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RESEARCH ARTICLE

Risk Factors for Urinary Tract Infection in Men Treated with Transurethral Resection of the Prostate for Lower Urinary Tract Symptoms

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Abstract

Objective: To identify predictors of urinary tract infection (UTI) in patients undergoing transurethral resection of the prostate (TURP) for lower urinary tract symptoms. We hypothesized that men with prostate enlargement and/or postvoid residual are more likely to harbour an UTI and therefore benefit from antibiotic treatment during this elective surgery.

Patients and methods: Our cohort comprised 96 consecutive patients treated with TURP for obstructive lower urinary tract symptoms associated with benign prostatic enlargement suggestive of benign prostate hyperplasia. We collected relevant data of our cohort including demographic data, comorbidities, past medical history presence of preoperative indwelling transurethral catheter and histopathology of prostate chips after resection were assessed for each patient. Patients' charts were also reviewed to ascertain the results of midstream urine samples, postvoid residual volume and estimated prostate volume. Study endpoint was the presence of UTI before undergoing surgery. Therefore, univariable logistic regression analyses were performed to assess for risk factors.

Results: Nine patients (13.6%) had a positive preoperative urine culture. The median prostate volume was 55 ml (range 20-210) and the median postvoid residual volume was 153 ml (range 40-1800). Forty-nine patients (64.5%) presented with an indwelling transurethral catheter prior to their TURP for acute urinary retention. Neither prostate, nor post voiding volume was associated with urinary tract infection (UTI) rate (p = 0.6 and p = 0.1). Only patients' age was significantly associated with the risk of developing an UTI (OR 1.1, 95% CI 1.0-1.2, p = 0.03); this was confirmed in the subgroup of patients without a catheter (OR 1.2, 95% CI 1.0-1.5, p = 0.03).

Conclusions: We rejected our hypothesis and accepted the null hypothesis that postvoid and/or prostate volume are not associated with risk of developing an UTI in patients with LUTS planned for elective TURP. Increasing patients' age was associated with the risk of developing an UTI. This finding should be validated in larger well-designed studies. Further studies are needed to define an antibiotic prophylaxis strategy for the elderly who are planned for a TURP.

Keywords

Urinary tract infection, Transurethral resection of the prostate, Risk factor, Prostate size, Postvoid residual

Introduction

Urinary tract infections (UTIs) are very common with a prevalence of 0.7% in the community-acquired setting [1]. In noninstitutionalized men older than 65 years, the estimated rate of UTI is 10.9% [2] and considered one of the most common causes of hospitalisation [3]. Several risk factors have been identified

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such as age, diabetes mellitus, previous history of UTI, obesity, genetic susceptibility and sexual activity [1,4,5].

In case of bladder outlet obstruction with incomplete voiding, residual urine is a potential medium for bacterial growth leading to UTI [6,7]. Postvoid residual (PVR) can vary greatly in the males and has been shown to be correlated to prostate volume (PV) [8,9]. Previous studies reported that the odds of postvoid residual greater than 50 ml was 2.4 times greater for men with a PV > 30 ml (OR 2.4, 95% CI 1.5-3.9). However, while some investigators failed to demonstrate an association between PVR and UTI [10], others showed an association of PVR with significant bacterial growth in the urine [11]. There were no consistent cut-off of PVR predicting increased risk for UTI [12,13].

Urine cultures are a poor indicator for prostatic parenchyma bacterial colonisation. In fact, positive prostatic cultures have been found in about one third of patients undergoing prostate surgery despite sterile preoperative urine cultures [14-16]. Several risk factors for UTI after transurethral resection of the prostate (TURP) have been identified such as patient's age ≥ 65 years, preoperative indwelling urinary catheter, bacteriuria, uncontrolled diabetes, longer operating time and need for long-term indwelling catheter after TURP [17,18]. Therefore, guidelines recommend intraoperative antibiotics to reduce the risk severe febrile infections and sepsis in these patients specifically [18-20].

We retrospectively reviewed the medical records of patients who presented for surgical relief of non-neurogenic lower urinary tract symptoms (LUTS), in order to determine risk factors for UTI before undergoing TURP. Moreover, we hypothesised that prostate enlargement and PVR were associated with the risk of harbouring an UTI while undergoing TURP.

