A Review of Surgical Techniques for Impending Distal Erosion and Intraoperative Penile Implant Complications: Part 2 of a Three-part Review Series on Penile Prosthetic Surgery

Gerard D. Henry, MD* and Eric Laborde, MD†

*Department of Surgery, Regional Urology, Shreveport, LA, USA; †Department of Urology, Ochsner Health Center, New Orleans, LA, USA

DOI: 10.1111/j.1743-6109.2011.02606.x

ABSTRACT

Introduction. More than half of intraoperative complications occur during dilatation of the corpora cavernosa, a critical step in the placement of any type of penile prosthesis, which can be especially difficult in a patient with corporal fibrosis. A late manifestation of cylinder placement can be impending erosion with lateral extrusion or medial deviation (into the urethra) of the distal tips. There are many different approaches to try and fix these surgical issues.

Aim. The review article evaluates the many different surgical techniques prosthetic surgeons use in the management of intraoperative complications and lateral extrusion.

Methods. A review of the literature was preformed with published results being evaluated to try to help guide the management of intraoperative complications and impending distal erosion. There is a special focus on dilation of the corpora cavernosa.

Main Outcomes Measures. The article reviews and evaluates the outcomes of the landmark papers in the management of intraoperative complications and impending distal erosion.

Results. Intraoperative complications of penile implant placement can be distressing for the prosthetic surgeon, but with proper recognition, most of these complications can be navigated with excellent postoperative results.

Conclusions. This review article summarizes many of the techniques, outcomes, and new developments in the complicated field of penile prosthetic surgery to help guide the implanting surgeon. **Henry GD and Laborde E. A review of surgical techniques for impending distal erosion and intraoperative penile implant complications: Part 2 of a three-part review series on penile prosthetic surgery. J Sex Med 2012;9:927–936.**

Key Words. Penile Prosthesis; Surgical Complications; Erectile Dysfunction; Impending Distal Erosion

Introduction

A literature review of more than the past 70 years revealed an extensive search for a reliable surgical therapy to correct impotence. In 1936, Bogoras' study (as cited in Gee [1]) described the first attempt to reestablish an acceptable penile erection by implantation [1]. Bogoras inserted a section of rib cartilage into a newly reconstructed penis to provide rigidity. Loeffler and Sayegh reported the use of acrylic implants beginning in 1950 [2]. As early as 1967, Pearman proposed a unitary rigid rod of silastic for implantation [3]. The original inflatable penile prosthesis (IPP) was introduced in 1973 by Scott et al. [4]. Although early experiences had a high rate of mechanical breakdown, multiple design changes in the device and surgical technique have since greatly improved the IPP. Very high patient satisfaction and mechanical reliability rates with IPPs have been reported internationally [5–14]. Mechanical reliability is so outstanding that many experts suggest that more penile prosthesis revisions are required for nonmechanical than mechanical reasons [15]. Therefore, much consideration has been taken in an effort to reduce these

nonmechanical problems, e.g., the salvage rescue, use of nonsynthetic material for repairs, and the revision washout, all appear to reduce infection rates [16–21].

Today, in the United States, the most frequently implanted penile prostheses are the multicomponent inflatable type, and this article will concentrate on IPPs. However, surgeons who implant rods can still benefit from the section on the dilatation of the corpora cavernosa, because more than half of the iatrogenic complications (including those with three-piece IPP implantation) occur during this critical step. During the early 1990s, approximately 80% of three-piece IPPs were placed via the infrapubic approach, but by 2003, more implants were placed via the penoscrotal, than the infrapubic approach. Today, it is believed that 85% the IPPs are placed penoscrotally. Fortunately, most complications that the prosthetic urologist encounters can be corrected. This review article discusses intraoperative complications of penile prosthesis implantation and their management.

Before the Surgery

Once the patient and the physician choose to proceed with penile prosthesis implantation and the patient has been medically cleared for surgery, many steps can be taken to avoid problems. Antibiotic soap showers, preoperative antibiotics, 10 to 15-minute skin preps after shaving, and step-by-step implantation of the primary IPP have been described [22,23]. (The third paper in this series on penile prostheses will be on a step-by-step penoscrotal approach to placement of the primary IPP.) It is critical to ensure the patient has no source of infection. In addition, he should be evaluated for Peyronie's disease, corporal fibrosis, and/or retropubic space scarring. If the patient presents for revision/replacement of his penile prosthesis, the surgeon should determine whether or not the integrity of the tunica albuginea is intact and look for aneurysm or impending erosion. Moreover, it has been shown that revision washout reduces infection rates in cases of clinically uninfected IPPs, and the prosthetic surgeon may want to have the operating room staff prepare the antibiotic solutions prior to surgery [17,24]. While the traditional salvage rescue protocol as described by Mulcahy uses multiple solutions and changing of gowns, gloves, drapes, and instruments, the revision washout is typically done with three to four asepto syringes of one solution irrigated into each implant space and does not involve changing the gowns, drapes, or instruments [17,24] (Table 1). Appropriate preoperative assessment and planning can lead to fewer intraoperative surprises.

Table 1 Salvage protocol

Irrigation of corpora, reservoir pocket, and pump pocket done in a stepwise fashion with the following solutions in sequence:
1. 80 mg/L kanamycin and 50,000 units/L bacitracin in normal saline (NS)
2. ½ strength hydrogen peroxide
3. ½ strength providone-iodine solution
4. Pressure irrigation with 5 L NS containing 1 g vancomycin and 80 mg gentamicin
5. ½ strength providone-iodine solution
6. ½ strength hydrogen peroxide
7. 80 mg/L kanamycin and 50,000 units/L bacitracin in NS

As shown in: Mulcahy JJ, Brant MD, Ludlow JK. Management of infected penile implants. Tech Urol 1995;1:115–9

A special note for preoperative evaluation of the very complicated prosthetic patient: the authors advocate getting a magnetic resonance imaging (MRI) on revision/replacement patients who have undergone multiple penile prosthetic surgeries by other surgeons. The MRI can help in identifying prosthetic components placed by other surgeons or abscesses [25].

