Original Article

Association between the levels of postoperative pyuria and urinary tract infection in patients undergoing Transurethral Anatomical Enucleation of Prostate (TUAEP) in Rajavithi Hospital

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Keywords:
Prostatic hyperplasia, Transurethral Anatomical Enucleation of Prostate, TUAEP, postoperative bacteriuria, postoperative pyuria

Abstract

Objective: Pyuria is a common condition that can occur after TUAEP. One possible cause is postoperative inflammation. To limit this many physicians prescribe antibiotic prophylaxis to prevent postoperative urinary tract infections, however this can lead to the overuse of antibiotics and increase the growing problem of antibiotic resistance. Therefore the object of this study is to evaluate the association between the level of postoperative pyuria and urinary tract infections in patients undergoing TUAEP and to identify other risk factors associated with postoperative urinary tract infection facilitating appropriate antibiotic management.

Materials and Methods: Data from 94 patients who underwent TUAEP in Rajavithi Hospital from 1st December 2016 to 31st March 2021 were retrospectively analyzed. The data collected from medical records included demographic data, details from operative record sheets and laboratory results.

Results: A significant association was found between a level of postoperative pyuria >100 WBCs/HPF and postoperative bacteriuria (46.15% vs 19.35%, p = 0.024). Diabetes mellitus and preoperative bacteriuria were also significant risk factors for postoperative bacteriuria. The bacterium which was the most frequently cultured from samples taken both preoperatively and postoperatively was *Escherichia coli*.

Conclusion: The risk factors for postoperative bacteriuria in patients undergoing TUAEP are a level of postoperative pyuria > 100/HPF, diabetes mellitus and preoperative bacteriuria. It may be concluded from the results that the most frequent cause of postoperative pyuria was more likely to be due to a tissue reaction after surgery than from a urinary tract infection. Selective antibiotic treatment in patients who have these risk factors can reduce problems of antibiotic overuse and antibiotic resistance.

Insight Urol 2023;44(1):1-6. doi: 10.52786/isu.a.65

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Manuscript received: April 12, 2022
Revision received: October 20, 2022
Accepted after revision: February 10, 2023

Introduction

The gold standard surgical treatment for patients with benign prostatic hyperplasia is transurethral resection of prostate (TURP) because of its excellent record of long-term efficacy.[1] However, it has some limitations, especially when prostate size is over 80 ml,[2] for example bleeding and TURP syndrome especially in the monopolar type.[3] Transurethral Anatomical Enucleation of Prostate (TUAEP)[4-6] is a technique which was developed from Transurethral Enucleation and resection of prostate (TUERP) by using a bipolar system for enucleation of the prostatic gland and using a morcellator to remove all lobes of the prostate gland floating in the urinary bladder. From the first pilot study in Thailand6, which was conducted in Rajavithi Hospital, it was shown that TUAEP was more advantageous with regard to reduction of bleeding and TURP syndrome when compared with M-TURP and more obstructing adenomas were removed in comparison to Bipolar-TURP (B-TURP). Thus, TUAEP has been established as an alternative to TURP especially when patients have a particularly enlarged prostate gland.[7,8]

Postoperative pyuria is commonly found after TUAEP. Its cause may be due to a tissue reaction after bipolar therapy rather than as a result of urinary tract infection.[9,10] The potential problem is that many physicians prescribe antibiotic prophylaxis when a urine culture has not been carried out to prevent postoperative urinary tract infections which can lead to the overuse of antibiotics and antibiotic resistance.[11,12] The aim of this study is to evaluate the association between the level of postoperative pyuria and urinary tract infections in patients undergoing TUAEP and also to identify other risk factors associated with postoperative urinary tract infections to inform appropriate antibiotic management and to investigate the most common bacterial strains found in preoperative and postoperative bacteriuria in patients undergoing TUAEP in Rajavithi Hospital.

Materials and Methods

Data from all 94 patients who underwent TUAEP in Rajavithi Hospital from 1st December 2016 to 31st March 2021 were retrospectively analyzed. The data were collected from medical records and included age, underlying diseases, medication, retention of the Foley catheter, preoperative and postoperative urine analysis and urine culture, PSA, operation time, weight of resected tissue, estimated blood loss, and tissue pathology. This research was approved by the Ethics Committee of Rajavithi Hospital (Study Number: 64120). Only 57 patients met the inclusion criteria, the other 37 patients being excluded due to the exclusion criteria, specifically, patients who were lost to follow-up including death, transfered back to another institution, no postoperative urine culture to confirm postoperative bacteriuria (> 105 CFU/ml)[13] and no postoperative pyuria (WBC > 5 cells/HPF).[14] Patient selection is shown in Figure 1.

The authors recorded and analyzed all data including age, underlying disease (diabetes mellitus), medication (5-ARIs), preoperative indwelling Foley catheter, PSA, length of operation, weight of resected tissue, estimated blood loss, tissue pathology, preoperative and postoperative urine analysis and urine culture. Data collection was followed up at 1, 2, 3, 6, and 12 months.

