



Inflatable Penile Prosthesis: Considerations in Revision Surgery

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Abstract

Purpose of Review To provide an evidence based discussion of preoperative, intraoperative, and postoperative factors that lead to successful outcomes in penile prosthesis surgery.

Recent Findings In the preoperative period, careful patient selection, appropriate counseling, thorough evaluation, and sufficient time for physical and emotional adaptation to an inflatable penile prosthesis are the key. During surgery, the entire device should be explanted whenever possible. A drain and retain strategy for the reservoir is a safe alternative in situation where the reservoir is not easily removable. The mechanical cleansing of lavage is more important than chemical sterilization. Postoperative instructions should be made clear and nursing phone calls may reduce the number of ER visits.

Summary Careful preoperative counseling, attention to intraoperative details, and vigilance in the postoperative period are necessary for a successful outcome with penile prosthesis revision surgery.

Keywords Inflatable penile prosthesis · Penile prosthesis surgery · Urology

Introduction

In 1973, Brantley Scott [1] published a series of five patients in which he had implanted two silicone bodies, a reservoir and control pump, setting off the era of the modern inflatable penile prosthesis (IPP). While the early IPPs were the first efficacious treatment for patients with organic erectile dysfunction, they were unreliable with mechanical failure rates as high as 50% at 5 years [2].

Overtime, manufacturers of these devices improved on areas prone to premature wear and mechanical malfunction resulting in a safer, more reliable, more appealing products. Due to the growing number of implants greater experience on the part of prosthetic urologists lead to improvements in surgical technique, further improving longevity of implanted devices. Sales of penile implants increased throughout the 1980s and early 1990s and reached a peak of approximately 33,000 units sold worldwide in 1996. Although this number has decreased somewhat following the advent of phosphodiesterase

inhibitors, the number of implants each year has stabilized around 28,000 annually, [3] with >90% of men undergoing initial surgery in the USA receiving an IPP [4].

While the currently available inflatable penile prostheses from Boston Scientific and Coloplast are more durable than ever, the large and growing volume of patients living with IPPs has made revision surgery an inevitable part of practice for the high-volume prosthetic surgeon. Moreover, while patient satisfaction with IPPs is generally high, some patients present complaints including discomfort, inadequate inflation, visible deformity, palpable abnormality and painful intercourse [5,6], necessitating revision surgery.

It is our goal to outline some of the key considerations regarding revision surgery for IPPs, which we find useful in our daily practice. These are broadly divided into preoperative, intraoperative, and postoperative considerations.

Preoperative

Counseling

It is important to ensure that the patient's preoperative expectations are realistic and aligned with those of the prosthetic surgeon. Revision surgery in patients with vague complaints of discomfort or dissatisfaction in the setting of a functioning

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implant should be approached with caution and explicitly elucidating the patient's concerns about their current implant and goals of a revision operation is always time well spent.

On more than one occasion, a patient's dissatisfaction has turned out to be a desire for more penile length. This is better discovered preoperatively, before exposing the patient to additional morbidity and potentially compromising a functioning penile implant, in an attempt to meet unrealistic patient expectations. While the implanted phallus will typically appear longer than before surgery in the deflated state, it will appear shorter than before surgery when fully inflated. [7] It is important when discussing revision surgery with the patient, to consider that this is not a shortcoming of the implant, but rather a gap in the patient's understanding of the procedure. Some of the key determinants of decreased patient satisfaction are listed in Table 1.

In counseling patients, it is also important to consider that the first implant typically has the best outcome. Patients seeking to undergo revision of an existing IPP are at increased risk for dissatisfaction, infection, and decreased sensation compared with primary candidates [9].

In a study of 152 patients, undergoing 180 procedures, Lotan et al. [10] noted that primary prostheses had a better longevity compared with replacement prostheses (5-year rate survival rate 71% versus 42%; 10-year rate 60% versus 35%). The overall infection rate at final follow-up was 9.9% and 18.8% for primary and replacement prostheses, respectively.

In analyzing the satisfaction rates following revision surgery for IPPs, Caire [9] demonstrated a 58.3% rate of satisfaction with a revised IPP (compared with > 90% for primary IPP [11]), with 75% of patients indicating that they would be willing to undergo the surgery again. These findings serve to demonstrate that there is often an unfulfilled psychological aspect of many patients desiring revision surgery for an otherwise functional device.