Implantation of the Cylinders or Rods into the Corpora Cavernosa

As stated, this step in the implantation process is the one most fraught with peril, causing the majority of the iatrogenic complications. If corporal fibrosis is expected, a wide, transverse, penoscrotal incision is the best approach for proximal exposure of the tunica albuginea [26,27]. There is no superlative published article on the surgical management of corporal fibrosis, mainly because of insufficient numbers of patients and/or inadequate follow-up. Thus, many of the papers on corporal fibrosis are anecdotal and opinion-based [26–38]. With the reduction in infection rates associated with antibiotic-coated IPPs, there may never be a significant article on corporal fibrosis because the bulk of severe corporal fibrosis cases result from implant infection. A recent advancement in surgical technique, the rear tip sling for proximal perforation (see Figure 1) will help prosthetic urologists for years to come. With careful, deliberate dilation of the corpora cavernosa, most complications can be avoided.

Multiple instruments are available for dilation of the corpora cavernosa. For standard corporal dilatation, the Brooks dilator (Coloplast Corp, Minneapolis, MN, USA), with its bullet head and

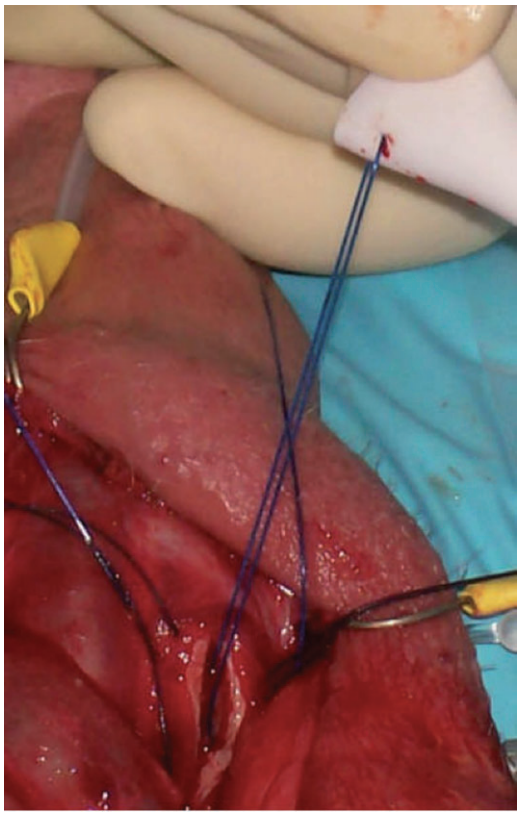

Figure 1 Rear tip sling in position for placement with the 0 Prolene stitch placed outside-in, then though the proximal part of the rear tip extender, then inside-out though the corporotomy.

bayonet configuration appears to be the easiest and safest of the dilators. However, these dilators do not work well for the woody consistency of the severely fibrotic corpora cavernosa. There is no consensus on the best technique for handling severe corporal fibrosis cases. Implantation with a downsized IPP is recommended as it obviates the need for additional cavernous reconstruction [26,35]. For many of these patients with corporal fibrosis and a downsized IPP, a year of maximally inflating the IPP on a regular basis has a stretching effect on the penis. These patients can then undergo additional surgery for "upsizing" to standard size cylinders and usually require several more centimeters of length [39]. Knoll, the most published author on corporal fibrosis, advocates that patients with extensive corporal fibrosis should be forewarned of dramatically increased risk factors associated with implantation into a scarred penis and that surgery may not be successful [33]. This same author has even used advancement flaps and lower abdominal tissue debulking in those patients with insufficient penile length for satisfactory sexual intercourse [31]. Shaeer has described using a resectoscope to remove the corporal fibrosis scar under direct vision during penoscopy, while other authors have used penoscopy for retrieval of rear tip extenders [40–42].

Typically, if the fibrosis is secondary to prior implant removal for infection, the proximal corpora are in worse condition, whereas if the fibrosis is due to priapism, the distal corpora are more fibrotic. Experience has shown that the Rosello dilator (American Medical Systems [AMS], Minneapolis, MN, USA) channels out a space better for proximal fibrosis, whereas the Mooreville cavernotome (Uramix, Lansdowne, PA, USA), working in an oscillating fashion, allows for easier cavity development for distal fibrosis [27]. With today's downsized IPPs, only 9–10 mm of dilation is needed. Usually, there is a soft area inside the corpora cavernosa to start a small diameter instrument, however, if there is none, more drastic measures need to be taken. An inverted T incision is done, for improved exposure, to open up the distal corpora and to allow for easier ergonomics in trying to channel out the fibrosis. By making an inverted T incision at the corporotomy, the surgeon is opening up the tunica albuginea in the direction of the distal fibrosis so that difficult dilation can be done under direct vision. Some authors advocate multiple incisions with minimal scar tissue excision [28–30,32]. Montegue and Angermeier have even performed corporal excavation for men with severe corporal fibrosis undergoing IPP implantation [43]. Although not well described in the literature, other experts have handled corporal fibrosis by making a longitudinal incision along the scarred corporal body. The prosthesis can then be placed within the corpora and a pericardium allograft is placed on top of the IPP and used to close the corporal defect [44].