Data were analyzed using SPSS version 26.0 (SPSS Inc., Chicago, Illinois, USA). Baseline characteristics were analyzed using descriptive statistics, specifically number, percentage, mean and standard deviation, median, minimum and maximum. Chi-square or Fisher's Exact test were used to compare the categorical variables and frequency differences. The continuous data were analyzed using a student's T-test. A p-value of less than 0.05 was considered statistically significant.

Results

Patients were divided into postoperative urine culture positive and postoperative urine culture negative groups and these were compared against patient characteristics. The results are shown in Table 1. There were no significant differences in mean age (73.38±6.97 vs 70.06±7.94 years, p = 0.102), PSA median min-max (3.84 (1.83-43.52) vs 4.05 (0.97-21.1) ng/ml, p = 0.368), number of patients with preoperative retention of the Foley catheter (12 (46.15%) vs 7 (22.58%), p = 0.060), mean operative time (160.46±52.85 vs 141.84±40.81 minutes, p = 0.139), mean weight of resected tissue (43.09±22.29 vs 35.06±20.77 g, p = 0.165), mean estimated blood loss (310.38±49.27 vs 244.19±25.39 ml, p = 0.216) and number of patients with malignant pathology (2 (7.69%) vs 1 (3.23%), p = 0.587)

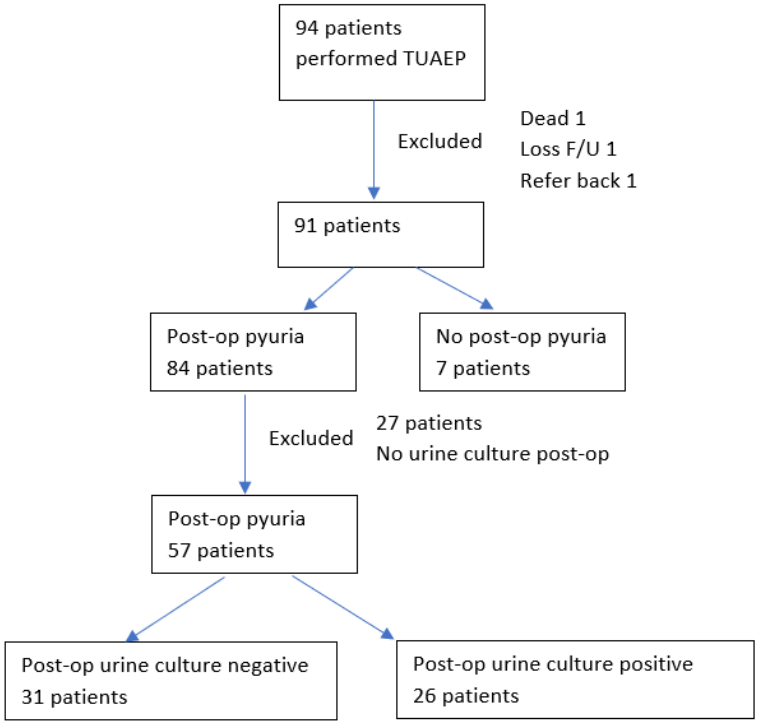

Figure 1. Study flow diagram showing the patient selection process

Table 1. Demographic data

Characteristic	Postoperative urine culture positive (n=26)	Postoperative urine culture negative (n=31)	P-value
Age (Mean±SD) (years) n (SD)	73.38±6.97	70.06±7.94	0.102
Diabetes mellitus n (%)	16 (61.54)	8 (25.81)	0.006
Preoperative bacteriuria n (%)	12 (46.15)	5 (16.13)	0.014
PSA median (min-max)	3.84 (1.83-43.52)	4.05 (0.97-21.1)	0.368
On 5-ARIs n (%)	5 (19.23)	14 (45.16)	0.039
On Foley catheter n (%)	12 (46.15)	7 (22.58)	0.060
Operation time (minutes) n (SD)	160.46±52.85	141.84±40.81	0.139
Weight of resected tissue (g) n (SD)	43.09±22.29	35.06±20.77	0.165
Estimated blood loss (ml) n (SD)	310.38±49.27	244.19±25.39	0.216
Malignant pathology n (%)	2 (7.69)	1 (3.23)	0.587

Significant p-value < 0.05

Diabetic mellitus (16 (61.54%) vs 8 (25.81%), p = 0.006) and preoperative bacteriuria (12 (46.15%) vs 5 (16.13%), p = 0.014) were the statistically significant risk factors for postoperative bacteriuria. Patients who had taken 5-ARIs preoperatively showed a statistically significant lower level of postoperative bacteriuria (5 (19.23%) vs 14 (45.16%), p = 0.039).

The correlation between the level of postoperative pyuria and bacteriuria is shown in Table 2. A significant association was found between the level of postoperative pyuria > 100 WBCs/HPF and postoperative bacteriuria compared with the group with a negative postoperative urine culture (12 (46.15%) vs 6 (19.35%), p = 0.024). The level of postoperative pyuria between 50-100 WBCs/HFP was not significantly different between the groups with a positive and negative postoperative urine culture (4 (15.38%) vs 3 (9.68%), p = 0.691). The level of postoperative pyuria < 50 WBCs/HPF was significantly lower in the group with a postoperative positive urine culture (10 (38.46%) vs 22 (70.97%), p = 0.014).