Patients who undergo revision of their IPPs for reasons other than malfunction, infection, or impending erosion/extrusion represent an estimated 16% of revision cases and

may be at an elevated risk for subsequent dissatisfaction, given that they are, by definition, dissatisfied with their prior IPP experience [12]. Characteristics of difficult IPP at increased risk of dissatisfaction can be remembered by the mnemonic "CURSED patients" and are summarized in Table 2.

The decreased rate of satisfaction following revision is consistent with cosmetic surgical literature, which has reported progressive decreases in overall satisfaction with each additional revision procedure [13].

The interval over which patients become comfortable and satisfied with the device also varies. In a cohort of 96 patients who underwent penile implants, the mean IIEF-6 erectile function scores were 7/30, 13/30, 21/30, and 24/30, and IIEF satisfaction scores were 7/20, 9/20, 11/20, and 15/20 at baseline and at 3, 6, and 12 months, respectively [14] This suggests that in a functioning device, in the absence of

Table 2 CURSED patients [8]

1. Compulsive
a. Obsess about major or minor abnormalities pre- or post-op
b. Perfectionist
c. Overly optimistic about outcomes
d. Impairs activities of daily life
e. "Goldilocks syndrome"
f. Frequently desire revision surgery
2. Unrealistic
a. Deny possibility of complications
b. May present numerous, specific requests
c. Resistant to suggestions of anything but a perfect outcome
d. Seek reassurances about outcomes
e. Underlying motives may be to improve self-esteem, improve relationship, etc.
3. Revision
a. Increased risk complications/poor outcomes
b. Frequently seek surgery to satisfy underlying psychological problems
4. Surgeon shopping
a. Numerous prior consultations
b. Report what other surgeons have "done" to them
c. Have specific "list" of requests/desired outcomes
d. May overly flatter selected surgeon
e. Quick to criticize at undesirable outcomes
f. May have experience in medical field
5. Entitled
a. Share many characteristics with narcissistic personality disorder
b. Overly demanding of time and resources
c. Disrespectful/patronizing, particularly to office staff
d. Demand specialized attention and treatments
e. Disregard clinic/hospital protocols poorly compliant increased risk of litigious behavior poor listeners
f. Have several "personal hypotheses"
g. Dominate conversations
6. Denial
a. Common
b. Exaggerated memories of prior penile length, girth, function
c. Frequently occurs with Peyronie's disease
7. Psychiatric
a. Psychotic disorders
b. Mood disorders
c. Personality disorders
d. Body dysmorphic disorder

Table 1 Key determinants of decrease satisfaction with IPP placement [8]

- Perceived/actual loss of penile length
- Decreased glanular engorgement
- Altered penile sensation
- Decreased sensation during ejaculation
- Perioperative discomfort
- Cosmetic outcome/ease of concealment
- Difficulty with device function
- Partner dissatisfaction and perception of unnatural feel
- Complications,
- Extent of treatments provided prior to surgery

infection, surgeons considering revising an IPP should delay the procedure for 6–12 months, to provide sufficient time for tissue healing, as well as to allow the patient additional time to adjust psychologically to their current device, and potentially reverse their decision to undergo a revision operation [7,14]. Patients should be explicitly counseled that time is required for both a physical adjustment as well as a psychological adjustment to the prosthesis.

Given the superiority of outcomes with a primary IPP compared with subsequent revision surgery, it is advisable that when complications develop at the time of placement of a virgin prosthesis to abandon the case and return to surgery later to complete the case, particularly for lower volume/less experienced surgeons [7]. A distal urethral injury for example will usually heal without issue if surgery is abandoned, but if repair is attempted and implant placed, the increased infection risk may lead to significant morbidity and dissatisfaction in the future.

For high-volume experienced surgeons however, correction of urethral injury/or other intraoperative complications may be reasonable. In a survey of Genitourinary Reconstructive Surgeons (GURS) and the Sexual Medicine Society of North America (SMSNA) members, a cohort with highly subspecialized training, 55% said they would abort the procedure after distal urethral injury, whereas 45% would continue the procedure with unilateral or bilateral insertion of cylinders. Patient factors that increased likelihood of terminating the procedure in the case of urethral injury included immunosuppression, spinal cord injury, and clean intermittent catheterization dependence [15]. This may be due to the fact that the experienced surgeon may be better able to discern when correction is reasonable and when surgery should be terminated, thus avoiding an undesirable outcome.