While dilating the corpora cavernosa, perforation occasionally happens. If distal corporal perforation is identified, e.g., a distally placed dilator comes out the meatus or while irrigating the distal corpora, the fluid shoots out of the meatus, the safest course of action is to abort the case. No good techniques have been published on how to handle distal perforation into the meatus. However, the rear tip sling is a wonderful solution for proximal perforation (Figure 1). Traditional correction for proximal perforation involved the use of synthetic graft material to form a "windsox," but use of synthetic grafts in repairs of the tunica albuginea resulted in infection rates as high as 30% [37,45]. This increased infection rate is thought to be due

to the ability for bacteria to grow in the protected environment between two synthetic surfaces: the graft and the penile implant [17]. The rear tip sling can avoid this problem, and this repair works well even if the rear tip extender can be seen outside the tunica albuginea at the level of the crus, but any deformity must be minimized for patient comfort and satisfaction. The suture sling should be placed at the most distal (open-end) of the rear tip extender to avoid instability of the associated cylinder. At 6 months postoperatively, the body will have encased the rear tip extender in fibrous scar tissue. The patient is instructed not to resume sexual intercourse for at least 6 weeks following surgery. Additionally, if only a small perforation is made inadvertently, tightly closing the corporotomy around the input tube of the IPP can prevent migration of the cylinder.

Mulcahy has shown that the tough fibrosis capsule that develops around the penile implant can be used for distal corporoplasty (discussed in detail later in the paper) in cases of lateral tunica albuginea weaknesses [46]. Organic tissue grafts—such as pericardium—have been shown to be a good substitute for synthetic material in grafting of the tunica albuginea [44,47]. Use of natural tissue repairs and organic grafts has proven to be a superior solution for tunica albuginea defects as they avoid the increased risk of infection associated with the use of synthetic grafts and penile implants [45]. The IPPs of choice for patients with tunica albuginea defects are the 700 controlled expansion (CX) or Titan (Coloplast Corp) and the Titan NB (Coloplast Corp) or the 700 CXR (AMS), if dilation of the corpora to 12–13 mm is not possible, because the design of these devices (the dacron-lycra layer of the 700 CX and CXR devices and the polyurethane of the Titan and Titan NB) limits the chance of an aneurysm formation. If an aneurysm is encountered during revision/replacement surgery, a "belt and suspenders" repair can be attempted. The surgical issue can be that the aneurismal "bubbled out" tunica albuginea may be very thin and any of the "bubbled out" thin tissue should be dissected back to stronger thicker tunical tissue. Next, a layer of simple interrupted 2-0 absorbable sutures is placed transversely across the entire length of the defect to close it completely. The first layer of simple interrupted sutures is then followed by a second layer of horizontal mattress sutures (similar to how many prosthetic surgeons "pre-place" sutures prior to making the corporotomy on primary implantation cases) placed in the tunica albuginea lateral to the first layer, which when tied down, envelopes over the top of the first layer to help strengthen the closure. Care must to taken to avoid injury to the cylinders. If the repair appears to be inadequate to the prosthetic surgeon, or alternatively, an organic tissue graft can be added to strengthen the repair of the aneurysm tissue defect.

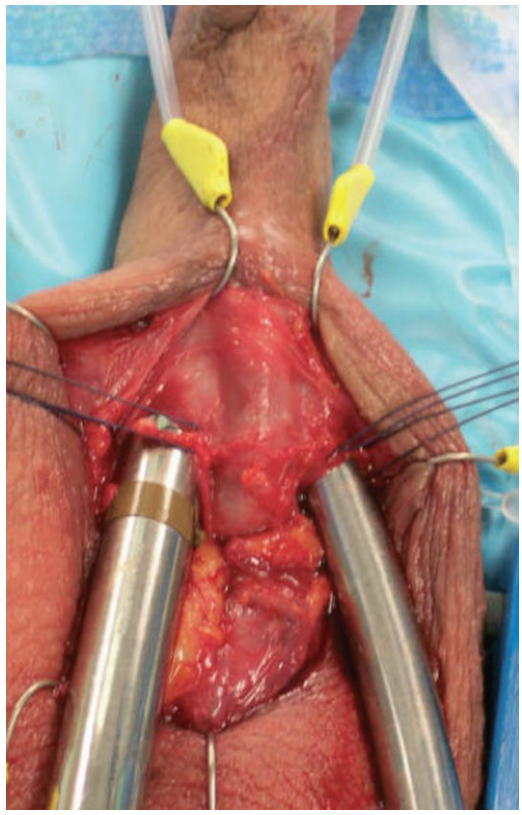

Figure 2 Distal crossover confirmed with Hegar dilators showing a left to right crossover situation.

During implantation of the cylinders, crossover may be detected. Both cylinders should be removed and the corpora cavernosa redilated both proximally and distally with a size 11 or 12 Hegar dilator (Millenium Surgical Corp., Narberth, PA, USA) in the opposite corpora. If the active dilator hits the opposite stationary Hegar, a crossover situation needs to be rectified (Figure 2). Typically, a dilator tracks over the midline into the contralateral corpora cavernosa, with the angle of the dilators indicating the side that crosses over. Place the Hegar dilator on the side contralateral to the one that crosses over, whether proximal or distal, and carefully rechannel the crossover side, staying lateral and using the stationary Hegar as a point of reference (Figure 3). Implant the cylinder in the crossover side with the stationary Hegar in place.

