Does Preoperative Topical Antimicrobial Scrub Reduce Positive Surgical Site Culture Rates in Men Undergoing Artificial Urinary Sphincter Placement?

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Purpose: We determined if the incidence of a perioperative surgical site-positive culture was reduced by a 5-day topical antimicrobial scrub before implantation of an artificial urinary sphincter.

Materials and Methods: A single surgeon prospective cohort study was conducted of 100 consecutive artificial urinary sphincter implants placed between May 2003 and November 2005. We compared 50 men who performed preoperative topical antimicrobial scrub with 4% chlorhexidine to the abdominal site and perineal site with 50 men who used their normal hygiene (soap and water). All received povidone-iodine skin disinfection before incision, and bacterial cultures of the abdominal and perineal sites were collected immediately after skin disinfection and after artificial urinary sphincter implantation. Baseline comparisons between groups were done with the Wilcoxon rank sum and Fisher exact tests. Predictors of positive culture were identified using multivariate logistic regression analysis.

Results: The causes of incontinence were radical prostatectomy (90), radiation therapy (8) and transurethral resection of the prostate (2). There were no baseline differences between the groups including age, diabetes or previous urethral surgery. Overall 140 of the 400 cultures were positive with only 37% of the positive cultures (52 of 140) observed with topical antimicrobial scrub. For the perineal site the only factor affecting preoperative culture status was topical antimicrobial scrub (OR 0.23, $p = 0.003$). A positive postoperative culture was predicted by a positive preoperative perineal (OR 4.61, $p = 0.003$) and abdominal culture (OR 3.80, $p = 0.013$).

Conclusions: Preoperative topical antimicrobial scrub resulted in a 4-fold reduction in preoperative perineal colonization rate and overall reduction in positive surgical site cultures. Given the low cost, safety and efficacy, topical antimicrobial scrub should be considered before artificial urinary sphincter placement.

Key Words: infection; postoperative complications; prostheses and implants; urinary sphincter, artificial

Artificial urinary sphincter implantation is an effective and durable treatment for intrinsic sphincter deficiency following radical prostatectomy and transurethral resection of the prostate with high patient satisfaction.[1–3] One of the most significant complications of AUS implantation is infection, typically requiring explantation and delayed reimplantation. Fortunately AUS infection is relatively uncommon, occurring in less than 2% of patients at medical centers that perform high volumes of AUS implantations.[1,4–6]

To avoid this major complication, meticulous attention to sterile technique and implementation of antimicrobial adjuncts, including prophylactic parenteral antibiotics and antimicrobial irrigation, are routinely used during the insertion process. Despite these interventions colonization of the prosthesis can occur during insertion and is most likely the initial step leading to infection.[7,8] The primary source of the bacterial contamination is the patient's skin flora,[7] and staphylococcus has been reported as the most commonly isolated organism from infected prostheses.[9]

The use of chlorhexidine gluconate for surgical hand scrubs has been shown to produce a log scale reduction in the quantity of cutaneous bacteria.[10,11] Residual antimicrobial activity is noted with chlorhexidine,[12,13] which further reduces microbial counts when applied for 5 days.[14] This may partly explain why preoperative chlorhexidine topical scrubs have been superior to other forms of topical antimicrobial scrub for prevention of intraoperative wound contamination.[15] With these desirable properties and strong activity against gram-positive and gram-negative pathogens, chlorhexidine is an ideal topical antimicrobial scrub that could be used before AUS implantation. Thus, we prospectively studied the ability of a 5-day topical chlorhexidine scrub to suppress the abdominal and perineal cutaneous bacteria present at AUS implantation.

MATERIALS AND METHODS

After approval from the Mayo Clinic institutional review board, we conducted a single surgeon prospective cohort

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Study received institutional review board approval.
Nothing to disclose.
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study of 100 consecutive AUS implants between May 2003 and November 2005. A first group of 50 men was instructed to perform a 5-minute scrub to the perineal and abdominal skin with 15 ml 4% chlorhexidine topical antiseptic (Hibiclens®) twice daily during the 5-day period immediately preceding AUS implantation. A second group of 50 men was instructed to maintain normal hygiene practices of skin cleansing with soap and water. The abdominal and perineal skin was closely inspected immediately before surgery for signs of cutaneous breakdown, infection and dermatitis. All men received prophylactic parenteral antibiotics immediately preceding skin incision, with vancomycin and gentamicin. In addition, a 10-minute, 2-step povidone-iodine skin disinfection was performed before skin incision. An antimicrobial solution consisting of 50,000 units of bacitracin and 1 gm neomycin sulfate diluted in 1 l 0.9% sodium chloride was used to bathe the prosthesis before insertion. This antimicrobial solution was used liberally throughout each operation to irrigate the surgical sites.

