Original Article

Positive preoperative cultures but not bacterial species predict postoperative urine culture results after holmium laser enucleation of the prostate

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Abstract

Purpose: The purpose of this study was to evaluate risk factors associated with positive urine cultures following holmium laser enucleation of the prostate (HoLEP).

Materials and Methods: The data from a prospectively maintained database were analyzed to evaluate urine culture results following HoLEP and determine the contribution of predefined variables (age, prostate size, Charlson comorbidity score, surgical time [surrogate for case difficulty], the presence of a catheter preoperatively, postoperative urinary retention, and preoperative positive culture) on urine culture positivity at 60 days postoperatively. Statistical analyses included logistic regression and ANOVA.

Results: The data from 136 subjects were included in the database and were evaluated at a median of 13.37 ± 6.72 months after their HoLEP. Postoperative positive cultures were noted in 23 subjects (16.91%). Preoperative positive cultures were found to predict positive postoperative urine cultures (odds ratio: 3.78, confidence interval: 1.18–12.78, $P = 0.03$). However, the preoperative and postoperative results were discordant in 9 of 14 subjects with both positive preoperative and postoperative cultures.

Conclusions: Positive preoperative cultures were predictive of positive postoperative cultures. However, the pre- and postoperative results were often discordant. Host factors increasing susceptibility to bacteriuria may explain these findings.

Keywords: Antibiotic stewardship, bacteriuria, benign prostatic hyperplasia, perioperative antibiotic prophylaxis, urinary tract infection

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INTRODUCTION

Holmium laser enucleation of the prostate (HoLEP) has become a well-accepted treatment modality for benign prostate hyperplasia (BPH).[1] It is safe and effective even for large prostate glands (>80 mL), which were traditionally treated with open simple prostatectomy.[1] Recent meta-analyses found HoLEP superior to the gold standard, transurethral resection of the prostate (TURP), in terms of hemoglobin loss, bladder irrigation, catheterization time, hospital stay, and blood transfusion while having comparable complication rates.[1,2]

The impact of bacterial colonization on postoperative urinary tract infections (UTIs) in BPH is not well-established.

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Studies have shown that the rate of postoperative UTIs is similar between HoLEP and TURP, reported at 1%–6% and 0%–7%, respectively, though the criteria for diagnosis are not well-established.[3,4] If patients develop preoperative signs and symptoms of a UTI, the standard of care is a urine culture and accurate treatment before surgery.[5] Furthermore, for BPH surgery, it is recommended to give a single dose of preoperative antibiotic prophylaxis based on the patient's infection history, risk factors, allergies, and local antibiograms.[5] However, many patients in this population experience bacterial colonization, and the management of positive urine cultures in this population warrants further investigation. Maintaining a delicate balance between preventing UTIs and minimizing unnecessary utilization of antibiotics is crucial due to the growing problem of antibiotic resistance.[6] Antibiotic stewardship is critical in maintaining the ability to effectively prevent and treat infections and improve patient outcomes after surgery.

The aim of this study was to determine the prevalence of positive pre- and postoperative urine cultures and identify the factors that predict positive postoperative urine cultures following HoLEP for BPH. An understanding of the urine culture results associated with HoLEP could promote responsible antibiotic use by reducing the prescription of unnecessary antibiotics in cases of asymptomatic bacteriuria and identifying patients at risk for UTIs.

MATERIALS AND METHODS

Ethics statement

Institutional review board (IRB) approval was obtained before the study commencement. Informed consent was obtained from all subjects whose data were collected prospectively. Consent was waived by the IRB for retrospective review of past patients.

Database and population

Subjects included in this database are those who underwent a HoLEP at the University of Rochester Medical Center between November 2020 and November 2022. Inclusion criteria included any individuals undergoing HoLEP in the designated timeframe with culture data from 60 days postoperatively. Exclusion criteria for this study were any individual who did not undergo a HoLEP or individuals who were lost to follow-up at 60 days postoperatively. All individuals undergoing HoLEP between November 2020 and January 2022 were identified and included retrospectively. Individuals undergoing a HoLEP between February 2022 and November 2022 were prospectively recruited and consented before inclusion in the database, and their data were collected prospectively.

Definition of variables

Demographics such as age, Charlson comorbidity index score, and whether patients were managed with a catheter for urinary retention preoperatively were obtained from the database. Prostate sizes, determined through ultrasound or cross-sectional imaging, were also obtained from the database. Procedure time was defined as the time from incision to insertion of the catheter at the end of the case. Postoperative urinary retention was defined as subjects failing at least one postoperative void trial after their surgery.