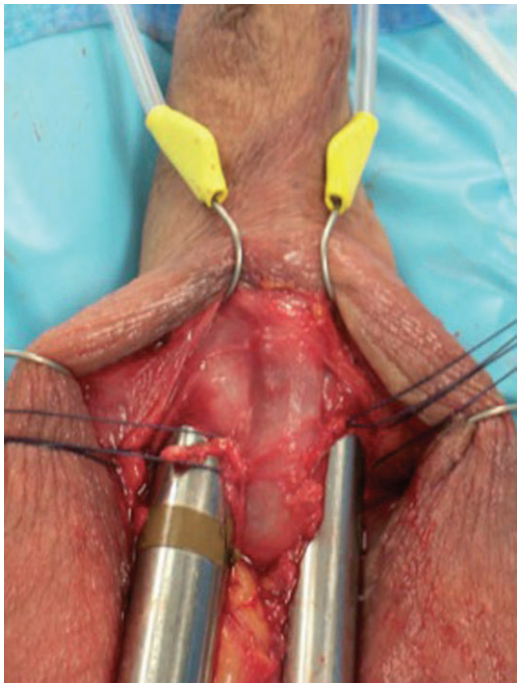

Figure 3 Using the Hegar dilator as a reference guide, the dilator is placed into the newly dilated tract that is not in a crossover position (stays lateral).

If the worrisome cylinder side goes in correctly, then proceed with removing the stationary Hegar and implant the second cylinder.

Placement of the Reservoir

Most intraoperative complications of the reservoir occur during "blind" placement from the penoscrotal approach. However, even under direct vision from the infrapubic approach or a counter incision, the retropubic space (space of Retzius) can be scarred down, not allowing for safe reservoir placement. If the surgeon encounters such a patient—such as one that has had a radical cystoprostatectomy—a reservoir can be placed in an ectopic location between the anterior abdominal musculature and transversalis fascia and cephalad to the external inguinal ring [48]. Alternately, a counter incision in the epigastrium for peritoneal cavity placement has been described [49].

Whether or not to choose ectopic reservoir placement can be decided at the time of surgery. In those difficult patients with a scarred retropubic space, the Lock-Out Valve (Coloplast Corp) reservoir can be placed through the scrotal incision in an ectopic location beneath the abdominal musculature but superior to transversalis fascia. A space is created by forcing one's finger through the inguinal ring between the anterior abdominal musculature and the transversalis fascia cephalad to the external inguinal ring. The reservoir is placed into this created space and filled with normal saline. The lockout valve is positioned facing toward the spine. In the past, placement of IPPs with no lockout valve feature in this location could have resulted in bothersome autoinflation caused by a tight reservoir cavity and limiting reservoir expansion. The lockout valve for the AMS device is in the MS pump mechanism; moreover, there is now a flat reservoir called Conceal (AMS) for the very fact of it having a low profile for ectopic placement. Ectopic reservoir placement avoids a second incision, with shorter operative time, and less postoperative pain. In addition, the patient receives a three-piece prosthesis with optimal flaccidity and rigidity rather than a compromised two-piece prosthesis, such as has been used in patients with a known scarred retropubic space. In the future, ectopic reservoir placement will become more and more prominent. Now with the new flat reservoir with low profile, the patient is much less likely to feel the reservoir.

If while performing blind reservoir placement, blood starts to well up from deep in the pelvis, a cephalad hockey stick incision needs to be performed to regain control of the iliac vessels from above, as the surgeon most likely struck a vessel with the scissors when popping through the transversalis fascia. Typically, this occurs when the scissors are passed in a lateral position. A vascular surgery consult may be warranted. If the bleeding vessel is the external iliac vein, a small permanent monofilament stitch has been advocated for repair of this injury. Now, if bowel contents are encountered instead of blood, the IPP placement should be aborted and a general surgery consult obtained immediately, as some of the worst postoperative IPP complications ever seen are enteric-cutaneous fistulas. Rarely, a 100 cc reservoir that is placed through the inguinal canal can cause iliac vessel compression with lower extremity edema and thrombosis [50,51].

Bladder injury is another possibility that must be managed with care. The two most common scenarios include passage of the scissors through the transversalis fascia and, during reservoir overfilling, "hydrocapsulotomy" for autoinflation revision surgery [48]. Bladder injury is identified with gross blood in the urine (the bladder should be emptied prior to either of the previous scenarios). The injury can be confirmed by flexible cystoscopy

or by irrigating through the Foley and having fluid enter the wound, but these steps are not technically necessary. In the case of bladder perforation secondary to scissor penetration, simply remove the newly placed reservoir and implant it on the contralateral side, with catheter drainage for 7–10 days. For bladder rupture associated with hydrocapsulotomy—where the tissue capsule around the contracted reservoir is burst open with forceful overfilling of the reservoir—an open repair of the bladder through a suprapubic incision is advocated by some experts. The bladder must be repaired in two layers with an absorbable suture and suprapubic tube placement considered. The reservoir needs to be moved to the contralateral side such that the reservoir does not come in contact with the repair site. In either scenario, a cystogram prior to catheter removal ensures that the injury has healed. The Lock-Out Valve on the Titan IPP has been shown to prevent autoinflation, decreasing the need for hydrocapsulotomy, whereas the Momentary Squeeze pump on the AMS 700 series IPP is designed to prevent autoinflation [48,52].

Dissecting out a reservoir during IPP revision/replacement surgery can be difficult secondary to exposure and scarring. Some authors advocate not leaving behind a retained reservoir [53,54]. However, if there is no gross sign of infection, leaving the reservoir behind during revision surgery has been shown to be safe [55]. If removing the reservoir becomes difficult, trace the tubing as far back as possible, pump all the fluid out of the reservoir, and then cut the tube as high up as possible. The tubing should retract back out of sight. Simply implant the new reservoir on the contralateral side.

