Infections Associated with Inflatable Penile Prostheses

Mayar Al Mohajer, MD, FACP* and Rabih O. Darouiche, MD†

*Department of Medicine, University of Arizona, Tucson, AZ, USA; †Spinal Cord Injury and Medical Care Lines, Infectious Disease Section, Michael E. DeBakey and Veterans Affairs Medical Center, Baylor College of Medicine, Houston, TX, USA

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ABSTRACT

Introduction. The implantation of inflatable penile prosthesis (IPP) has become a successful method for the treatment of erectile dysfunction. Infections are rare but they can result in devastating complications following surgical implantation of the prosthesis.
Aim. To discuss pathogenesis, risk factors, and microbiology of IPP infections, summarize clinical manifestation and diagnostic methods, and discuss future directions of prevention and management.
Methods. A PubMed search was performed of all articles published from 1960 to present relating to IPP infections.
Main Outcome Measure and Results. Skin flora organisms such as *Staphylococcus epidermis* are the most common source of infection. Several host and surgical risk factors for prosthesis infection have been demonstrated, including uncontrolled diabetes mellitus and previous surgical interventions. Biofilms play an important role in the pathogenesis of device-related infections. Pain, fever, drainage, and device extrusions are suggestive of IPP infection. Preventive methods include preoperative skin cleansing, systemic antibiotic prophylaxis, and the use of surface-modified prostheses. The most frequently utilized surgical management is a single-stage approach that comprises aggressive irrigation and debridement, removal of all components of the infected prosthesis, and placement of a new IPP in the same surgical setting.
Conclusion. Advances in systemic antimicrobial prophylaxis, skin cleansing and surface-modification of the devices, as well as a number of other potentially protective measures, have decreased the rates of infections. Currently, most infected IPP are surgically managed by adopting the salvage approach. **Al Mohajer M and Darouiche RO. Infections associated with inflatable penile prostheses. Sex Med Rev 2014;2:134–140.**

Key Words. Inflatable Penile Prostheses; Infection; Prevention; Management; Salvage

Introduction

Over half of the men over the age of 40 years suffer from erectile dysfunction [1]. Phosphodiesterase inhibitors are regarded as the first-line therapy [2]. Second-line therapy includes penile self-injectable drugs, intraurethral alprostadil, and vacuum devices [3,4]. Implantation of penile prostheses is the mainstay treatment for persistent erectile dysfunction that is not responsive to less-invasive approaches [5,6].

It is estimated that about 20,000 to 25,000 implantable penile prostheses are implanted each year in the United States [7]. Inflatable penile prostheses (IPP) are more commonly used than semi-rigid devices in the United States. The multicomponent devices are generally preferred and they consist of one pair of intracavernosal cylinders, a fluid reservoir, a scrotal pump, and silicone tubings connecting the prosthesis components [8]. These devices can be inserted via an infrapubic or penoscrotal approach [9]. The 10-year mechanical survival rate for IPP ranges from 67% to 88% [5].

While the average infection rate of IPP is relatively low (3%), the disastrous complications caused by IPP infections are significant [5]. They are associated with significant morbidity, psycho-

logical trauma, and financial burden [10]. The cost of medical and surgical treatment for infected IPP is estimated to be US $35,000 [11]. Furthermore, mechanical improvements and prolonged survival of the IPP made suspected or documented infection the most common cause of removal of these implants [11]. In this review, we discuss the diagnosis and management of inflatable penile prostheses infections.

In this review we discuss the diagnosis, prevention and management of IPP infections. To evaluate the current literature, we searched PubMed for articles relating to IPP Infection from 1960 to present. We used the following MESH terms: penile prostheses infections; penile implant infections; and penile prosthetic devices infections. Articles not written in English were excluded.

Microbiology and Risk Factors

Skin flora organisms can be introduced during surgery and leading to IPP infections [12]. *Staphylococcus epidermis* is the most common pathogen in primary and revision surgeries [5,13]. Infections of penile prosthesis can also be caused by streptococci (mainly group B), other staphylococcal species (including *S. aureus*), Gram-negative organisms, and yeast [12]. Infrequently, anaerobes, mycobacteria, and gonococci have been reported as causes of IPP infections [14–16].

Several risk factors for IPP infections have been demonstrated. These include spinal cord injury, urinary tract infection, diabetes mellitus, immunosuppression, surgical inexperience, prolonged hospitalization, and distant sites of infection [5,17,18]. Although diabetic patients are more likely than non-diabetic persons to acquire prosthesis infection, glycosylated hemoglobin reportedly has no predictive value in predicting IPP infections [19].

Prior surgical implantation and multiple surgical procedures at the time of implantation have been associated with an increased risk of infection [20]. Concomitant surgical procedures such as simultaneous circumcision and the use of additional foreign body material like Gore-Tex or Dacron have also been reported as risk factors for IPP infection [21].

Pathogenesis

Infections of IPP require bacterial colonization of the surface of the device and development of biofilms [22,23]. The production of biofilm is an important method for bacteria to survive by evading phagocytosis, trapping nutrients, and decreasing efficacy of antibiotics [24,25]. The reduced efficacy of antibiotics against bacteria in biofilms can be attributed to inadequate antibiotic penetration through the layers of the biofilm, high minimal inhibitory concentrations of antibiotics for biofilm organisms, or inhibition of certain antibiotics (like vancomycin) but not others (such as rifampin) by certain substances present in the biofilm [26–28].

The biofilm is not only essential for infection but may also play a role in mechanical malfunction. In one study, a total of ten patients undergoing IPP removal or revision due to mechanical failure were analyzed. Biofilms were noted in 8 out of 10 clinically uninfected prostheses [28]. The symptomatic prosthesis infection develops when the bacteria in the biofilms proliferate and become planktonic (free-floating). This theory is the foundation of the salvage protocols developed by surgeons [5]. Figure 1 shows scanning electron microscopy of the biofilm surrounding a urologic device.

Clinical Manifestations and Diagnosis

Infections of IPP can be grouped into apparent clinical and subclinical infections. Symptoms and signs suggestive of clinical infection include acute onset penile pain, erythema and induration over the prosthesis, and progressive fixation of the pump to the scrotal wall. Fever, wound drainage, cellulitis, and fluctuance may also indicate overt infection [29,30]. Subclinical infections are more common, difficult to diagnose and treat, and are often manifested by chronic pain associated with the prosthesis, with or without device migration [29,31].

One study showed that the majority of infection (56%) occurred in the first 7 months after device implantation, whereas 36% occurred between 7 and 12 months after implantation [30]. Early infections were likely secondary to bacterial contamination or colonization during surgery. Late infections (after 12–24 months) were mostly hematogenously contracted [30].

Prevention

Preoperative Skin Cleansing, Showering, Bathing, and Scrubbing

Antiseptic cleansing of the skin using chlorhexidine-alcohol has been demonstrated to be superior to cleansing with aqueous povidone-iodine in