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Multicenter Investigation of the Micro-Organisms Involved in Penile Prosthesis Infection: An Analysis of the Efficacy of the AUA and EAU Guidelines for Penile Prosthesis Prophylaxis

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ABSTRACT

Introduction: Penile prosthesis infections remain challenging despite advancements in surgical technique, device improvements, and adoption of antibiotic prophylaxis guidelines.

Aim: To investigate penile prosthesis infection microbiology to consider which changes in practice could decrease infection rates, to evaluate current antibiotic prophylaxis guidelines, and to develop a proposed algorithm for penile prosthesis infections.

Methods: This retrospective institutional review board–exempt multi-institutional study from 25 centers reviewed intraoperative cultures obtained at explantation or Mulcahy salvage of infected three-piece inflatable penile prostheses (IPPs). Antibiotic usage was recorded at implantation, admission for infection, and explantation or salvage surgery. Cultures were obtained from purulent material in the implant space and from the biofilm on the device.

Main Outcome Measures: Intraoperative culture data from infected IPPs.

Results: Two hundred twenty-seven intraoperative cultures (2002–2016) were obtained at salvage or explantation. No culture growth occurred in 33% of cases and gram-positive and gram-negative organisms were

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While it is the policy of *The Journal of Sexual Medicine* to limit the number of authors on a paper to eight, this manuscript represents an unusual circumstance. It represents an international registry project where patients were enrolled from many centers, with every author contributed patients to the analysis and reviewed the manuscript. Because of this an exception was made for this paper.

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found in 73% and 39% of positive cultures, respectively. *Candida* species (11.1%), anaerobes (10.5%) and methicillin-resistant *Staphylococcus aureus* (9.2%) constituted nearly one third of 153 positive cultures. Multi-organism infections occurred in 25% of positive cultures. Antibiotic regimens at initial implantation were generally consistent with American Urological Association (AUA) and European Association of Urology (EAU) guidelines. However, the micro-organisms identified in this study were covered by these guidelines in only 62% to 86% of cases. Antibiotic selection at admissions for infection and salvage or explantation varied widely compared with those at IPP implantation.

Conclusion: This study documents a high incidence of anaerobic, *Candida*, and methicillin-resistant *S aureus* infections. In addition, approximately one third of infected penile prosthesis cases had negative cultures. Micro-organisms identified in this study were not covered by the AUA and EAU antibiotic guidelines in at least 14% to 38% of cases. These findings suggest broadening antibiotic prophylaxis guidelines and creating a management algorithm for IPP infections might lower infection rates and improve salvage success. **Gross MS, Phillips EA, Carrasquillo RJ, et al. Multicenter Investigation of the Micro-Organisms Involved in Penile Prosthesis Infection: An Analysis of the Efficacy of the AUA and EAU Guidelines for Penile Prosthesis Prophylaxis. J Sex Med 2017;14:455−463.**

Key Words: Penile Prosthesis; Infection; Bacteria; Antibiotic Prophylaxis

INTRODUCTION

Significant advances in infection prevention have occurred since the introduction of inflatable penile prostheses (IPPs). Experienced prosthetic surgeons have innovated and standardized the surgical technique for better care, as seen in a recent study of implanters' practices showing diverse strategies.[1] Less skin contact and shorter operative time have decreased the likelihood of device bacterial contamination.[2,3] Other techniques have decreased hematoma formation, which in turn have decreased nutrient sources available to bacteria.[4,5] American Urological Association (AUA) and European Association of Urology (EAU) guidelines for antibiotic selection have broadened perioperative prophylaxis to more appropriate agents for the bacteria expected to cause infection.[6,7] Manufacturers have made device coating adaptations that lower infection rates.[8−11]

Despite these advances, infection occurs in 1% to 3% of cases after new implantation and up to 10% of the time at penile prosthesis revision.[10,12] The period for infection typically lasts up to 1 year after surgery and skin flora are the most commonly cultured organisms at the time of explantation or salvage.[13] Clinically uninfected prostheses can have culture-positive biofilms with skin flora,[14] so some cultured organisms might be inactive in healthy patients in the modern era of infection-retardant coatings. However, there has been an increasing incidence of infection with more virulent, antibiotic-resistant, and systemically invasive organisms.[15,16]

A recent review of culture data obtained from multiple experienced prosthetic surgeons at salvage showed that many of the micro-organisms isolated were unusual and were not adequately covered by current antibiotic guidelines.[17] The present multi-institutional study was designed to investigate the microbiology of penile prosthesis infections to better understand and potentially decrease infection rates and to evaluate current antibiotic prophylaxis guidelines. In addition, we applied our results to the development of a proposed management algorithm for infected IPPs.

