Are postoperative antibiotics necessary after artificial urinary sphincter insertion?

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Introduction: *We sought to explore whether patients discharged without antibiotics after artificial urinary sphincter (AUS) insertion were more likely to require device explantation for infection or erosion compared to patients discharged with antibiotics at our institution and compared to patients in other large, contemporary series.*

Materials and methods: *AUS insertions performed at our institution between 2013 and 2017 were retrospectively reviewed to determine demographics, comorbidities, and perioperative and medium-term outcomes. Patients were grouped based on 1) known risk factors for infectious complications or erosion and 2) postoperative antibiotic prescription status. Patients were placed in Group 1 if they did not demonstrate risk factors and did not receive postoperative antibiotics, Group 2 if they did possess risk factors but did not receive postoperative antibiotics, and Group 3 if they had risk factors and received postoperative antibiotics.*

Results: *Of the 155 men who met inclusion criteria, 44, 47, and 64 were categorized in Groups 1, 2, and 3, respectively. Median (IQR) follow up was similar across Groups 1, 2, and 3 (12.7 [4.6-25.1] versus 10.7 [4.5-31.3] versus 8.3 [4.4-26.4] months, p = 0.808). Rates of explantation due to device infection (0 versus 2 versus 6%, p = 0.172) or cuff erosion (2 versus 2 versus 8%, p = 0.253) did not vary significantly between Groups 1-3.*

Conclusions: *Patients undergoing AUS insertion may be unlikely to benefit from the routine administration of postoperative antibiotics. In light of the known consequences of antibiotic overuse, a randomized controlled trial is warranted.*

Key Words: genitourinary sphincter, artificial, urinary stress incontinence, antibiotics, prosthesis related infection

Introduction

The majority of men undergoing artificial urinary sphincter (AUS) insertion in the United States are discharged with a course of oral antibiotics with the goal of reducing the risk of device infection.[1] Literature available to guide this practice is limited to prevention studies in non-urologic prosthetic surgery, which generally have not found any benefit attributable to postoperative antibiotics.[2] Multiple consensus statements, including the AUA Best Practice Statement on antimicrobial prophylaxis, suggest that antibiotic prophylaxis beyond 24 hours is unnecessary in non-infected patients undergoing prosthetic implantation.[3,4] Routine postoperative antibiotic administration may entail an unfavorable risk/benefit ratio in the context of collateral damage, adverse events, and increasing rates of worldwide antibiotic resistance.[5-7] In an effort to optimize antibiotic stewardship at our institution, postoperative antibiotics after AUS insertion are withheld for patients deemed to be at low risk for infection. The present study aims to explore whether patients discharged without antibiotics after AUS insertion were more likely to require device explantation for infection or erosion compared to patients discharged with antibiotics at our institution and compared to patients in other large, contemporary series.

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Materials and methods

Patients undergoing AUS insertion between June 2013 and November 2017 were identified by CPT code 53445 and their electronic medical records reviewed for demographics, medical and surgical history, postoperative antibiotic prescription status, and outcomes as of last follow up. Risk factors for AUS explantation due to infection or erosion were defined as a history of diabetes,[8] prostate radiation,[9-11] prior AUS explant,[10,12] chronic steroid use,[13] 3.5 cm cuff size,[9] the presence of a penile prosthesis at time of AUS insertion,[14] prior urethral stent placement,[9] and prior urethroplasty.[10] An 'other' category captured suspected risk factors such as prior pelvic trauma that have not been critically evaluated in the literature. Patients were grouped based on known risk factors for infectious complications or erosion and postoperative antibiotic prescription status. Group 1 consisted of men with no risk factors for infection who did not receive postoperative antibiotics, Group 2 of men with risk factors who did not receive postoperative antibiotics, and Group 3 of men with risk factors who received postoperative antibiotics. Statistical analysis was performed with STATA (StataCorp. 2017. Stata Statistical Software: Release 15. College Station, TX, USA: StataCorp LLC). Groups were compared using one-way ANOVA, Kruskal-Wallis, or Student's t-tests with unequal variance for continuous variables and with Pearson Chi-squared tests for categorical variables.