Evaluation

In evaluating patients being considered for IPP revision surgery, the first step is to obtain operative notes from the patients' prior procedure(s). These notes can provide important information regarding not only the sizing of the patient's current implant, but also the approach used (penoscrotal, infrapubic, subcoronal) as well as any intraoperative complications. Often the patient may be unaware of excessive intraoperative bleeding or proximal corporal perforation which may be contributing to their current issue. Similarly, noting a disparity in the number of rear tip extenders on the left vs right side can save much angst at the time of revision surgery, as time is not wasted searching for a non-existent rear tip extender.

Operative notes may be useful in determining the type of suture material used. If a permanent suture was used to close the corporotomies at the time of the original implant, it likely

to contain a biofilm and should be entirely removed to avoid infection of the revised prosthesis.

Another source of useful information regarding prior prosthetic surgery is the Product Information Form (PIF) which is kept by Boston Scientific and Coloplast. This form may be obtained by a company from a company representative and is often better maintained than the operative notes of a low-volume implant. It is a useful source of information if prior operative notes are unavailable or incomplete.

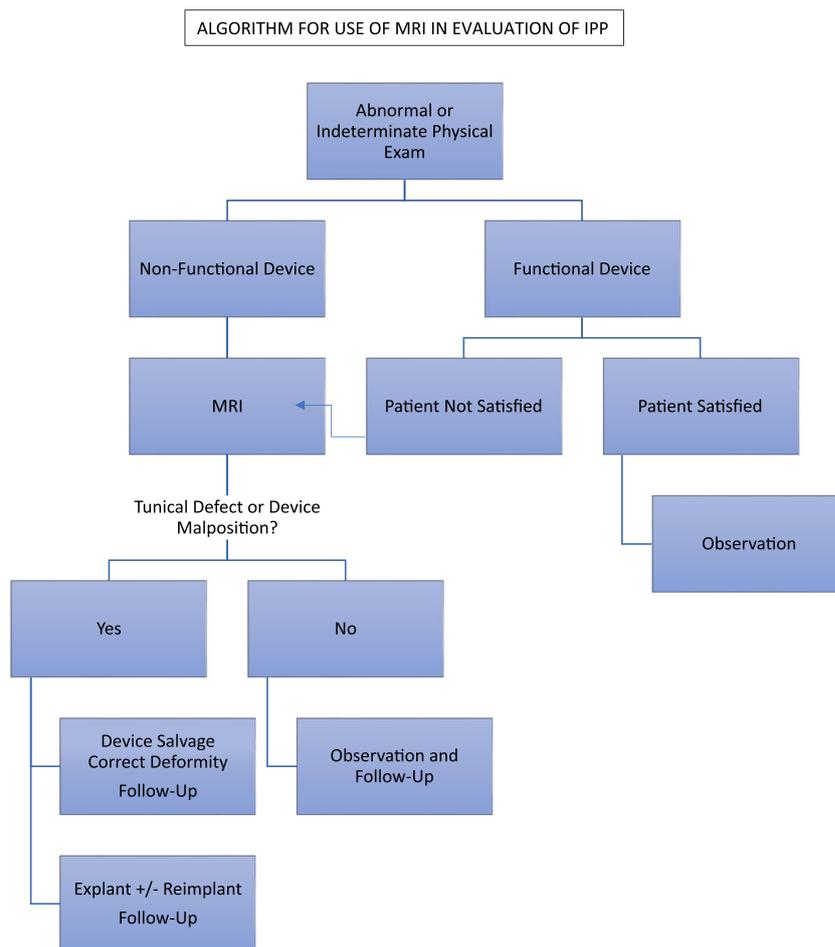
A crucial component of evaluating IPP patients for revision surgery is the clinical history and physical examination. Hematoma, infection, crossover, perforation, curvature, impending erosion, aneurysm, and implant function may be elucidated from the pt's history and/or seen on exam. Physical examination, however, is often difficult if these abnormalities are subtle. Additionally many patients with IPPs may have factors further confounding physical examination, including previous operations, edema, or Peyronie's disease [6], therefore imaging should be considered when the diagnosis is unclear.

The imaging modality of choice in evaluation of penile prostheses is MRI. MRI appears to be most useful for determination of surgical approach in those patients with abnormal physical examination, and as a justification of either surgical or expectant management in those with indeterminate physical examination [6].