Bacterial cultures of the abdominal skin and perineal skin were collected at 2 times. The first set was obtained immediately following skin disinfection and before skin incision (preoperative cultures). The second set was obtained immediately following AUS implantation and before skin closure (postoperative cultures). The bacterial cultures were obtained by swabbing the skin sites with sterile 1 cm segments of prosthetic tubing. As a negative control a 1 cm segment of prosthetic tubing was sent for culture without exposure to the surgical sites. There were 5 specimens collected for each patient, that is negative control, preoperative perineal, postoperative perineal, preoperative abdominal and postoperative abdominal. The prosthetic tubing swabs were transferred in individual sterile specimen containers (PRECISION™ Premium Sterile 5 ounce Specimen Container, Kendall Healthcare, Mansfield, Massachusetts) from the operating suite to the microbiology laboratory. Upon arrival 5 ml broth (BBL™ Brain Heart Infusion, BD Diagnostic Systems, Sparks, Maryland) was added to each container. After vortexing 30 seconds 1 drop (0.2 ml) of broth was transferred to a soy agar plate (BD BBL™ Trypticase™ Soy Agar with 5% Sheep Blood, BD Diagnostic Systems) and streaked using a standard 4-quadrant technique. Incubation of the broth and soy agar plate was performed at 35C in 5% to 7% CO_2 for 24 hours. Growth in the broth or the plate was considered a positive bacterial culture.

A standardized technique of AUS implantation was performed as previously described.[16] Postoperatively the urethral catheter was removed the morning after surgery. Prophylactic parenteral antibiotics were continued during hospitalization, which was typically 24 hours. Prophylactic oral antibiotics, typically cephalexin, were continued for 7 days after discharge from hospital. The AUS remained deactivated for 6 weeks postoperatively.

Comparisons between the baseline characteristics of the 2 study cohorts, 5-day chlorhexidine scrub and normal hygiene, were done with the Wilcoxon rank sum test (for continuous variables) and the Fisher exact test (for binary categorical variables). Univariate logistic regression models were then created to predict positive bacterial cultures for both times at each anatomical site. Multivariate logistic regression models were constructed using a combined forward and backward stepwise variable selection procedure using the Akaike information criterion F test for comparing nested models. Interaction terms between the treatment group and preoperative culture status were included for both postoperative models because of the potential indirect impact of the chlorhexidine scrub on preoperative culture results. Confidence intervals (95% CI) for all ORs were calculated based on profile likelihoods. Statistical analyses were performed with R 2.3.1 for Windows with the MASS package installed, and all p values were 2-sided and considered significant if 0.05 or less.

RESULTS

The prostate cancer therapies contributing to urinary incontinence were radical retropubic prostatectomy (90), external beam radiotherapy (27) and brachytherapy (3). Demographic information for the study cohorts is summarized in table 1. No significant differences were noted between the 2 groups with regard to any of the potential risk factors for infection that were identified.

A total of 100 controls were obtained with 2% (2 of 100) positive results, 1 in each treatment group. Growth was observed from broth in only 1 culture. Both cultures grew low levels of Staphylococcus epidermidis, and are believed to represent contamination during specimen collection and processing. Preoperatively no dermatitis was noted in either group, suggesting that chlorhexidine scrub did not produce significant skin irritation or breakdown. Despite standardized 2-step povidone-iodine skin disinfection, 140 of the 400 (35%) preoperative and postoperative cultures were positive. Although the majority of these cultures were positive for a single bacteria, 5 cultures had 2 isolates and 1 culture had 3 isolates. As shown in table 2, S. epidermidis grew in 124 of 400 (31%) cultures and was the most common bacterial

TABLE 1. *Comparison of baseline group characteristics*

	Normal Hygiene	5-Day Chlorhexidine Scrub	p Value
Median pt age (IQR)	73.2 (69.4–78.6)	74.1 (69.4–79.2)	0.833*
Median BMI (IQR)	27.5 (24.8–31.2)	28.2 (24.7–30.8)	0.980*
Median operative hrs (IQR)	1.02 (0.86–1.32)	1.00 (0.87–1.15)	0.285*
No. diabetes (%)	9 (18)	8 (16)	1.000†
No. prior urethral surgery (%)	23 (46)	13 (26)	0.060†
No. androgen deprivation (%)	8 (16)	7 (14)	1.000†
No. bladder neck contracture (%)	10 (20)	9 (18)	1.000†
No. radical prostatectomy (%)	46 (92)	44 (88)	0.741†
No. brachytherapy (%)	3 (6)	0 (0)	0.242†
No. external beam radiation (%)	13 (26)	14 (28)	1.000†

* Wilcoxon rank sum test.
† Fisher exact test.