Results

Of the 155 subjects identified by CPT code 53445, eight were excluded because they had no identifiable risk factors for infectious complications but did receive postoperative antibiotics. Forty-four, 47, and 64 men met the inclusion criteria for Groups 1, 2, and 3, respectively. Each procedure was performed via perineal cuff placement by one of two reconstructive surgeons. Single, weight-based doses of vancomycin and gentamicin were administered preoperatively in 138 (89%) patients; broad spectrum coverage was achieved with alternative regimens in 17 (11%) patients secondary to known allergies. No drains were placed intraoperatively. All patients received the AMS 800 Urinary Control System implant with rifampin/minocylcine coating (Boston Scientific, Marlborough, MA, USA). The postoperative antibiotics most frequently prescribed to patients in Group 3 were amoxicillin/clavulanate (38, 60%) and trimethoprim/sulfamethoxazole (TMP-SMX) (11, 18%). Antibiotic selection was determined by physician preference, local antibiogram, and patient allergies. Antibiotic prescriptions averaged 6.7 ± 1.6 days.

Demographic data for Groups 1, 2, and 3 differed with regards to body mass index (BMI) (27.4 ± 5.5 versus 29.1 ± 5.1 versus 29.9 ± 4.6, $p = 0.036$) and active smoking status (0 versus 21 versus 3 %, $p < 0.001$), Table 1. Patients in Group 3 were more likely than those in Group 2 to have a history of prostate radiation (32 versus 63 %, $p = 0.001$) or prior AUS explant (4 versus 22 %, $p = 0.009$), Table 2. 'Other' risk factors included a history of pelvic fracture (2), use of maintenance chemotherapy for multiple myeloma (1), and prior rectourethral fistula (1), Table 2. Of the 16 men with a history of prior AUS explant, reason for explant included urethral erosion (12), infection (3), and unspecified (1). Overall, 8 (3%) devices were explanted due to infection and 12 (5%) due to cuff erosion. When comparing outcomes among Groups 1-3, no significant differences were observed with regards to rates of device explantation due to infection (0 versus 2 versus 6 %, $p = 0.172$), cuff erosion (2 versus 2 versus 8 %, $p = 0.253$), or for any cause (9 versus 6 versus 19 %, $p = 0.109$). Analysis of Groups 2 versus 3 similarly did not identify any differences in the rates of device explantation for infection, erosion, or any cause: (2 versus 6 %, $p = 0.301$), (2 versus 8 %, $p = 0.191$), and (6 versus 19 %, $p = 0.060$), respectively.

Discussion

Device infection and erosion require explantation and can be devastating complications for patients dependent on an AUS for continence. In practice, infection and erosion leading to explantation are difficult to separate because either one may lead to the other.[15] For this reason, we grouped risk factors for these complications together. Risk factors for AUS explantation due to erosion or infection include histories of diabetes,[8] prostate radiation,[9-11] prior AUS explant,[10,12] chronic steroid use,[13] 3.5 cm cuff size,[9] the presence of a penile prosthesis at time of AUS insertion,[14] prior urethral stent placement,[9] and prior urethroplasty.[10] Principles of infection prevention include preoperative urine culture with treatment if indicated, adherence to strict sterile technique during device preparation and insertion, preoperative intravenous antibiotics, and a thorough antibacterial skin prep.[3,16]

A rifampin and minocycline antibiotic coating (Inhibizone; Boston Scientific, Marlborough, MA, USA) has been available for AMS 800 cuffs and pumps since 2008.[17] While decidedly effective in the context of penile prosthesis insertion,[18] the effect of Inhibizone coating on infection rates after AUS insertion is less

TABLE 1. **Patient demographics**

Group	Group 1 LR, Abx (-) (n = 44)	Group 2 HR, Abx (-) (n = 47)	Group 3 HR, Abx (+) (n = 64)	p value	p value Group 2 vs. 3 only
Risk factors for infection, mean ± STD	0 ± 0	1.2 ± 0.8	1.7 ± 0.8	< 0.001	0.002
Discharged with antibiotics, count (%)	0 (0)	0 (0)	64 (100)	< 0.001	< 0.001
Age (years), mean ± SD	69.8 ± 7.7	69.0 ± 7.7	70.6 ± 9.6	0.638	0.347
BMI (kg/m^2), mean ± SD	27.4 ± 5.5	29.1 ± 5.1	29.9 ± 4.6	0.036	0.365
ASA score, mean ± SD	2.8 ± 0.5	2.8 ± 0.4	2.9 ± 0.4	0.426	0.356
History of HTN, count (%)	28 (64)	35 (74)	48 (75)	0.382	0.949
Anticoagulation other than ASA 81 mg, count (%)	8 (18)	8 (17)	11 (17)	0.987	0.982
Preoperative narcotic use, count (%)	4 (9)	8 (17)	12 (19)	0.371	0.815
History of prostatectomy, count (%)	41 (93)	39 (83)	50 (78)	0.110	0.526
Concomitant IPP insertion, count (%)	1 (2)	2 (4)	2 (3)	0.865	0.752
History of bladder neck contracture, count (%)	6 (14)	13 (28)	17 (27)	0.203	0.898
History of urethral stricture disease, count (%)	3 (7)	10 (21)	14 (22)	0.090	0.940
History of DVIU, count (%)	1 (2)	0 (0)	3 (5)	0.302	0.132
Current smoker, count (%)	0 (0)	10 (21)	2 (3)	< 0.001	0.002
Former smoker, count (%)	18 (41)	20 (43)	32 (50)	0.590	0.437