Holmium laser enucleation of the prostate procedure

HoLEPs were performed in a hospital setting by two fellowship-trained endourologists. Prostates were enucleated using a Boston Scientific MOSES holmium laser and morcellated with the Wolf Piranha morcellator. HoLEP protocol included for observation one night and catheter removal before discharge if the patient was able to void and there were no significant injuries to the urethra, bladder, or prostatic fossa.

Urine cultures and antibiotic therapy

Before undergoing HoLEP, subjects underwent a preoperative urine culture within approximately 2 weeks of their procedure. Antibiotics were prescribed based on the findings of these cultures with the goal of achieving sterile urine. All subjects received intraoperative antibiotic prophylaxis according to American Urological Association best practices.[5] Following HoLEP, the collection of urine cultures and antibiotics was at the discretion of the subjects' treating clinicians, but routine cultures were not performed.

Definition of positive culture

Preoperative urine cultures were considered positive if subjects had any bacteria requiring preoperative antibiotic therapy as determined by their treatment team within 30 days of their surgery. Postoperative cultures were considered positive if they grew any number of colony-forming units (CFUs) of pathogenic bacteria within 60 days of HoLEP. The 60-day time point was chosen to capture cultures collected at subjects' follow-up clinic visits.

Statistical analysis

Analysis was performed on January 30, 2023. Descriptive statistics was reported as median ± standard deviation. Logistic regression and ANOVA were performed in R (version 4.0.1) to evaluate the impact of predefined variables, including age, prostate size, Charlson comorbidity score, surgical time (surrogate for case difficulty), the presence of a catheter preoperatively, postoperative urinary retention, and preoperative positive culture, on 60-day postoperative positive culture risk. The results are shown

as odds ratio and 95% confidence interval. Statistical significance was defined as $P \leq 0.05$.

RESULTS

Subject characteristics

During the study period, 136 subjects were included in the database and were evaluated at a median of 13.37 ± 6.72 months after their HoLEP. All subjects had at least 60 days of follow-up. The median age was 70.00 ± 7.22 years, and the median Charlson score was 3 ± 1.85 with a range of 1–11. The median prostate size was 101 ± 37.33 cc. The median procedure time was 120 ± 47.42 min. Sixty-eight subjects required a catheter for urinary retention preoperatively and 11 subjects failed their postoperative void trial.

Urine culture results

Postoperative cultures were collected at a median of 24 ± 15.62 days postoperatively. Preoperative urine cultures were positive in 35/136 subjects (25.74%) and postoperative cultures were positive in 23/136 (16.91%). Of the variables explored, only the presence of a preoperative positive culture was found to predict positive postoperative urine cultures [Table 1]. Interestingly, the pre- and postoperative results were often discordant. Of the subjects with positive postoperative cultures, 11/23 (47.82%) also had positive preoperative cultures. Thus, there were 12 subjects with only positive cultures postoperatively and 24 with only positive cultures preoperatively. Furthermore, of subjects that had both pre- and postoperative positive cultures, 4 grew the same bacteria, whereas 7 demonstrated discordance [Table 2]. A majority of subjects with positive cultures were managed with outpatient antibiotic therapy, although 1 subject required hospitalization for antibiotic therapy due to a febrile UTI.

DISCUSSION

This study demonstrates that the population undergoing HoLEPs is susceptible to bacteriuria, with high rates of positive urine cultures both pre- and postoperatively. Positive preoperative urine culture positivity was the only factor evaluated and found to increase positive postoperative urine culture rates. Despite the predictivity of positive preoperative cultures on positive postoperative cultures, bacteria were frequently discordant. This finding likely indicates that host factors increasing susceptibility to bacterial colonization drive urinary bacteria postoperatively but do not favor any specific bacteria.

A broad definition of positive cultures to include any colony count of an established uropathogen was used to fully capture clinical scenarios, in which patients would likely receive antibiotics.[7] Furthermore, the 60-day cutoff for postoperative positive cultures was used to capture subjects' follow-up visits, which often occurred after a strict 30-day timeframe. Other studies have used a stricter definition to define clinically significant postoperative urine cultures, such as those that occur within 30 days or those with >100,000 CFU of a known uropathogen.[7] However, positive cultures within the perioperative follow-up period are likely to be clinically relevant and prompt treatment by the urologic team, even at lower colony counts.[7]

Others have evaluated risk factors for postoperative infectious complications. Kyono *et al*. demonstrated that a positive preoperative culture in the setting of a preoperative catheter was a risk factor for the development of a febrile UTI following HoLEP.[8] In the current study, the requirement for catheterization, either pre- or postoperatively, did not impact the likelihood of postoperative culture. However, the febrile UTI rate in this study was low, with only 1 of 136 subjects (0.74%) developing a febrile UTI requiring hospitalization. These disparate findings may represent differences in the populations included in these two studies.