Table 2. Correlation between the level of postoperative pyuria and bacteriuria

Level of postoperative pyuria (WBC/HPF)	Postoperative urine culture positive (n=26) n (%)	Postoperative urine culture negative (n=31) n (%)	P-value
> 100	12 (46.15)	6 (19.35)	0.024
50-100	4 (15.38)	3 (9.68)	0.691
< 50	10 (38.46)	22 (70.97)	0.014

Significant p-value < 0.05

Table 3. Bacterial spectrum in patients with preoperative bacteriuria

Bacterial strains	Number of patients (n=17) n (%)
Escherichia coli	8 (47.06)
Escherichia coli ESBL	4 (23.53)
Enterococcus faecalis	3 (17.65)
Staphylococcus haemolyticus	1 (5.88)
Klebsiella pneumoniae	1 (5.88)

Table 4. Bacterial spectrum in patients with postoperative bacteriuria

Bacterial strains	Number of patients (n=26) n (%)
Escherichia coli	9 (34.62)
Enterococcus faecalis	6 (23.08)
Escherichia coli ESBL	5 (19.23)
Klebsiella pneumoniae	2 (7.69)
Klebsiella pneumoniae ESBL	1 (3.85)
Staphylococcus haemolyticus	1 (3.85)
Acinetobacter baumannii	1 (3.85)
Corynebacterium	1 (3.85)

The spectra of preoperative bacteriuria are shown in Table 3, and spectra of postoperative bacteriuria are shown in Table 4. Preoperatively, *Escherichia coli* (47.06%) was the most frequently cultured bacteria, the second was *Escherichia coli* ESBL (23.53%), and the third was Enterococcus faecalis (17.65%). Postoperatively, *Escherichia coli* was still the most frequently cultured bacteria (34.62%), whereas the second was Enterococcus faecalis (23.08%), and the third was *Escherichia coli* ESBL (19.23%).

The duration of postoperative pyuria is shown in Table 5. The most frequent duration is 2 months (23 patients, 43.86%) followed by 3 months (17, 29.82%), 1 month (7, 12.28%), 6 months (5, 8.77%), and 12 months (3, 5.26%).

Table 5. Duration of postoperative pyuria

Duration of postoperative pyuria (months)	Number of patients (n=57) n (%)
1	7 (12.28)
2	25 (43.86)
3	17 (29.82)
6	5 (8.77)
12	3 (5.26)

Discussion

Postoperative pyuria was commonly found after TUAEP,[15] including 92.31% of patients in this study, but postoperative bacteriuria was only found in 45.61% of cases. Prior to this study physicians did not wait for urine culture results and many prescribed antibiotic prophylaxis to prevent postoperative urinary tract infections. This practice can lead to the overuse of antibiotics and antibiotic resistance. The significant risk factors associated with postoperative bacteriuria (p-value < 0.05) were a level of postoperative pyuria > 100 WBCs/HPF, diabetic mellitus and preoperative bacteriuria. Selective antibiotic treatment solely in this group of patients could reduce the significant problems of overuse and antibiotic resistance.

Patients with levels of postoperative pyuria < 50 WBCs/HPF were significantly associated with the group of negative postoperative bacteriuria and antibiotic treatment can be omitted if the patients don't have any other risk factors or clinical symptoms. Postoperative pyuria with a level of 50-100 WBCs/HPF is the grey zone because

there was no difference between the two groups. Antibiotic prophylaxis may be considered in diabetic patients or patients who have preoperative bacteriuria.[16] The possibility that 5-alpha reductase inhibitors (5-ARIs) can reduce the rate of postoperative bacteriuria has been suggested. This may be due to 5- ARI treatment reducing the rate of prostatic vascularity, and decreasing perioperative bleeding. The most frequently cultured bacterium, both preoperatively and postoperatively, was *Escherichia coli*. Therefore an antibiotic that covers gram-negative bacterial strains is suggested. Postoperative pyuria was resolved in most patients within 3 months (85.96%).

One limitation to this study is that is was retrospective in nature and therefore is subject to variations in collection and surgical techniques and a second is that due to the large number of exclusions the sample size was quite small. In the future, a prospective study with a larger number of participants is warranted to verify and identify other significant risk factors and improve statistical outcomes.

Conclusion

The risk factors for postoperative bacteriuria in patients undergoing TUAEP are a level of postoperative pyuria > 100 WBCs/HPF, a comorbidity of diabetic mellitus and preoperative bacteriuria. It may be concluded from the results that the majority of causes of postoperative pyuria came from tissue reaction after surgery rather than from urinary tract infections. Selective antibiotic treatment for patients who have these specific risk factors can reduce the problems of antibiotic overuse and antibiotic resistance. Preoperative 5-ARIs may be considered as an option for reducing postoperative bacteriuria.

Conflicts of Interest

The authors declare no conflicts of interest.

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