

Prevention and management of penile prosthesis infections

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Abstract: Penile prosthesis placement is the gold standard in surgical management of medically refractory erectile dysfunction. The malleable penile prosthesis (MPP) and the inflatable penile prosthesis (IPP) were both introduced in 1973, and there have been substantial changes to these devices and to surgical technique in the intervening five decades. These changes in device insertion and mechanical reliability have placed IPPs among the most reliable and satisfying prosthetic surgical devices. These improvements have also helped to drastically reduce penile prosthesis infection, which is widely considered the most dreaded complication of penile prosthesis surgery. There have also been significant advances in the management of penile prosthesis infection in the last 25 years. For patients, penile prosthesis infections can result in one (or more) reoperative procedures, loss of restored erectile function, penile length loss, and emotional trauma. For surgeons, penile prosthesis infections can be difficult to manage and can result in dire medicolegal repercussions. Even after years of progress in penile prosthesis infection prevention, infections still occur after a small percentage of primary penile prosthesis insertion cases. In addition, the increased risk of penile prosthesis infection associated with revision surgeries remains an issue. Penile prosthesis infection prevention factors include patient-dependent factors, surgeon-dependent factors, and device-dependent factors. In this video article we aim to review and summarize methods for penile prosthesis infection prevention and management.

Keywords: Inflatable penile prosthesis (IPP); infection; erectile dysfunction

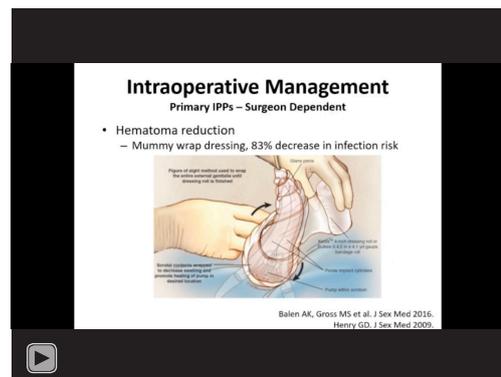
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Introduction

Inflatable penile prostheses (IPP) are the gold standard for medical refractory erectile dysfunction (1). First introduced in 1973, these devices have undergone many modifications over time with great improvement in device functionality and decreased device failure and infection complications (2). While several complications are possible after IPP surgery, infection is perhaps the most dreaded as it results in not only patient and partner emotional and physical distress but is also a time-involved and expensive complication to manage (3-6). There are several key factors in managing penile prosthesis infection an these include clinical diagnosis, treatment, and important pre-operative and intraoperative steps (*Video 1*).



Video 1 Prevention and management of penile prosthesis infection.

Table 1 Modifiable risk factors for IPP infection

Modifiable risk factors	Proposed intervention
Primary surgery	
Elevated blood glucose >200 (4,6,13-19)	Anesthesia team manages intra-operatively
Spinal cord injury (15,19-21)	Careful patient selection and thorough counseling
HIV positivity/immune suppression (15,19)	Careful patient selection, thorough counseling, modify immune modulating medications if able
Polysubstance abuse (19)	Pre-operative counseling, drug/alcohol cessation
Revision surgery	
Diabetes mellitus (4,6,13-19)	Medical optimization; intra-operative glucose monitoring; anti-fungal prophylaxis
Prior Implant (2,22)	Careful patient selection, thorough counseling
Biofilm (2,23,24)	Peri-operative antibiotic selection, wound irrigation/washout

Diagnosis

IPP infections are classified as either immediate or indolent, depending on when they occur post-operatively. We use a cut-off of eight weeks to define the two groups. Immediate infections often manifest as surgical site infections with purulence, edema, etc. Patients may be clinically ill with fever and/or sepsis (7). These patients are most often easy to recognize. The majority of infections, however, are indolent and require clinical experience and judgement. These patients present with vague symptoms including pain, pump issues such as fixation to the skin and difficulty with maneuvering, and some may have draining sinus tracts (8). Whereas immediate infections are caused by aggressive bacteria such as staph aureus and gram negatives, indolent infections are often caused by skin flora such as staph epidermidis (9-11). It is hypothesized that indolent infections arise from hematogenous seeding in the setting of other procedures (12). It is crucial to recognize an indolent infection as early as possible.

Risk factors

Imperative to a discussion regarding a surgical complication is risk factors. Several studies have been conducted to examine risk factors given the feared complications and those that have been identified, including ways to target them, are outlined in *Table 1*. It is important to classify these into two groups—primary surgery and revision surgery. Infection rates at primary surgery are quoted to be from 1–3% and at revision surgery, this number more than triples to 10–18% (22,25).

Risk factors at primary surgery include comorbidities and behavioral risk factors (2,26). Diabetes has been proposed to be an independent risk factor however, multiple studies have demonstrated that the diagnosis alone is not a risk factor but the risk is related to poorly controlled glucose at the time of the surgery. A level of >200 mg/dL has been cited as a cutoff. These patients have been documented to have up to 4X increased infectious risk (22,27). It is recommended to have frequent glucose checks intra-operatively and tight glucose control surrounding the procedure. Further risk factors at virgin implants include spinal cord injury, HIV positivity, and long-term immunosuppression for chronic disease. Decreasing these risk factors is more difficult and involves careful patient selection and pre-operative counseling. Some immunosuppression may be able to be modified surrounding the surgery depending on the type.

Risk factors at revision surgery are slightly different and it is imperative to acknowledge that having a revision surgery itself is an independent risk factor for infection and increases the risk from 1–3% to 10–18% (22,25). Additional risk factors unique to revision surgery include a diagnosis of diabetes, capsule formation, and biofilm.