The Tubing and the Pump

Intraoperative complications of the tubing and the pump are infrequent but can be worrisome. If any component of the IPP is penetrated by a sharp object (e.g., a stitch), it has to be replaced with a new component. A Babcock clamp (Millenium Surgical Corp.) can be used to hold the tubing and pump down, away from the area of suture closing [48]. Another problem arises when the cylinder tubing on a preconnected IPP is too short and the pump is almost against the urethra; this is due to too much tubing running inside the tunica albuginea. The cylinders can be removed and a shorter cylinder length with more rear tips inserted. Alternatively, place rubber shods on the cylinder tubing and cut the tubing near the pump, then, open a separate pump and make the new connections at the desired tubing length.

During revision/replacement surgery, the tubing can be difficult to dissect out, especially the gortex boots of the 700 series (AMS) IPP. A special note for removing these gortex boots on an infrapubically placed IPP is to avoid the penile dorsal nerve complex at essentially all costs. If a penoscrotal approach is used to remove an infrapubically placed IPP, adequate exposure is key to avoid injury to the dorsal nerve. If adequate exposure cannot be obtained, removing the cylinders through an infrapubic approach should be done. Additionally, cautery near the dorsal nerve should be avoided to prevent inadvertent injury. Injuring the dorsal nerve with electrocautery can be difficult to adequately repair, possibly resulting in distal penile numbness.

Similarly, from a penoscrotal approach, when tracing out the tubing to the cylinders, there can be an injury to the urethra at the level of the penile-scrotal junction. This injury can also occur during primary implantation of the cylinders. Always use an indwelling urethral Foley during penoscrotal penile prosthesis placement/repair to aid in identification of the corpus spongiosum. For injuries to the urethra at this level, the prosthetic surgeon can primarily close the defect in two layers. Close the mucosa with 4-0 braided absorbable stitch on an RB1 needle with simple interrupted sutures. Close the outer layer of the urethra with 3-0 braided absorbable stitch on a tapered needle. The integrity of the repair can be checked by injecting normal saline down the meatus along side the catheter in the fashion of a pericatheter retrograde urethrogram (RUG). Moreover, the catheter should be manipulated to make sure that it was not caught by a stitch. Once the urethra repair is deemed adequate, the IPP procedure can be completed. The catheter should be left in for 7–10 days with a negative pericatheter RUG obtained prior to catheter removal.

Postoperative Development of Lateral Extrusion/Impending Erosion

There are experts in the field of prosthetic urology who believe many cases of lateral extrusion and/or impending erosion occurring after primary IPP placement can be due to "micropreforations" created during dilation of the distal corpora cavernosa with a small (size 6–8) Hegar dilator or due to infection. Either way, copious irrigation is advo-

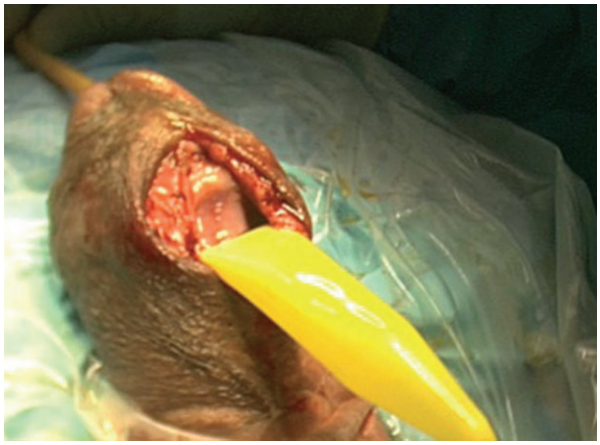

Figure 4 Exposure of the "shiny" medial wall of the implant space capsule with proximal retraction of the cylinder through the lateral transverse penile incision that is several centimeters proximal of the point of lateral extrusion.

cated during this repair procedure. First of all, the surgeon must decide whether or not to replace the whole device—most experts would use the same device if it is less than 2 years old, and conversely, most would use a whole new device if the original IPP is more than 5 years old. Currently, there is no sentinel paper in the literature that defines these postoperative times well. If using the same device, only a distal penile incision can be used, whereas, if replacing the whole device, both a distal and the usual penoscrotal incision are needed for standard removal of the old IPPs and placement of the new IPP.

Distal corporoplasty for lateral extrusion of penile prosthesis cylinders can be done using the patient's own "natural" tissue in the form of the tough fibrous capsule that develops around the IPP [45]. Make a lateral transverse incision several centimeters proximal to tip of the cylinder that is extruding and dissect down through the tunica albuginea. Do not injure the IPP cylinder if you plan on using the same implant. Injury to the polyurethane of the Coloplast Titan can be avoided by using a cautery setting of less than 35 W. Pull the cylinder tip out through the incision and retract it proximally, exposing the medial surface of the cylinder space (Figure 4). Make a sharp transverse incision in the capsule of the medial wall of the cylinder space; dorsal of the urethra (Foley catheter placement can assist with knowledge of the position of the urethra) and long enough for the cylinder used. Carefully develop this medial wall incision distally, through the spongy erectile tissue, just medial to the capsule wall, to proper glans positioning using blunt dilators, protecting the urethra as best possible. Next, sew the medial wall capsule to the lateral capsule wall on the distal side, effectively closing the "old" distal implant space and creating a double layer of "natural" capsule tissue to protect the distal cylinder tip from future lateral extrusion. Now, the cylinder is loaded in the Furlow inserter, and the Furlow is fired out the glans through the newly dilated tract just medial to the double layer of now closed capsule tissue (Figure 5). The tunica albuginea is carefully closed, avoiding the IPP cylinder. If the surgeon wishes to use a patch graft in addition to the natural tissue repair, the graft is prepared and placed at this time (Figure 6). Pericardium and dermis allograft, porcine small intestinal submucosal xenograft, and autologous rectus fascia have