In a retrospective study of 28 consecutive patients, who underwent 32 MRI studies, MRI confirmed abnormalities suspected on physical examination in 87% (28/32) of cases and was discordant in 13% (4/32) of cases. Additional information was frequently gained by the MRI beyond what that appreciated on history and physical examination. New findings included periprosthetic fluid collection, cylinder crossover, reservoir fluid loss, cylinder erosion, and migration, angulation or herniation of the proximal parts of the cylinders. MRI often provided information regarding the degree of abnormality beyond what was predicted on physical examination and served to rule out complications which could be excluded by physical examination alone (cylinder aneurysm, tunical erosion, and periprosthetic fluid collection). MRI was especially useful in the detection of tunical defects which would prompt operative intervention. If device salvage is being considered, MRI may be helpful because it will allow the surgeon to understand the extent, severity, and laterality of the abnormality, and to determine the role of and surgical approach to a device-sparing operation. A suggested algorithm for the utilization of MRI by McPhail et al. [6] can be found in Fig. 1.

The recommended MRI protocol for evaluation of IPP is T1-weighted imaging, and transaxial, sagittal, and coronal fat-saturated fast spin-echo T2-weighted imaging in both deflated and inflated states. It should be noted that with mechanical malfunction, full inflation sometimes is not possible [6].

Fig. 1 Algorithm for MRI utilization in the evaluation of IPP [from McPhail et al.] [6]



If a thorough evaluation has demonstrated a non-functioning device, a decision must be made as to whether surgery is required. In older patients who no longer desire sexually active, the device may be left in situ so long as there is no evidence of infection erosion or pending extrusion.

Likewise, non-surgical treatment options may be possible for certain conditions such as “stiction (static friction) syndrome” in which patients present with transient difficulty activating the pump after prolonged periods of inactivity. Physical exam demonstrates a hard incompressible bulb or persistent incomplete refilling of the bulb with attempted inflation. During normal inflation, squeezing the pump moves a poppet valve pin into an open position, allowing reservoir fluid through the pump and into the cylinders. In stiction syndrome, the poppet valve pin becomes fixed in the deflated position, preventing the movement of fluid among the reservoir, pump, and cylinder. This may be resolved with a “forced deflation maneuver,” in which one hand is used to perform cylinder deflation at the proximal penile shaft while the other hand is used to simultaneously depress the pump deflation button [16].

Intraoperative

Approach

Revision cases can provide a unique set of intraoperative challenges. Often the tissue planes may be distorted by prior surgery and complications such as cylinder crossover or tunical perforation must not only be avoided as in a virgin case, but must themselves be addressed. As a result, the most crucial step in revision surgery is to thoroughly expose the corpora in order to clearly visualize the anatomy.

Some surgeons prefer to begin the procedure by exposing an easily accessible portion of device such as the pump, and following the tubing proximally to the corpora. This approach can be the most expedient in experienced hands. We, however, prefer to approach a revision IPP case in the same way as a virgin IPP case by exposing the corpora first. Once the corpora are adequately exposed, the pump and reservoir may be dissected free. We recommend this approach for the less experienced surgeon as exposure of the corpora is most easily done at the beginning of the case prior to onset of tissue edema and further disruption of surgical planes.

When revising an IPP, the question of whether to use the same surgical approach that was initially used (penoscrotal initial placement and penoscrotal revision) or to select and alternative approach (such as infrapubic) has no uniformly correct answer. It depends on a variety of factors including the patient's body habitus, the source of the malfunction, the number and type of prior revisions, and surgeon comfort with the various approaches. As a general rule, the surgeon should perform the surgery by the approach he/she is most comfortable with as the anatomy may be distorted which can make an unfamiliar approach even more challenging.

In revision surgery, safety checks are even more important than in virgin IPP cases. Slight errors can compound if they are not appropriately addressed and unidentified problems from prior operations which can lead to complications if not addressed intraoperatively. Common safety checks used by the authors are listed in Table 3.

Leaving a drain for 12–24 h has been shown to be safe, with no increase in infection rate and a very low incidence of postoperative hematoma formation, swelling, and ecchymosis [17]. In revision cases, the lymphatic drainage may be compromised from prior operations leading to increased edema compared with virgin cases. Similarly, distorted anatomy and the need for greater manipulation in removing the original malfunctioning device may predispose the patient to hematoma. Our drain of choice is a 10Fr round, fluted, closed-suction channel drain with a trocar (C.R. Bard Inc., West Sussex, UK). It is large enough to allow evacuation of excess blood or lymphatic fluid, yet small enough to not cause additional morbidity to the patient.