METHODS

This is a retrospective study of 227 patients at 25 institutions who underwent salvage or explantation of three-piece IPPs from 2002 through 2016; this study was exempt from review by the institutional review board of Boston University School of Medicine (BUMC protocol H-33597; Boston, MA, USA). Antibiotic usage was recorded at implantation, admission for infection, and explantation or salvage surgery. Patient data were compiled after extensive review of all aspects of their electronic medical records.

Patients appropriate for a salvage procedure (ie, a clear source of scrotal or shaft infection on examination and/or at imaging) were included and offered Mulcahy salvage with a malleable or inflatable device.[17,18] Patients with more extensive complications, including device erosion, visible necrosis, inability to tolerate extended surgery, or sepsis, underwent explantation. Infected implant spaces were cultured using culture swabs and/or 10-mL syringes, with transfer of purulent material into a sterile cup. In some cases, explanted devices were swabbed to obtain a biofilm sample. Salvage technique was consistent across sites and proceeded as outlined by Mulcahy. Collaborating author data were compiled into a database using Excel (Microsoft, Redmond, WA, USA), which also was used for statistical calculation and analysis.[18]

RESULTS

The malleable implant salvage technique was used in 76 cases (34%), standard three-piece IPP salvage was used in 66 cases (29%), and explantation was performed in 83 cases (37%). The

Table 1. Overall culture summary

Cultured organisms	Cultures, n	Cultures, %
Positive cultures	153/227	67
Gram-positive bacteria	111/153	73
Gram-negative bacteria	60/153	39
Fungi	17/153	11.1
Anaerobic bacteria	16/153	10.5
Multiple organisms	38/153	25
Negative cultures	74/227	33

exact procedure was unknown in the other two cases. Fifty-five patients (24%) had undergone multiple prior IPP surgeries (mean = 2.1, range = 1–9). The other 172 patients had undergone primary IPP implantation before presenting with infection. Three of these patients with primary implantation underwent simultaneous artificial urinary sphincter (AUS) implantation. Patients presented with infection approximately 4.8 months after surgery on average (range = 2 weeks to 81 months, median = 1.5 months).

We obtained 227 intraoperative cultures at salvage or explantation (Table 1) and identified 204 organisms. Thirty-eight of the 153 positive cultures grew multiple organisms (25%). Gram-positive organisms were found in 73% (111 of 153) and gram-negative bacteria were found in 39% (60 of 153) of positive cultures. Table 2 lists the bacteria and fungi found in 153 positive cultures in order of frequency of occurrence. *Candida* species, anaerobes, and methicillin-resistant *Staphylococcus aureus* (MRSA) were present in 11.1% (17 of 153), 10.5% (16 of 153), and 9.2% (14 of 153) of positive cultures, respectively.

Intravenous antibiotic regimens for all patients at implantation were generally, but not always, consistent with AUA or EAU guidelines (Table 3). Twenty-two percent (49 of 227) received a cephalosporin (cefazolin) and an aminoglycoside (gentamicin) and 56% (126 of 227) received vancomycin and an aminoglycoside (gentamicin) at implantation. One of these latter patients also received a dose of fluconazole preoperatively. Other antibiotic choices were unknown or consisted of different single agents and two double-agent combinations. Surgeon rationale for antibiotic choices was not requested. Data on the brand of implant, antibiotic irrigation, and selection for hydrophilic devices were not requested.

Table 4 lists antibiotic selection for patients before and at salvage surgery or explantation. Forty-six percent of patients (105 of 227) received vancomycin and gentamicin before surgery, and this number increased to 50% (113 of 227) at surgery. The number of patients receiving cefazolin and gentamicin remained the same perioperatively (33 of 227, 14.5%). Multiple single and combination oral and intravenous agents were used preoperatively, and the amount of these combinations was decreased at time of surgery. Data on patient preoperative courses (ie, hospitalization vs outpatient management before surgery) were not requested.