Strengths of this study include the robust multivariable analysis. Weaknesses include the retrospective nature of the study and the small sample size. Despite these limitations, this study adds to our understanding of urinary tract colonization in the setting of BPH and following HoLEP surgery. Future studies should seek to establish factors impacting postoperative urinary bacterial growth and

Table 1: Results of Univariable and Multivariable Analysis for Predictors of Post-Operative Bacteriuria following HoLEP

Characteristics	Univariable			Multivariable		
	OR	95% CI	*P*	OR	95% CI	*P*
Age	0.98	0.91–1.06	0.62	1.00	0.89–1.12	0.99
Prostate size	1.00	0.98–1.02	0.97	1.00	0.97–1.02	0.81
Charlson score	0.90	0.59–1.31	0.61	0.87	0.47–1.50	0.62
Urinary retention	3.12	0.55–15.89	0.17	4.61	0.70–29.89	0.10
Positive preoperative culture	3.91	1.26–13.21	0.02*	4.38	1.26–17.04	0.02*
Preoperative catheter	0.83	0.27–2.48	0.74	Excluded due to interaction with positive preoperative culture		

OR: Odds ratio, CI: Confidence interval. *Indicates $P < 0.05$

Table 2: Urine Culture Results for Subjects Undergoing HoLEP

Parameter	Discordant (*n*=11)	Concordant (*n*=3)
Preoperative culture	*E. faecalis* (*n*=2) *S. epidermidis* (*n*=1) *P. aeruginosa* (*n*=1) *K. pneumoniae* (*n*=1) Negative (*n*=7)	*E. coli* (*n*=3)
Preoperative antibiotics	Trimethoprim–sulfamethoxazole (*n*=2) Ciprofloxacin (*n*=1) Nitrofurantoin (*n*=1) No antibiotic (*n*=8)	Trimethoprim–sulfamethoxazole (*n*=1) Cephalexin (*n*=2)
Postoperative culture	*C. parapsilosis* (*n*=1) *E. faecalis* (*n*=1) *E. coli* (*n*=3) *K. aerogenes* (*n*=1) *K. oxytoca* (*n*=2) *K. pneumoniae* *P. aeruginosa* (*n*=1) *S. aureus* (*n*=1) *S. epidermidis* (*n*=1) *S. mitis* (*n*=1) *P. mirabilis* (*n*=1) Sepsis with positive urinalysis but negative culture (*n*=1)	*E. coli* (*n*=3)
UTI treatment	Ampicillin (*n*=1) Cefpodoxime (*n*=2) Ceftriaxone (*n*=1) Cephalexin (*n*=4) Fosfomycin (*n*=1) Fluconazole (*n*=1) Nitrofurantoin (*n*=1) Piperacillin–tazobactam (*n*=1) Trimethoprim–sulfamethoxazole (*n*=2)	Cephalexin (*n*=2) Linezolid (*n*=1)
Hospitalization required	*n*=2	*n*=0

E. faecalis: *Enterococcus faecalis, S. epidermidis*: *Staphylococcus epidermidis, P. aeruginosa*: *Pseudomonas aeruginosa, K. pneumoniae*: *Klebsiella pneumoniae, E. coli*: *Escherichia coli, C. parapsilosis*: *Candida parapsilosis, K. aerogenes*: *Klebsiella aerogenes, K. oxytoca*: *Klebsiella oxytoca, S. aureus*: *Staphylococcus aureus, S. mitis*: *Streptococcus mitis, P. mirabilis*: *Proteus mirabilis,* UTI: Urinary tract infection

explore strategies that reduce UTI and clinically significant positive urine cultures in this population while reducing antibiotic utilization.

CONCLUSION

Positive urine cultures occur frequently in BPH patients both before and after undergoing HoLEP. In this study, the presence of a positive preoperative urine culture was associated with an increased risk of postoperative urine culture positivity, yet these cultures often showed discordance. Thus, host factors may play a significant role in bacterial colonization, which may be modifiable. Further evaluation of factors contributing to bacterial colonization may yield strategies for preventing clinically significant postoperative infections in patients undergoing HoLEP.

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Conflicts of interest

There are no conflicts of interest.

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