. Operative time ranged between 50 and 60 minutes.

Discussion

Most of the methods proposed for safe and effective excavation of the fibrosed corpora cavernosa lack the optical element, where an instrument is introduced into the corpora cavernosa to resect fibrous tissue without visual supervision. The instrument may deviate from the desired plane to perforate the tunica albuginea. Overlooked attenuation of the tunica albuginea may result from blind forceful dilation with consequent posterior migration of the prosthesis despite initial absence of formal perforation [9]. This is possibly the reason why none of the "blinded techniques" has a 100% implant survival rate, and why they may end up with injuries to the urethra, or with perforations whether proximal or distal.

The Carrion-Rossello cavernotome, used in conjunction with the transverse scrotal incision and downsized prosthesis, had a complication rate of around 20% [10]. The Mooreville cavernotome resulted in three distal erosions, six proximal perforations, and three crossovers in 16 implantations [3]. Otis Urethrotome is even more risky and difficult to use in comparison with the cavernotomes [11].

There is no doubt that these instruments have made implantation in cases with fibrosis easier and safer, and that they have improved implant survival. However, with visual monitoring added to these instruments, it is possible to increase the ease and safety of the procedure and to further decrease the complication rate.

Ultrasound guidance can be applied to monitor and orient any of the aforementioned instruments in the mid-corpus cavernosum, thereby avoiding perforation of the tunica albuginea and injury to the urethra. Ultrasound guidance also enables safe use of sharp instruments, such as the laparoscopy trochar, scissors, and Otis Urethrotome, with the advantage of faster drilling in comparison with blunt-tipped instruments (such as cavernotomes).

With ultrasound-guided cavernotomy, it is possible to reevaluate the corpora after excavation to determine the need for further resection of remnants, to widen and to smooth out the tunnel created.

Alternative methods that provide visual monitoring are open excavation [6] and Shaeer's endoscopic technique [7]. Open excavation is conducted through an inverted-T incision through the peno-scrotal junction and along the ventral midline of the penis, followed by bilateral corporotomies extending along the whole length of the corpora cavernosa. The fibrotic core is enucleated after dissecting it off the tunica albuginea by scissors. The prosthesis is laid into the corporeal bed. Primary closure of the tunica albuginea follows [6].

Obviously, open excavation requires extensive exposure, as the corporotomies span the whole length of the corpora cavernosa. This is not the case with ultrasound-guided cavernotomy, which enables visual monitoring despite minimal corporotomy incisions.

"Shaeer's Technique" is endoscopic excavation of the fibrosed corpora cavernosa by a blade

"optical corporotomy" or a resection loop "transcorporeal resection," monitored by a cystoscope inserted through the corporotomy. This technique is minimally invasive and has been reported to allow for safe and efficient excavation of the fibrosed corpora cavernosa. The choice between Shaeer's Technique and ultrasound-guided cavernotomy is up to the physician's domain of experience and availability of equipment.

In this series, we used laparoscopy instruments for ultrasound-guided cavernotomy. The laparoscopy set allows direct drilling into the core of fibrous tissue with the sharp-tipped trochar, contrary to sideway resection with the blunt-tipped cavernotomes. It also allows direct cutting of fibrous tissue masses with scissors, with or without diathermy. Such drilling and cutting may be faster and more efficient in comparison with alternatives but is very risky, unless the instruments are sheathed and visually monitored, which is the case with our technique. The laparoscopy sheath isolates the sharp tip from surrounding tissues until it reaches its work field. Ultrasound guidance ensures that the tip will drill into the fibrous tissue, and not into the tunica albuginea.

Ultrasound-guided sharp cutting and drilling require less force, with a resultant steady, gentle, and force-free excavation, thereby decreasing complications and allowing confident excavation in critical areas such as deep in the crura and underneath the glans.

Conclusion

Ultrasound guidance can be a handy adjunct to any of the available techniques developed for assisting penile prosthesis implantation into fibrosed corpora cavernosa. Ultrasound-guided cavernotomy enables orienting the excavating instrument in the mid-corpus cavernosum, thereby avoiding perforation of the tunica albuginea or injury to the urethra.

Utility of sheathed, sharp instruments is an alternative to the cavernotomes, allowing fast, efficient, and visually monitored drilling.

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Conflict of Interest: None declared.

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