Table 2. Positive culture summary

Cultured organism	Cultures, n (% of 153 positive cultures)
Escherichia coli	28/153 (18.3)
Coagulase-negative *Staphylococcus* spp	23/153 (15)
Candida spp	17/153 (11.1)
Group B *Streptococcus* spp	16/153 (10.5)
MSSA	16/153 (10.5)
MRSA	14/153 (9.2)
Enterococcus faecalis	12/153 (8)
Staphylococcus epidermidis	11/153 (7.2)
Klebsiella pneumoniae	9/153 (5.9)
Pseudomonas aeruginosa	9/153 (5.9)
Serratia spp	4/153 (2.6)
Staphylococcus haemolyticus	4/153 (2.6)
α-Hemolytic *Streptococcus* spp	3/153 (2)
Bacteroides spp*	3/153 (2)
Corynebacterium spp	3/153 (2)
Peptostreptococcus spp*	3/153 (2)
*Prevotella bivia**	3/153 (2)
Staphylococcus lugdunensis	3/153 (2)
Enterobacter spp	2/153 (1.3)
Group F *Streptococcus* spp	2/153 (1.3)
Morganella spp	2/153 (1.3)
Propionibacterium spp*	2/153 (1.3)
Proteus mirabilis	2/153 (1.3)
Staphylococcus intermedius	2/153 (1.3)
Achromobacter spp	1/153 (0.6)
Anaerobes (un-speciated)*	1/153 (0.6)
Citrobacter freundii	1/153 (0.6)
*Clostridium innocuum**	1/153 (0.6)
Dermabacter hominis	1/153 (0.6)
Eikenella corrodens	1/153 (0.6)
*Finegoldia magna**	1/153 (0.6)
Group A *Streptococcus* spp	1/153 (0.6)
*Lactobacillus acidophilus**	1/153 (0.6)
Neisseria spp	1/153 (0.6)
*Peptoniphilus asaccharolyticus**	1/153 (0.6)

MRSA = methicillin-resistant *Staphylococcus aureus;* MSSA = methicillin-sensitive *Staphylococcus aureus.*
*Anaerobic organism.

Table 5 presents the efficacy of AUA and EAU antibiotic guidelines on the organisms isolated in our series using the antimicrobial coverage tables from the 2015 *Sanford Guide to Antimicrobial Therapy.*[19] These results did not consider bacterial resistance. The AUA recommends an aminoglycoside (or aztreonam in patients with renal compromise) in combination with a first- or second-generation cephalosporin or vancomycin. The combination of an aminoglycoside (or aztreonam) and vancomycin showed the greatest efficacy, eliminating 86% (175 of 204) of the microbes found in culture in our series. However, this combination had poor anaerobic coverage (25%, 4 of 16) and lacked fungal coverage. The EAU suggests a second- or third-generation cephalosporin or a penicillin agent with

Table 3. Intravenous antibiotic selection at IPP insertion

Antibiotics at IPP insertion	Patients, n (% of 227 cases)
Vancomycin, gentamicin	126/227 (56)
Cefazolin, gentamicin	49/227 (22)
Unknown	15/227 (6.6)
Cefuroxime	14/227 (6.2)
Augmentin, gentamicin	9/227 (4)
Cefazolin	3/227 (1.3)
Cefixime	3/227 (1.3)
Levofloxacin	3/227 (1.3)
Ampicillin, gentamicin	2/227 (0.8)
Ciprofloxacin	1/227 (0.4)
Vancomycin	1/227 (0.4)
Vancomycin, gentamicin, fluconazole	1/227 (0.4)

IPP = inflatable penile prosthesis.

anti-penicillinase efficacy. Ampicillin-sulbactam was the most effective single anti-penicillinase agent in the EAU guidelines and eliminated 72% (146 of 204) of the cultured microbes in our series. Anaerobic coverage was excellent (100%, 16 of 16), but sacrificed gram-positive and gram-negative coverage (72% and 73%, respectively), did not cover *Candida* species, and was not used by our surgeons.

DISCUSSION

This is the largest study of infected prostheses to date and the data collected raised questions and concerns. Antibiotic regimens at initial implantation were generally consistent with AUA and EAU guidelines. However, the micro-organisms identified in this study were not covered by current AUA and EAU antibiotic guidelines in at least 14% to 38% of cases. We applied these findings to the development of a proposed management protocol for infected IPPs.