LR = low risk: no history of risk factors for infection or erosion; HR = higher risk: history of ≥ 1 risk factors for infection or erosion; Abx (-) = no postoperative antibiotics prescribed; Abx (+) = postoperative antibiotics prescribed

clear.[17,19] Contemporary series of patients receiving devices with or without the antibiotic coating have reported rates of 3.3-8.5% for device removal due to infection, with no significant differences between groups.[17] Nonetheless, it has been and remains our practice to use Inhibizone-coated cuffs and pumps for all AUS insertions.

Evidence to support the routine administration of postoperative antibiotics after AUS insertion is lacking. A report from the 2015 International Continence Society Consensus on the artificial urinary sphincter states that no evidence exists to support the standard administration of postoperative antibiotics.[20] Two papers from the AUA also highlight the lack of evidence supporting antibiosis beyond 24 hours - the Best Practice Statement on Urologic Procedures and Antibiotic Prophylaxis (2019) and a White Paper on optimizing postoperative outcomes (2018).[21,22] The European Association of Urology (EAU) similarly makes no recommendation for postoperative antibiotic use.[23] No studies to our knowledge have supported the use of more than 24 hours of perioperative prophylactic antibiotics after AUS insertion.

One study to date has addressed use of postoperative antibiotics after AUS insertion. Using the MarketScan claims database and controlling for patient comorbidities and prior device history, Adamsky et al found no correlation between postoperative antibiotic administration and a decreased risk of device explantation within 90 days of surgery.[1] They did observe a trend of decreasing rates of postoperative antibiotic administration over the 11 year study period (75.9% in 2003 versus 56.0% in 2014, p < 0.01). Potential explanations for this finding include the AUA

TABLE 2. **Risk factors for infection and/or erosion**

Group	Group 1 LR, Abx (-) (n = 44)	Group 2 HR, Abx (-) (n = 47)	Group 3 HR, Abx (+) (n = 64)	p value	p value Group 2 vs. 3 only
History of diabetes, count (%)	0 (0)	25 (53)	26 (41)	< 0.001	0.189
History of prostate radiation, count (%)	0 (0)	15 (32)	40 (63)	< 0.001	0.001
History of prior AUS, count (%)	0 (0)	2 (4)	14 (22)	< 0.001	0.009
Chronic steroid use, count (%)	0 (0)	3 (6)	3 (5)	0.261	0.696
Cuff size 3.5 cm, count (%)	0 (0)	2 (4)	2 (3)	0.414	0.752
IPP in place at time of AUS insertion, count (%)	0 (0)	3 (6)	8 (13)	0.044	0.287
History of urolume urethral stent, count (%)	0 (0)	5 (11)	7 (11)	0.076	0.960
History of urethroplasty, count (%)	0 (0)	1 (2)	3 (5)	0.311	0.475
History of 'other' risk factor, count (%)	0 (0)	0 (0)	4 (6)	0.054	0.081

Best Practice Statement on antimicrobial prophylaxis mentioned above and the broader attention given to antibiotic stewardship over the past two decades.[3,24]

In the present study there were 0 explantations due to infection and 1 due to erosion among 44 low risk patients discharged without antibiotics and followed for a median (IQR) of 12.7 (4.6-25.1) months. Among 47 patients with risk factors who were discharged without antibiotics, 1 required explanation for infection and 1 for erosion through median (IQR) follow up of 10.7 (4.5-31.3) months. Among the highest risk cohort, who did receive postoperative antibiotics, there were