Component Replacement

Component replacement should be used sparingly. It may be considered if revision is needed for mechanical malfunction in newer devices. We are extremely hesitant to pursue component replacement in any device greater than 3 years old as the probability of malfunction of other components increases with age of the device. Additionally, almost all device components will be colonized with biofilm at the time of revision surgery, making colonization (if not infection) of any new device component likely. In a study by Henry et al. if the device was revised but not replaced, infection/impending erosion

developed in 9.1% of cases, as compared with 5% when the entire device was replaced [12]. For this reason we almost always replace the entire device.

Washout

The use of a washout intraoperatively can significantly impact the outcome of IPP revision. In one study, 4% of cases which incorporated washout developed infection or impending extrusion/erosion, as compared with 25% of cases in which a washout procedure was not performed. [12] This is likely due to the presence of biofilm and/or subclinical infection resulting from the original device which, if not removed may lead to infection of the newly implanted device.

The washout protocol should include complete device explantation, followed by antiseptic lavage of all implant spaces with multiple rounds of dilute antibiotic solution, and subsequent placement of a new device. The mechanical cleansing of lavage combined with entire device explant (and explantation of all permanent suture material) is more important and simpler than the chemical sterilization of multiple antiseptic solutions originally proposed by Mulcahy [18,19]. The key aspect of a washout in revision surgery is vigorous irrigation of all implant spaces in order to disrupt this biofilm and prevent or diminish recolonization of the new device.

According to Henry et al. [12], 94% of individuals with functional satisfactory IPPs at the end of the study period had a washout as part of their revision surgery, compared with only 80% of those who did not receive a revision washout. It is possible that this difference may be due to differences in subclinical infection rates.

The antibiotic coating on modern IPPs may further serve to decrease the infection risk in patients undergoing revision surgery. In a study by Abouassaly et al. [20], patients underwent replacement of an IPP for mechanical failure using a device coated with rifampin and minocycline HCL (InhibiZone™) following a standard washout. At a median follow up of 32 months, postoperative device infection requiring explantation developed in only one patient (1.8%). Antibiotic-coated inflatable penile prosthesis may, therefore, further decrease infection rates in patients undergoing penile prosthesis replacement for mechanical failure.

Implant Sizing and Device Selection

The timing or revision surgery may have an impact on the size of implant used and may itself be impacted by the type of implant originally used. In an analysis of 2749 patients (1532 AMS 700 LGX, 717 AMS 700 CX, and 500 Coloplast Titan), the mean time between implants was earlier for LGX (29 months) than CX (39 months) and Titan (48 months) patients. Patients who underwent device replacement at < 2 years did not experience an

Table 3 Safety checks for revision surgery

1. Goal post test to assess for proximal perforation
2. Symmetric measurements on both sides
3. Irrigate corpora to ensure no urethral perforation distally
4. Cycle device multiple times to sure cosmesis
5. Ensure bladder is empty prior to reservoir placement
6. Assess for back pressure after reservoir filling

increase in mean cylinder length. In contrast, patients who underwent device replacement at ≥ 2 years experienced a mean increase in cylinder length (LGX 1.2 cm, CX 1.1 cm, and Titan 0.9 cm). Overall, 60 % of patients demonstrated increases of > 0.5 cm and 40% demonstrated increases of ≥ 1 cm. [21] This suggests that the corpora may accommodate to some degree over time and that upsizing may be warranted at the time of revision surgery. The increase in size, however, is typically limited to < 2 cm, provided that the original implant was appropriately sized [21].

The selection of penile implant for revision surgery is in part based on the patient's prior experience. If the reason for the revision is mechanical malfunction and the patient is satisfied with the functionality of the original device, then the same device should be implanted. If, however, the patient has concerns regarding the rigidity of the original device, a device with greater rigidity should be substituted. For example, an AMS 700 LGX may be replaced with an AMS 700 CX or Coloplast Titan due to the greater ability to withstand both longitudinal and horizontal forces of the later [22].

Drain and Retain the Reservoir

A potentially catastrophic complication of IPP revision surgery is injury to the iliac vessels in the process of removing the reservoir. The encapsulated reservoir may become adherent to the iliac vessels, and traction on the reservoir may result in injury to the vessels or surrounding structures. As the reservoir is typically removed through a small incision or through the inguinal canal, gaining vascular control of the iliac vessels can be challenging in an urgent situation, leading to significant morbidity or even death.