Almost 70% of IPP infections were caused by gram-positive organisms. Our data are similar to prior studies documenting the prevalence of gram-positive infection. Gram-positive infections, according to our results and those in the literature, continue to be the most common cause of IPP infection.[13] We noted that 39% of our infections contained gram-negative organisms. The most common infectious agent seen in our series was *Escherichia coli,* and it is the most common bacteria in the genitourinary and gastrointestinal tracts. We cannot speculate on whether this high rate of *E coli* infection was related to the antibiotic coating on modern IPPs, although this remains a possibility.

Our study documented a 33% negative culture rate. We believe negative culture results occur in part from outpatient and/or inpatient administration of antibiotics before culture acquisition and from the difficult nature of growing and identifying biofilm-associated organisms. This could be due to flaws in culture collection techniques. Boston Medical Center transitioned from direct swabbing of purulent material to pus aspiration using a syringe and targeting swabs to the biofilm on the device. This was suggested by the infectious disease service after reviewing hospital surgical cultures to gather more accurate data to guide eventual antibiotic selection from a gram stain and improve culture positivity. This change was reinforced by the orthopedic literature suggesting that direct fluid and tissue culturing improves sensitivity compared with swab cultures.[20,21] Hospital admission and treatment with intravenous antibiotics before salvage or explantation could have lowered our positive culture rates. As a result, we recommend obtaining a culture before antibiotic administration.

In addition, *Candida* species were identified in 11.1% of the positive cultures. The first documented IPP infection with *Candida* species dates to 1988.[21] In the seminal article by Brant et al[18] on implant salvage, 1 of 12 patients had a mixed infection with *Candida albicans* and another with *Candida glabrata.* The fungal infection rate in that series was 16.7% overall (and 20% of positive cultures), comparable with our overall rate of 11.1% of positive cultures. According to conventional wisdom, *Candida* infections are opportunistic and brought about by the eradication of other species in an infectious space. However, a thorough review of the literature yielded no articles authenticating this phenomenon. Instead, we found that the prevalence and virulence of candidal infections of medical devices from biofilm formation has been documented in the infectious disease literature since at least 2004.[22] Our data and the current literature suggest that *Candida* species are a real cause of clinical IPP infection and, we speculate, might be a more common cause of infection in diabetic and immunocompromised patients undergoing prosthetic surgery, although our series was not designed to capture this information.

Infections caused by anaerobic bacteria occurred in 10.5% of positive cultures. As with *Candida* species, there is limited urologic literature on anaerobic infections of IPPs. However, the more extensive orthopedic literature has reported that 3% to 6% of prosthetic joint infections are related to anaerobes. Anaerobic joint infections are difficult to culture and diagnose.[23] Novel techniques of microbiological sequencing, including 16s rRNA molecular identification, have advanced the ability to detect previously concealed anaerobes in prosthetic joint infections.[24] Biofilm sonication has been used to "release" highly virulent organisms from within the biofilm of infected prostheses that previously were not identified by culture of the biofilm.[25] These anaerobes might have always been present in IPP infections and improvements in culturing methods and detection are now allowing them to be seen.

Nine percent of the infections in our series were caused by MRSA. There are no articles to date that offer comparable MRSA infection rates in IPPs. MRSA infection is particularly worrisome because the AUA guidelines for prosthetic implantation offer a suggested antibiotic combination that does not cover MRSA effectively (use of a first- or second-generation cephalosporin in combination with an aminoglycoside). The vancomycin recommendation in the guidelines covers MRSA;

Table 4. Oral and intravenous antibiotic selection before surgery and at surgery*