TABLE 3. **Implant survival and complications**

Group	Group 1 LR, Abx (-) (n = 44)	Group 2 HR, Abx (-) (n = 47)	Group 3 HR, Abx (+) (n = 64)	p value	p value Group 2 vs. 3 only
Total length of follow up (months), med (IQR)	12.7 (4.6-25.1)	10.7 (4.5-31.3)	8.3 (4.4-26.4)	0.808	0.567
Device explant for any cause count (%)	4 (9)	3 (6)	12 (19)	0.109	0.060
Device explant for infection or erosion, count (%)	1 (2)	2 (4)	9 (14)	0.045	0.088
Device explant for infection, count (%)	0 (0)	1 (2)	4 (6)	0.172	0.301
Device explant for cuff erosion, count (%)	1 (2)	1 (2)	5 (8)	0.253	0.191
Device explant for mechanical failure, count (%)	3 (7)	0 (0)	1 (2)	0.098	0.389
Device explant for persistent pain, count (%)	0 (0)	0 (0)	1 (2)	0.489	0.389

4 explantations due to infection and 5 due to erosion through median (IQR) follow up of 8.3 (4.4-26.4) months. Taken together, these data suggest that the potential benefit from postoperative antibiotics after AUS insertion, particularly for patients with no or fewer risk factors for infection, is exceedingly small. While underpowered to detect small differences in absolute rates of these uncommon complications, these findings raise further questions about the value of a common, unproven, and potentially harmful practice.

Routine use of postoperative antibiotics after non-urologic prosthetic surgery has been discouraged on account of minimal supportive evidence and increasing antibiotic resistance worldwide.[7] In 2017, the Centers for Disease Control and Prevention issued a guideline on the prevention of surgical site infections that included a Category IA (strong recommendation supported by high to moderate-quality evidence suggesting net clinical benefits or harms) recommendation advising against the use of additional prophylactic antibiotics after a clean or clean-contaminated procedure with or without drain placement.[4] Many studies in the orthopedic literature have assessed the use of prophylactic antibiotics at the time of total joint replacement. A recent systematic review and meta-analysis of this literature found no benefit of perioperative antibiosis for more than 24 hours.[2]

Inappropriate antibiotic usage provokes harm to both the recipient as well as the wider population. Six to eight percent of patients exposed to TMP-SMX experience adverse events ranging from nausea to rare, life-threatening conditions such as Stevens-Johnson syndrome.[5] Ten percent of patients exposed to amoxicillin/clavulanate experience adverse events, most frequently diarrhea.[6] At the community level, higher rates of antibiotic administration in a given neighborhood were recently shown to be associated with the risk of acquiring an antibiotic-resistant urinary tract infection, regardless of personal antibiotic consumption.[25] With around 3500 AUS insertions per year performed in the United States, the overuse of antibiotics has the potential to cause significant harm.[26]

The present study is limited by its retrospective design, relatively small sample size, and selection bias without a standardized protocol for determining which patients received postoperative antibiotics. It is possible that some infectious complications were not captured. Adherence to antibiotic prescriptions was not tracked. The risk profile of patients treated at a tertiary referral center may differ significantly from those treated at community centers.

Importantly, the groups analyzed had substantial differences in terms of their comorbidities and infection risk profiles. Among the patients with risk factors for infectious complications (Groups 2 and 3), those who received antibiotics were significantly more likely to have histories of prostate radiation and/or prior AUS explant. This limits direct comparison between Groups 2 and 3 and limits the strength of conclusions that can be drawn about postoperative antibiotics for patients with risk factors for infection or erosion. We cannot rule out the possibility that additional patients in Group 3 might have experienced infection or erosion had they not received postoperative antibiotics. These challenges are likely to limit any similar retrospective study and further support the need for a randomized controlled trial.

Finally, follow up was somewhat limited. Most device infections occur within the first few months of insertion. Our practice is to have patients follow up as needed after their post-activation visit, which takes place around 4.5 months postoperatively. We would therefore expect that we would have been made aware of the great majority of complications arising in this cohort. Indeed, a recent study of nearly 4000 patients undergoing AUS insertion found a median time to explant of 41 days.[1] Patients in our study were a minimum of 8 months out from device insertion at the time of data collection.

Conclusions

In our experience, withholding postoperative antibiotics after AUS insertion does not appear to increase the risk of device explantation. In light of the known consequences of antibiotic overuse, a randomized controlled trial is warranted. □

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