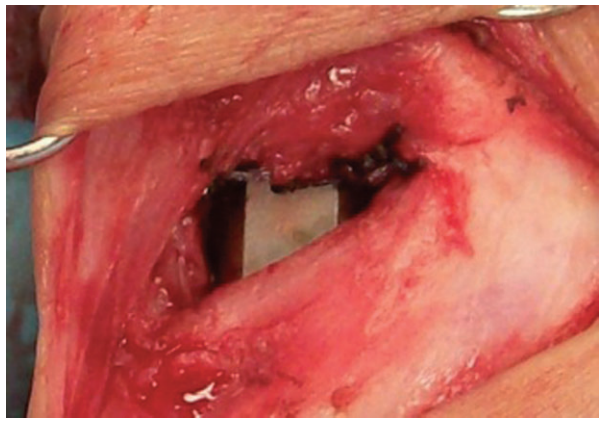

Figure 5 Furlow inserter placed into proper position, just medial to the closed double layer of capsule tissue. In this case, the whole implant was being replaced with the cylinder tip down at the penoscrotal incision.

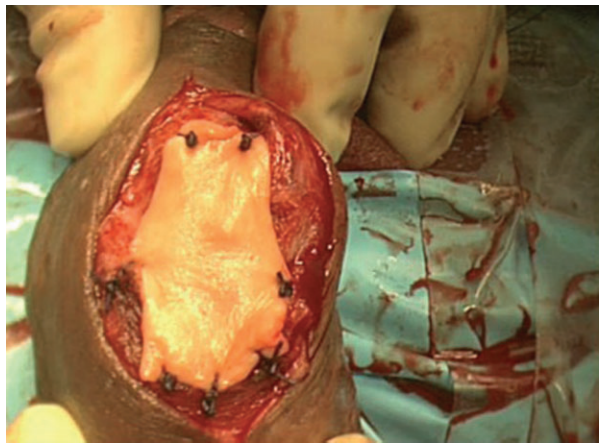

Figure 6 Patch graphing of the tunica albuginea using dermis allograft for lateral extrusion.

been used successfully in the past for tunical deficiencies, but the author has used fascia lata without complications [44,47,56–60].

Similarly, for impending medial erosion of the distal tip of the cylinder—typically into the fossa naviccularis—a natural tissue repair and/or grafting is done with the "new" channel dilated just lateral to the lateral capsule wall. Most of the time, repair of impending medial erosion is actually easier than for lateral extrusion because the urethra is now less of a worry and the lateral capsule wall is closer with less depth decision making for the surgeon. With no real data to support this decision making, the author places the allograft between the two capsule layers in impending medial erosion because of the ease of placement and wanting to make sure the graft covers the weak spot in the urethral wall. It may be better to place the graft on the outside of the capsule layer because the body probably incorporates it better. To date, however, there are no good data on these techniques in the published literature.

Hypermobile Glans

Occasionally, a patient may present with a supersonic transporter deformity because of a hypermobile glans. This complication can also be seen when inappropriately sized cylinders were placed. If the complication is due to inappropriate sized cylinders, replacement of the cylinders will correct the problem. However, if the problem arises from a hypermobile glans, replacing the cylinders will not fix the problem. In these patients, glans fixation should be performed.

Mulhall and Kim describe a technique for glans fixation [61]. This can be done by making a dorsal subcoronal incision just proximally to the coronal sulcus. The glans penis can then be dissected free from the distal ends of the corporal bodies. Buck's fascia is elevated, and care must be taken to avoid damage to the neurovascular bundles. Loupe magnification can aid in this. The glans is then repositioned more proximally on the corporal bodies and fixed with nonabsorbable suture such as a 2-0 nylon. After fixing the glans, two sutures are placed on both sides of the midline in a horizontal mattress fashion. These are placed through the tunica albuginea on the corporal body and through the fascial layer on the undersurface of the glans. Buck's fascia and any subcutaneous tissue can then be closed over the suture line.

Conclusions

The search for a reliable surgical therapy for impotence has produced penile implants that yield the highest patient satisfaction and mechanical reliability rates of any medically implanted device. With recent enhancements in the IPP design, the implantation process is getting more and more consideration for improvements. Dilation of the corpora has been historically noted as the step wherein the majority of intraoperative complications occur. Fortunately, when the prosthetic urologist encounters an intraoperative complication, the vast majority of them can be readily corrected.

Corresponding Author: Gerard Henry, MD, Department of Surgery, Regional Urology, 255 Bert-Kouns, Shreveport, LA 71106, USA. Tel: (318) 683-0411; (318) 636-5883; E-mail: GDHenry@Hotmail.com

Conflict of Interest: None.