Antibiotics	Usage before salvage surgery or explantation (% of 227 cases)	Usage at salvage surgery or explantation (% of 227 cases)
Ampicillin, gentamicin	1/227 (0.4)	2/227 (0.9)
Augmentin	2/227 (0.9)	2/227 (0.9)
Augmentin, cefuroxime	1/227 (0.4)	1/227 (0.4)
Augmentin, ciprofloxacin	1/227 (0.4)	1/227 (0.4)
Augmentin, clindamycin	1/227 (0.4)	3/227 (1.3)
Cefazolin	1/227 (0.4)	4/227 (1.8)
Cefazolin, gentamicin	33/227 (14.5)	33/227 (14.5)
Cefepime	1/227 (0.4)	1/227 (0.4)
Ceftriaxone, clindamycin	1/227 (0.4)	1/227 (0.4)
Ceftriaxone, fluconazole, vancomycin		1/227 (0.4)
Cefuroxime	1/227 (0.4)	
Cefuroxime, fluconazole	1/227 (0.4)	
Cephalexin	2/227 (0.9)	
Ciprofloxacin, clindamycin	2/227 (0.9)	1/227 (0.4)
Doxycycline, levofloxacin	2/227 (0.9)	
Fluconazole	1/227 (0.4)	
Gentamicin	1/227 (0.4)	2/227 (0.9)
Levofloxacin	1/227 (0.4)	
Levofloxacin, trimethoprim-sulfamethoxazole	1/227 (0.4)	
Piperacillin-tazobactam	1/227 (0.4)	2/227 (0.9)
Teicoplanin	1/227 (0.4)	1/227 (0.4)
Trimethoprim-sulfamethoxazole	3/227 (1.3)	
Unknown	54/227 (24)	46/227 (20.3)
Vancomycin	4/227 (1.8)	3/227 (1.3)
Vancomycin, gentamicin	105/227 (46.3)	113/227 (50)
Vancomycin, gentamycin, fluconazole		3/227 (1.3)
Vancomycin, piperacillin-tazobactam	5/227 (2.2)	5/227 (2.2)

*Antibiotics and antibiotic combinations listed in alphabetical order as reported.

however, in our series, it was used in only 56% (127 of 227) of primary IPP implants. In 2008, Magera and Elliott[26] published a series that showed MRSA as the most prevalent cause (12%) of AUS infections. None of the simultaneous AUS implantations in our series had MRSA infections, and two of three cases used vancomycin and gentamicin. The surgical sites and skin flora are different for IPP and AUS implantation, but the incidence of MRSA in the two series remains a cause for concern. This could be mitigated by amending the guidelines to recommend antibiotics that specifically cover MRSA at implantation in patients known to be colonized.

Orthopedic surgeons have established diagnostic and management algorithms for prosthetic joint infections. Microbiological or cytologic analysis using joint aspiration is the most important early diagnostic tool, because it provides synovial white blood cell and neutrophil counts, assess the presence of purulence, and allows aspirate culture.[27] Clinical practice guidelines from 2013 suggest diagnostic arthrocentesis should be performed in patients with suspected acute periprosthetic joint infection.[28] If infection is confirmed, then further diagnostics are performed at the time of surgical debridement. Current guidelines recommend that at least three to five periprosthetic tissue cultures be taken at the time of surgical debridement (if not the prosthesis itself) and incubated in anaerobic and aerobic cultures.[27]

We propose a management algorithm for clinically infected IPPs based on the findings described in our study, the published literature, and the consensus expert opinions of prosthetic urologists, epidemiologists, and infectious disease specialists (Figure 1). Based on the recommendations of these physicians and the data collected for this study, we have switched to vancomycin and gentamicin for initial implants at Boston Medical Center, with vancomycin and ceftriaxone as an alternative combination in patients with renal dysfunction. We also have been adding fluconazole to these intravenous drug combinations for diabetic patients because of our suspicion of an increased likelihood of fungal infections in these patients.

The first step when a patient presents with a clearly infected prosthesis is culturing the device by needle aspiration (and/or direct swabbing) as originally proposed by Mulcahy.[29] Providers need not be concerned about injuring the prosthesis because it will be soon removed, as noted in Köhler's editorial comment following the article by Gross et al.[17] Needle aspiration or swabbing can be performed in the clinic, preoperative holding, emergency department, or any other suitably private location.