Biofilm

Biofilm is secreted by bacteria, presumably brought into contact with the device as it passes through the skin, and becomes integrated into the corpora and sealed off by the body's surgical capsule. This biofilm provides nourishment to the bacteria and the surgical capsule wards off immune activity resulting in decreased antibiotic penetration and

efficacy and challenges to the management overall of these infections (23,24,28).

Infection prevention

There are three phases of potential intervention to decrease infection: pre-operative, intra-operative, and post-operative. Pre-operatively, patient selection and counseling cannot be emphasized enough. A thorough medical history and physical exam should be conducted. Any groin fungal rashes should be treated with oral fluconazole. While of low yield and questionable clinical relevance, urine cultures are often obtained (28). Similarly, Hb A1c levels are frequently checked pre-operatively but there has been no correlation in the literature regarding their relevance to outcomes (2). We do recommend nasal swabs to identify and treat carriers of *S. aureus* based on a randomized control trial demonstrating an 80% reduction in deep surgical site infections for patients with *s. aureus* who were pre-treated with mupirocin and chlorhexidine (29). While not evidence based, high volume prosthetic surgeons recommend patients to bathe with chlorhexidine a few days before surgery (2). As discussed earlier, patients with a history of polysubstance abuse have an increased incidence of infection and in their study examining this, these patients had an 892% increased rate of infection compared to patients who did not have a history of polysubstance abuse (27). Patient selection cannot be emphasized enough.

For patients on anti-coagulation or blood thinning medication, we allow them to continue a baby aspirin through surgery but will hold other forms of anti-coagulation. For high risk patients, consider using a lovenox bridge and holding lovenox for 24 hours peri-operatively before resuming.

On the day of surgery, a physical exam should be repeated. Hair should be removed with clippers instead of razors (30). IV antibiotics have undergone recent changes given the results of a large multicenter analysis revealing that isolated bacteria were resistant to the most commonly antibiotics in up to 1/3 of cases (31). We recommend broad spectrum antibiotics to infuse at 1–2 hours pre-operatively and to last for 24 hours (31,32). We routinely use vancomycin, gentamicin, and fluconazole. Current AUA Guidelines for prosthetic devices recommend an aminoglycoside and 1st/2nd generation cephalosporin or vancomycin (33). While anti-fungal prophylaxis is not endorsed by the AUA, recent studies have examined fungal rates and have found them to be increasing. For high risk patients including diabetics,

obese patients, and revision surgeries, we recommend fluconazole based on these data (13,14).

Intra-operatively, infection retardant coating from device manufactures has contributed substantially to decreased infections with a meta-analysis revealing a 60% decrease in infections (15). Coloplast IPPs are soaked in antibiotic solution immediately before placement as they are absorptive. AMS devices are built with InhibiZone® which includes rifampin and gentamicin. In addition to using these devices, we recommend that all prosthetic cases, especially revision surgeries, be performed at high volume centers. This provides surgical expertise, a decrease in operative time, a consistent operative team including a recommended standardized checklist, and lower complication rates (2). Based on data from other surgical fields, we recommend prepping the surgical site with chlorhexidine-alcohol based solution and at all times minimizing contact with the skin, also referred to as the no touch technique (NTT) (16-18,20). The anesthesia team should work on tight glycemic control and maintaining normothermia. Regarding the placement of a drain, a multicenter retrospective analysis revealed decreased postoperative hematoma but no change in infection rates (21). We do also recommend a wrap to reduce hematoma formation and specifically use the ‘Mummy’ wrap which has been associated with an 83% reduction in infection rates (19,27).

Climate has recently been examined and found to be associated with increased infection rates. In their recent study, Gross *et al.* found increased infections in summer months and in increasingly humid climates. In addition, fungal infections occurred more frequently with increasing humidity and Gram positive organisms were seen more often in Fall/Spring climates than in Summer climates (34). When choosing peri-operative antibiotics, special note should be taken to identify all risk factors and treat appropriately.

Post-operatively, there is no data to support extended use of antibiotics beyond 24 hours. While most prosthetic surgeons continue their patients on home antibiotics, this is an area of sparse data and needs further investigation.

Managing infections

Whereas the original management of prosthetic infections was device explant with delayed reimplant, Mulcahy *et al.* introduced the salvage technique in 1996 that is now widely adapted although not universally utilized by prosthetic surgeons. In this procedure, the infected IPP is removed, the wound thoroughly irrigated, and a new

device immediately implanted. They report a success rate of over 80% (7,14). Replacement of an IPP vs a malleable have both been described (35). A third technique described is the Carrion Cast which we do not recommend using in the absence of an experienced prosthetic surgeon. This technique involves injecting antibiotic impregnated calcium sulfate into the corpora that dissolves over time and allows the corporal space to be preserved (36).

While there is no definitive guide on managing infected implants, we recommend the following First, the device should be cultured via direct swap or needle aspirate. Second, broad spectrum antibiotics including anti-fungal and anti-pseudomonas coverage should be administered and tailored once cultures finalize. Surgical procedures from this point are based on clinical judgement and patient wishes. If surgery is to be performed, the Mulcahy salvage with either a malleable or inflatable implant should be used. Antibiotics are routinely given for 4–6 weeks post-operatively. Again, expert opinion should be sought and thorough patient counseling is imperative.

Conclusions

Penile prosthesis infections are devastating. With attention to detail at the pre-operative, intra-operative, and post-operative setting, infectious risks can be minimized. The most common infections involve skin flora and present as indolent, often difficult to diagnose, vague complaints. Device cultures and broad spectrum antibiotics are mandated and while most infections will require explantation, some can be measured conservatively. Overall, these are best managed at centers of excellence by high volume prosthetic surgeons.

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