The reservoir should be removed if it is easily accessible and does not require significant traction on the tubing to remove it. However, if the reservoir is firmly adherent or difficult to remove, the best strategy is to drain the reservoir, remove as much excess tubing as feasible, and allow it to retract back into the retroperitoneum.

In a study of 120 reoperative prosthetic cases (consisting of IPPs and AUSs), a "drain and retain" strategy was used in 55 cases (46%). This was compared with a control group consisting of 352 patients undergoing initial AUS (154 cases) and/or IPP (236 cases) placement. No difference in infection rate was identified between the control group (6 of 390; 1.5%) and the "drain and retain" group (1 of 55; 1.8%). [23]

A "drain and retain" strategy is therefore a safe and effective alternative to intact reservoir removal in revision surgery. There with no apparent increase in postoperative infection rate, with the possibility of avoiding catastrophic intraoperative complications.

Postoperative

Instructions

Postoperative care is important in ensuring good outcomes. Postoperative instructions should be made clear and are reviewed with the patient prior to discharge. This avoids a situation in which the patient may not allow adequate time for tissue to heal, or engage in activity that compromises the success of the operation. Patients are often anxious prior to surgery and may easily forget instructions provided preoperatively. Similarly, in the setting of revision surgery patients may overstate their knowledge of postoperative care, having "gone through it before." Or, if they were previously under the care of a different surgeon, there may be differences in postoperative care pathways, leading to confusion on the part of the patient. We have found follow-up nursing phone calls to be helpful in reducing calls to our triage line as well as reducing ER visits. [24]

Management of Complications

As revision surgery is often complex, some flexibility in the postoperative care pathway may be warranted for optimal outcome. For example, if a drain left in place at the time of revision surgery has a higher than expected output, it may left in place for several days longer than normal to ensure a hematoma is avoided.

Patients who are having difficulty with pain or other postoperative complaints should be seen frequently. For example, out of proportion perineal pain may be the result of superficial cellulitis or an unrecognized proximal corporal perforation. If the patient is evaluated promptly and started on antibiotics infection of the implant may be avoided. Even patients with no obvious surgical issues may harbor significant anxiety that can be greatly alleviated with a reassuring office visit and may save the surgeon time in the long run.

If true complications are encountered, they should be dealt with promptly

An infected device should be explanted or cylinder cross-over revised, just as if this was the surgeon's first encounter with the patient. There is no sense in providing false reassurance to the patient if complications arise, as not addressing complications appropriately may lead to increased morbidity in the long run.

Reporting

The IPP has gradually evolved since its introduction in 1973. A significant contribution to improvement of the device over the past 45 years has been input from prosthetic surgeons. Therefore, it is essential for surgeons take the time to inform the implant manufacturers of all patient complaints, and return

all defective and infected devices to the manufacturer for testing [7].

Conclusion

Due to the marked improvement in mechanical reliability and the reduction in infection rates, many urologists never faced a complex revision or even seen a prosthesis infection. In our opinion, no area of prosthetic surgery is more nuanced than revision surgery and should therefore be undertaken with great care. Careful preoperative counseling, attention to intraoperative details, and vigilance in the postoperative period are necessary for a successful outcome.

Compliance with Ethical Standards

Conflict of Interest Anton Wintner declares no potential conflicts of interest.

Aaron C. Lentz reports personal fees (speaker, consultant, and preceptor) from Coloplast Corporation and Boston Scientific.

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.

References

Papers of particular interest, published recently, have been highlighted as:

- Of importance

1. Scott FB, Bradley WE, Timm GW. Management of erectile impotence. Use of implantable inflatable prosthesis. *Urology*. 1973;2(1):80–2.
2. Gregory JG, Purcell MH, Standeven J. The inflatable penile prosthesis: failure of the rear tip extender in reducing the incidence of cylinder leakage. *J Urol*. 1984;131(4):668–9.
3. Mulcahy JJ. The development of modern penile implants. *Sex Med Rev*. 2016;4(2):177–89.
4. Lee DJ, Najari BB, Davison WL, al Awamlh BAH, Zhao F, Paduch DA, et al. Trends in the utilization of penile prostheses in the treatment of erectile dysfunction in the United States. *J Sex Med*. 2015;12(7):1638–45.
5. Montorsi F, Rigatti P, Carmignani G, Corbu C, Campo B, Ordesi G, et al. AMS three-piece inflatable implants for erectile dysfunction: a long-term multi-institutional study in 200 consecutive patients. *Eur Urol*. 2000;37(1):50–5.
6. McPhail EF, Nehra A, Bruner BC, Kawashima A, King BF, Kim B. MRI and its role in the evaluation and surgical decision making in patients with challenging IPP presentations: descriptions of MRI findings and algorithm for patient management: challenges with inflatable penile prostheses. *BJU Int*. 2012;109(12):1848–52.
7. Outcomes O. AUA update series 2014.
8. Trost LW, Baum N, Hellstrom WJG. Managing the difficult penile prosthesis patient. *J Sex Med*. 2013;10(4):893–906 quiz 907.
9. Caire AA, Boonjindasup A, Hellstrom WJG. Does a replacement or revision of an inflatable penile prosthesis lead to decreased patient satisfaction? *Int J Impot Res*. 2011;23(2):39–42.
10. Lotan Y, Roehrborn CG, McConnell JD, Hendin BN. Factors influencing the outcomes of penile prosthesis surgery at a teaching institution. *Urology*. 2003;62(5):918–21.
11. 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(1):159–63.
12. Henry GD, Donatucci CF, Conners W, Greenfield JM, Carson CC, Wilson SK, et al. An outcomes analysis of over 200 revision surgeries for penile prosthesis implantation: a multicenter study. *J Sex Med*. 2012;9(1):309–15.
13. Hellings PW, Trenité GJN. Long-term patient satisfaction after revision rhinoplasty. *Laryngoscope*. 2007;117(6):985–9.
14. Mulhall JP, Ahmed A, Branch J, Parker M. Serial assessment of efficacy and satisfaction profiles following penile prosthesis surgery. *J Urol*. 2003;169(4):1429–33.
15. Sexton SJ, Granieri MA, Lentz AC. Survey on the contemporary management of intraoperative urethral injuries during penile prosthesis implantation. *J Sex Med*. 2018;15(4):576–81 **Management of intraoperative urethral injury during IPP placement by surgeons with specialized training in prosthetic urology.**
16. Kavoussi NL, Viers BR, VanDyke ME, Pagliara TJ, Morey AF. “Stiction syndrome”: non-operative management of patients with difficult AMS 700 series inflation. *J Sex Med*. 2017;14(9):1079–83 **One of the few causes of IPP mechanical malfunction that can be repaired non-operatively.**
17. Sadeghi-Nejad H, Ilbeigi P, Wilson SK, Delk JR, Siegel A, Seftel AD, et al. Multi-institutional outcome study on the efficacy of closed-suction drainage of the scrotum in three-piece inflatable penile prosthesis surgery. *Int J Impot Res*. 2005;17(6):535–8.
18. Henry GD, Wilson SK, Delk JR 2nd, et al. Revision washout decreases penile prosthesis infection in revision surgery: a multicenter study. *J Urol*. 2005;173(1):89–92.
19. Mulcahy JJ. Long-term experience with salvage of infected penile implants. *J Urol*. 2000;163(2):481–2.
20. Abouassaly R, Angermeier KW, Montague DK. Risk of infection with an antibiotic coated penile prosthesis at device replacement for mechanical failure. *J Urol*. 2006;176(6 Pt 1):2471–3.
21. Chung PH, Siegel JA, Tausch TJ, Klein AK, Scott JM, Morey AF. Inflatable penile prosthesis as tissue expander: what is the evidence? *Int Braz J Urol*. 2017;43(5):911–6.
22. Scovell JM, Ge L, Barrera EV, Wilson SK, Carrion RE, Hakky TS. Longitudinal and horizontal load testing of inflatable penile implant cylinders of two manufacturers: an ex vivo demonstration of inflated rigidity. *J Sex Med*. 2016;13(11):1750–7.
23. Cefalu CA, Deng X, Zhao LC, Scott JF, Mehta S, Morey AF. Safety of the “drain and retain” option for defunctionalized urologic prosthetic balloons and reservoirs during artificial urinary sphincter and inflatable penile prosthesis revision surgery: 5-year experience. *Urology*. 2013;82(6):1436–9.
24. Tackitt HM, Eaton SH, Lentz AC. Nurse-initiated telephone follow up after ureteroscopic stone surgery. *Urol Nurs*. 2016;36(6):283–8.

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