Table 5. Organisms covered by current AUA and EAU guidelines*

Recommended antibiotic combinations	Gram-positive efficacy	Gram-negative efficacy	Fungal efficacy	Anaerobe efficacy	All organisms covered
AUA					
Aminoglycoside and first-generation cephalosporin	67% (74/111)	100% (60/60)	None	None	66% (134/204)
Aminoglycoside and second-generation cephalosporin	67% (74/111)	100% (60/60)	None	44% (7/16)	69% (141/204)
Aztreonam and first-generation cephalosporin	67% (74/111)	100% (60/60)	None	None	66% (134/204)
Aztreonam and second-generation cephalosporin	67% (74/111)	100% (60/60)	None	44% (7/16)	69% (141/204)
Aminoglycoside and vancomycin	100% (111/111)	100% (60/60)	None	25% (4/16)	86% (175/204)
Aztreonam and vancomycin	100% (111/111)	100% (60/60)	None	25% (4/16)	86% (175/204)
Alternative agents					
Ampicillin and sulbactam	77% (86/111)	73% (44/60)	None	100% (16/16)	72% (146/204)
Ticarcillin and clavulanate	67% (74/111)	100% (60/60)	None	44% (7/16)	69% (141/204)
Piperacillin and tazobactam	87% (97/111)	100% (60/60)	None	100% (16/16)	85% (173/204)
EAU					
Second-generation cephalosporin *or*	67% (74/111)	75% (45/60)	None	44% (7/16)	62% (126/204)
Third-generation cephalosporin *or*	67% (74/111)	85% (51/60)	None	25% (4/16)	63% (129/204)
Penicillin (penicillinase stable)	77% (86/111)	73% (44/60)	None	100% (16/16)	72% (146/204)

AUA = American Urological Association; EAU = European Association of Urology.
*Antimicrobial coverage tables adapted from Gilbert et al.[19]

The needle should be inserted into any penile area with erythema, edema, pain, abscess, or other clinical findings concerning for infection. If purulent discharge is readily available, then this can be directly swabbed (or in lieu of needle aspiration) at the urologist's discretion. Infection specimens should be obtained before antibiotic administration to maximize procurement of useful culture information.

The next step is to administer broad-spectrum antibiotics and antifungals to cover MRSA, oxacillin-resistant gram-positive and hardy gram-negative bacteria including *Pseudomonas aeruginosa* (cultured in ~5% of our series), anaerobic bacteria, and *Candida* species. At Boston Medical Center, based on our local antibiogram, the infectious disease service recommended vancomycin, piperacillin-tazobactam, and fluconazole. This combination covers 100% of the organisms in our series. Duration of antibiotic administration in the perioperative period should be based on hospital guidelines and clinical judgment.

Explantation or the salvage procedure would be carried out at the surgeon's discretion depending on the patient's desire and clinical status. Cultures should be obtained intraoperatively in accord with hospital guidelines. If salvage is performed, then we suggest adherence to the Mulcahy protocol and exchange of the IPP for a malleable device, which has been shown to have less risk of persistent or recurrent infection than a three-piece IPP.[18] The tissue and device (Coloplast, Minneapolis, MN, USA) should be irrigated with vancomycin and piperacillin-tazobactam and with amphotericin B to cover fungal infections. We also suggest tailoring antibiotics when appropriate cultures return. If the cultures are negative, then we suggest a broad-spectrum course of oral antibiotics for 4 to 6 weeks. Based on our data, a combination of trimethoprim-sulfamethoxazole and amoxicillin-clavulanic acid is a reasonable option. Our consensus did not recommend postoperative oral antifungals on discharge unless the cultures are positive for *Candida* species, because fungal infections are likely to be completely eradicated in the operating room. We believe that this management protocol should improve outcomes after IPP infection if properly followed.

The most important limitation of this study is that it was retrospective and performed in a small population and thus subject to the issues inherent to a review of retrospective data. However, the present result represents the very low infection rate from experienced prosthetic surgeons over a vast number of cases. We did not request data on the brand of an implant, irrigation antibiotics, and antibiotics used for hydrophilic coating of devices. Our study was not designed for head-to-head comparison of these variables. This lack of information can be seen as a limitation because we cannot comment on the utility of coating and irrigation in prophylaxis and infection management. Because these data are retrospective, there is no consensus on how cultures were obtained, and this must be considered a limitation. In addition, we have only recently begun to adopt our protocol and do not yet have specific findings to indicate improvement. However, we believe our data merit re-evaluation of the current AUA and EAU guidelines. Our data suggest that MRSA, anaerobic bacteria, and *Candida* species should be covered at the time of primary implantation and in cases of IPP