Statement of Authorship

Category 1

(a) Conception and Design
Gerard D. Henry

(b) Acquisition of Data
Gerard D. Henry

(c) Analysis and Interpretation of Data
Gerard D. Henry; Eric Laborde

Category 2

(a) Drafting the Article
Gerard D. Henry

(b) Revising It for Intellectual Content
Gerard D. Henry; Eric Laborde

Category 3

(a) Final Approval of the Completed Article
Gerard D. Henry; Eric Laborde

References

1 Gee WF. A history of surgical treatment of impotence. Urology 1975;5:401–5.
2 Loeffler RA, Sayegh ES. Perforated acrylic implants in management of organic impotence. J Urol 1960;84:559–61.
3 Pearman RO. Treatment of organic impotence by implantation of a penile prosthesis. J Urol 1967;97:716–9.
4 Scott FB, Bradley WE, Timm GW. Management of erectile impotence: Use of implantable inflatable prosthesis. Urology 1973;2:80–2.
5 Tiefer L, Pedersen B, Melman A. Psychosocial follow-up of penile prosthesis implant patients and partners. J Sex Marital Ther 1988;14:184–201.
6 Kearse WS Jr, Sago AL, Peretsman SJ, Bolton JO, Holcomb RG, Reddy PK, Bernhard PH, Eppel SM, Lewis JH, Gladsh-

teyn M. Report of a multicenter clinical evaluation of the Dura-II penile prosthesis. J Urol 1996;155:613–6.
7 Mulhall JP, Ahmed A, Branch J, Parker M. Serial assessment of efficacy and satisfaction profiles following penile prosthesis surgery. J Urol 2003;169:1429–33.
8 McLaren RH, Barrett DM. Patient and partner satisfaction with the AMS 700 penile prosthesis. J Urol 1992;147:62–5.
9 Lewis RW. Long-term results of penile prosthetic implants. Urol Clin North Am 1995;22:847–56.
10 Sexton WJ, Benedict JF, Jarow JP. Comparison of long-term outcomes of penile prostheses and intracavernosal injection therapy. J Urol 1998;159:811–5.
11 Jarow JP, Nana-Sinkam P, Sabbagh M, Eskew A. Outcome analysis of goal directed therapy for impotence. J Urol 1996;155:1609–12.
12 Whalen RK, Merrill DC. Patient satisfaction with Mentor inflatable penile prosthesis. Urology 1991;37:531–9.
13 Rajpurkar A, Dhabuwala CB. Comparison of satisfaction rates and erectile function in patients treated with sildenafil, intracavernous prostaglandin E1, and penile implant surgery for erectile dysfunction in urology practice. J Urol 2003;170:159–63.
14 Carson CC, Mulcahy JJ, Govier FE. Efficacy, safety and patient satisfaction outcomes of the AMS 700 CX inflatable penile prosthesis: Results of a long term, multicenter study. J Urol 2000;164:376–80.
15 Henry GD, Wilson SK, Delk JR II, Carson CC, Silverstein A, Cleves MA, Donatucci CF. Penile prosthesis cultures during revision surgery: A multicenter study. J Urol 2004;172:153–6.
16 Brant MD, Ludlow JK, Mulcahy JJ. The prosthesis salvage operation: Immediate replacement of the infected penile prosthesis. J Urol 1996;155:155–7.
17 Henry GD, Wilson SK, Delk JR II, Carson CC, Wiygul J, Tornehl C, Cleves MA, Silverstein A, Donatucci CF. Revision washout reduces penile prosthesis infection in revision surgery: A multicenter study. J Urol 2005;173:89–92.
18 Lotan Y, Roehrborn CG, McConnell JD, Hendin BN. Factors influencing the outcomes of penile prosthesis surgery at a teaching institution. Urology 2003;62:918–21.
19 Quesada ET, Light JK. The AMS 700 inflatable penile prosthesis: Long-term experience with the controlled expansion cylinders. J Urol 1993;149:46–8.
20 King AB, Klausner AP, Johnson CM, Moore BW, Wilson SK, Grob BM. Expert training with standardized operative technique helps establish a successful penile prosthetics program for urologic resident education. J Sex Med 2011;8:2726–273.
21 Kava BR, Kanagarajah P, Ayyathurai R. Contemporary revision penile prosthesis surgery is not associated with a high risk of implant colonization or infection: A single-surgeon series. J Sex Med 2011;8:1540–6.
22 Wilson SK, Henry GD. Penoscrotal approach for the three-piece and two-piece hydraulic implants. In: Mulcahy JJ, ed. Atlas of the Urologic Clinics of North America. 10th edition. Harcourt, Philadelphia, PA; 2002:169–80.
23 Eid JF. Multi-component inflatable penile prostheses: Keys to success. Contemp Urol 2003;15:2–10.
24 Abouassaly R, Angermeier KW, Montague DK. Risk of infection with use of an antibiotic coated penile prosthesis at the time of device replacement for mechanical failure. J Urol 2006;171:2471–3.
25 Thiel DD, Broderick GA, Bridges M. Utility of magnetic resonance imaging in evaluating inflatable penile prosthesis malfunction and complaints. Int J Impot Res 2003;15(suppl 5):S155–61.
26 Carbone DJ Jr, Daitch JA, Angermeier KW, Lakin MM, Montague DK. Management of severe corporeal fibrosis with implantation of prosthesis via a transverse scrotal approach. J Urol 1998;159:125–7.
27 Mooreville M, Adrian S, Delk JR II, Wilson SK. Implantation of inflatable penile prosthesis in patients with severe corporeal fibrosis: Introduction of a new penile cavernotome. J Urol 1999;162:2054–7.
28 Montorsi F, Salonia A, Maga T, Colombo R, Cestari A, Guazzoni G, Rigatti P. Reconfiguration of the severely fibrotic penis with a penile implant. J Urol 2001;166:1782–6.
29 Herschorn S. Penile implant success in patients with corporal fibrosis using multiple incisions and minimal scar tissue excision. Urology 2000;55:299–300.
30 Rajpurkar A, Li H, Dhabuwala CB. Penile implant success in patients with corporal fibrosis using multiple incisions and minimal scar tissue excision. Urology 1999;54:145–7.
31 Knoll LD, Fisher J, Benson RC Jr, Bilhartz DL, Minich PJ, Furlow WL. Treatment of penile fibrosis with prosthetic implantation and flap advancement with tissue debulking. J Urol 1996;156:394–7.
32 George VK, Shah GS, Mills R, Dhabuwala CB. The management of extensive penile fibrosis: A new technique of "minimal scar-tissue excision." Br J Urol 1996;77:282–4.
33 Knoll LD. Use of penile prosthetic implants in patients with penile fibrosis. Urol Clin North Am 1995;22:857–63.
34 Herschorn S, Ordorica RC. Penile prosthesis insertion with corporeal reconstruction with synthetic vascular graft material. J Urol 1995;154:80–4.
35 Knoll LD, Furlow WL, Benson RC Jr, Bilhartz DL. Management of nondilatable cavernous fibrosis with the use of a downsized inflatable penile prosthesis. J Urol 1995;153:366–7.
36 Kabalin JN. Corporeal fibrosis as a result of priapism prohibiting function of self-contained inflatable penile prosthesis. Urology 1994;43:401–3.
37 Knoll LD, Furlow WL. Corporeal reconstruction and prosthetic implantation for impotence associated with non-dilatable corporeal cavernosal fibrosis. Acta Urol Belg 1992;60:15–25.
38 Mireku-Boateng A, Jackson AG. Penile prosthesis in the management of priapism. Urol Int 1989;44:247–8.
39 Wilson SK, Henry GD, Delk JR II. Upsizing of penile implant cylinders in patients with corporal fibrosis. J Urol 2004;171:237.
40 Shaeer O. Implantation of penile prosthesis in cases of corporeal fibrosis: Modified Shaeer's excavation technique. J Sex Med 2008;5:2470–6.
41 Shaeer O. Penoscopy: Optical corporotomy and resection for prosthesis implantation in cases of penile fibrosis, Shaeer's technique. J Sex Med 2007;4:1214–7.
42 Munk-Hartig AK, Stübinger SH, Jünemann KP, van der Horst C. Endoscopic retrieval of a penile prosthesis' rear-tip extender. J Sex Med 2008;5:1758–61.
43 Montague DK, Angermeier KW. Corporal excavation: A new technique for penile prosthesis implantation in men with severe corporal fibrosis. Urology 2006;50:421–3.
44 Palese MA, Burnett AL. Corporoplasty using pericardium allograft (tutoplast) with complex penile prosthesis surgery. Urology 2001;58:1049–52.
45 Carson CC, Noh CH. Distal penile prosthesis extrusion: Treatment with distal corporoplasty or Gortex windsock reinforcement. Int J Impot Res 2002;14:81–4.
46 Mulcahy JJ. Distal corporoplasty for lateral extrusion of penile prosthesis cylinders. J Urol 1999;161:193–5.
47 Hellstrom WJ, Reddy S. Application of pericardial graft in the surgical management of Peyronie's disease. J Urol 2000;163:1445–7.
48 Wilson SK, Henry GD, Delk JR II, Cleves MA. The Mentor alpha-1 penile prosthesis with reservoir lock-out valve: Effective prevention of auto-inflation with improved capability for ectopic reservoir placement. J Urol 2002;168:1475–8.
49 Mulcahy JJ. Update: Penile prostheses. Contemp Urol 1994;10:15–9.