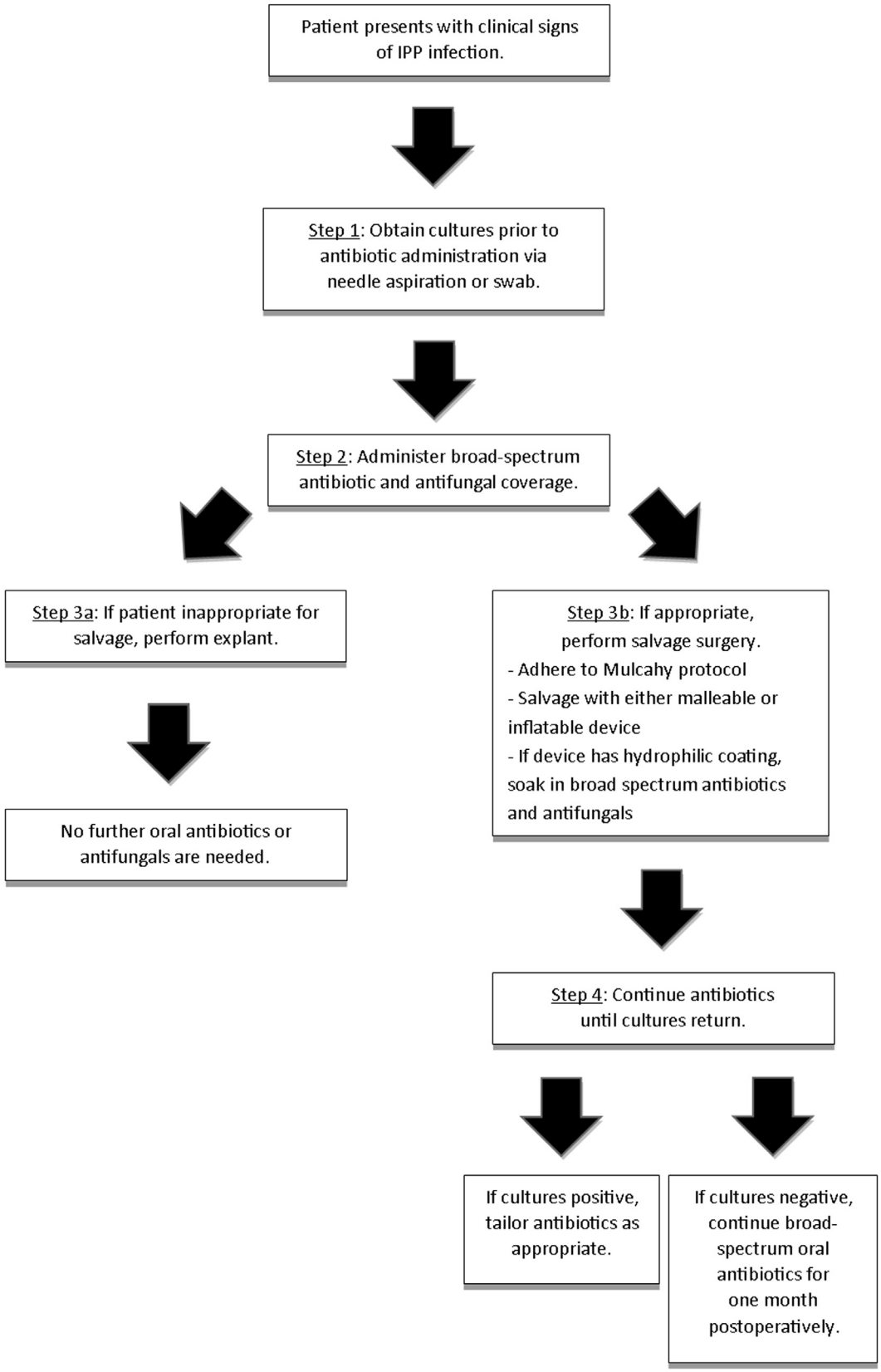

Figure 1. Management protocol for infected penile prostheses. IPP = inflatable penile prosthesis.

infection, and we suspect this is most important in high-risk patients such as those with diabetes and immunocompromise.[30]

CONCLUSIONS

Our study documented a high incidence of infections with anaerobic bacteria, *Candida* species, and MRSA. Approximately one third of infected IPPs had negative cultures and 25% of positive cultures were multi-organism infections. Antibiotic regimens at initial implantation were generally consistent with guidelines. However, the micro-organisms identified in this studied were not covered by the current AUA and EAU antibiotic guidelines in at least 14% to 38% of cases. This suggests a need to broaden antibiotic prophylaxis from current guidelines and to create a management algorithm for penile prosthesis infections.

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