50 Deho F, Henry GD, Marone EM, Sacca A, Chiesa R, Rigatti P, Montorsi F. Severe vascular complication after implantation of a three-piece inflatable penile prosthesis. J Sex Med 2008;5:2956–9.
51 Brison D, Ilbeigi P, Sadeghi-Nejad H. Reservoir repositioning and successful thrombectomy for deep venous thrombosis secondary to compression of pelvic veins by an inflatable penile prosthesis reservoir. J Sex Med 2007;4:1185–7.
52 Knoll LD, Henry GD, Culkin D, Ohl DA, Otheguy J, Shabsigh R, Wilson SK, Delk JR II. Physician and patient satisfaction with the new AMS 700™ momentary squeeze™ inflatable penile prosthesis. J Sex Med 2009;6:1773–8.
53 Sedeghi-Nejad H, Sharma A, Irwin RJ, Wilson SK, Delk JR II. Reservoir herniation as a complication of three-piece penile prosthesis insertion. Urology 2001;57:142–5.
54 Munoz JJ, Ellsworth PJ. The retained penile prosthesis reservoir: A risk. Urology 2000;55:949.
55 Rajpurkar AD, Bianco FJ, Terlecki R, Dhubuwala CB. Fate of the retained reservoir after replacement of a three-piece penile implant. J Urol 2003;169:S326.
56 Pathak AS, Chang JH, Parekh AR, Aboseif SR. Use of rectus fascia graft for corporeal reconstruction during placement of penile implant. Urology 2005;65:1198–201.
57 Usta MF, Bivalacqua TJ, Sanabria J., Koksal IT, Moparty K, Hellstrom WJ. Patient and partner satisfaction and long-term results after surgical treatment for Peyronie's disease. Urology 2003;62:105–9.
58 Knoll LD. Use of porcine small intestinal submucosal graft in the surgical management of tunical deficiencies with penile prosthetic surgery. Urology 2002;59:758–61.
59 Landman J, Bar-Chama N. Initial experience with processed human cadaveric allograft skin for reconstruction of the corpus cavernosum in repair of distal extrusion of a penile prosthesis. Urology 1999;53:1222–4.
60 Shaeer O. Management of distal extrusion of penile prosthesis: Partial disassembly and tip reinforcement by double breasting or grafting. J Sex Med 2008;5:1257–62.
61 Mulhall J, Kim J. Reconstructing penile supersonic transporter (SST) deformity using glanulopexy (glans fixation). Urology 2001;57:1160–2.