Patients and Methods

To detect preoperative UTI, we chose to retrospectively review electronical records of patients treated with TURP or Greenlight laser vaporization of the prostate for non-neurogenic LUTS. LUTS include a range of symptoms concerning storage, voiding, and post-micturition [21]. 146 consecutive patients were admitted therefore between July 2015 and July 2016 in our Austrian academic hospital. Upfront, the institutional ethical committee approved the conduct of the study (1482/2018). Exclusion criteria were preoperative intermittent self-catherization, immunosuppressant therapy and presence of malignancy and urodynamically proven neurogenic bladder voiding dysfunction. Overall, 96 patients remained for final analysis after all exclusions. Demographic data, medications, comorbidities and presence of preoperative indwelling transurethral catheter were assessed for each patient. Serum level of prostate-specific antigen (PSA) was assessed preoperatively and body mass index (BMI) was calculated with the formula kg/m^2. In our outpatient department, preoperative urine culture was collected within seven days before surgery and postoperatively within 30 days. To assess for bacterial growth in the urine, midstream urine was collected in a sterile fashion and incubated at 37 °C for 24 hours at the laboratory at our hospital. The urine was plated on blood- and MacConkey agar. A minimum of ≥ 10^5 colony forming units (CFU)/ml was defined as significant bacterial growth. Less bacterial growth was defined as bacteriuria. Further data on preoperative assessment were collected including volumetric measurement of PVR and PV, latter mostly done by pelvic ultrasonography. These measurements were done once and calculated with the formula volume (ml) = 0.5 × length (cm) × width (cm) × height (cm) [22]. Also, we included the variables operation time, presence of middle lobe (> 1.5 cm) of the prostate, insertion of a suprapubic catheter, days of catheterisation and hospitalisation and histological result of the resected tissue.

Statistical analysis was performed using the STATA v14 (StataCorp, College Station, TX, United States). Continuous and categorical variables were reported as median ± interquartile range (IQR) or mean ± standard deviation (SD) and frequencies as percentages, respectively. To test for risk factors for developing an UTI, we used univariate regression analyses. Differences between groups were assessed using the Fisher's exact test and t-test, when appropriate. A p-value of 0.05 or less was regarded as statistically significant and all tests were two-sided.

Results

The median age of patients in our cohort was 70.5 years (IQR 65.5 - 76.8). PV ranged from 20 to 210 ml, with half of the patients having a prostate size less than 55 ml. Five (7.3%) of the 68 patients with documented postvoiding residual completely voided the bladder (10 ml or less) in the preoperative setting and overall, the median PVR was 152.5 ml (IQR 50-500) before undergoing TURP. Spearman correlation analysis revealed no significant correlation between prostate volume and postvoid residual voiding volume (r_s = 0.1). The median PSA level before undergoing surgery was 3.1 ng/dl (IQR 1.4-4.9). None of these patients were suspected to harbour prostate cancer as their cause of bladder outlet obstruction. Baseline clinical characteristics and perioperative variables are shown in Table 1.

The results of preoperative urine culture were available in 83 patients: 9 patients (10.8%) had an UTI and in 33 (39.8%) urine culture revealed bacteriuria. In patients with UTI, the most prevalent bacterial strain were Enterococcus species which were found in the urine cultures of five patients (55.6%). The bacterial

Table 1: Clinical characteristics of men undergoing elective TURP and perioperative variables.

Preoperative variables	**Median**	**IQR**
Age (years)	70.5	65.5-76.8
PSA (ng/dl)	3.1	1.3-4.9
BMI (kg/m^2)	25.8	23.7-29.0
PV (ml)	55	37.7-76
PVR (ml)	152	50-500
Median time of catheterisation preop. in catheterised men (d)	20	15-70
	n	**%**
PVR > 180 ml	31	45.6
PVR > 300 ml	24	35.3
Bacteriuria	33	39.8
UTI	9	10.8
Prior use of antibiotics	7	7.3
Urolithiasis	6	6.3
Diabetes	18	18.6
Preoperative transurethral catheterism	27	35.5
Indications for surgery in addition to obstructive LUTS		
Urinary retention	30	31.3
Bladder stones	2	4.2
Recurrent UTI	1	1.0
Gross haematuria	1	1.0
Urinary overflow incontinence	1	1.0
Obstructive symptoms	59	61.5
Perioperative variables	**n**	**%**
Intraoperative suprapubic catheter	23	23.9
Prostatic middle lobe	38	39.6
Bipolar resection	91	94.8
Postoperative variables	**Median**	**IQR**
Transurethral catheterisation (d)	2	2-3
Suprapubic catheterisation (d)	4	3-16
Operation time (min)	55	30-75
Duration hospitalisation (d)	4	3-5
	n	**%**
Bacteriuria	16	42.1
UTI	9	23.7

N = 96; limited data on postvoid residual (PVR) (n = 68) and pre- and postoperative urine cultures (n = 83, n = 38, respectively). Abbreviations: BMI: Body Mass Index; LUTS: Lower Urinary Tract Symptoms; PSA: Prostate Specific Antigen; PV: Prostate Volume; PVR: Postvoid Residual Volume; TURP: Transurethral Resection of the Prostate; UTI: Urinary Tract Infection.

growth in the patients that harboured an UTI is shown in detail in Supplementary Table 1. Seven patients received upfront preoperative antimicrobial treatment, concordant to the antibiogram of the urine culture; all remaining patients received a single-shot antibiotic intraoperatively. Patients that presented with catheter *in situ*, if not treated due to UTI upfront, began antibiotic treatment one day before surgery. Twenty-seven individuals were catheterised preoperatively; all these men had a change of the transurethral catheter within a median time of 20 days before undergoing TURP.

Table 2 summarizes the baseline variables in patients with UTI before surgery and those without a significant bacterial growth in the urine. None of the patients with urolithiasis had significant bacterial growth in their urine culture. The only statistically significant variable that differs is the age at TURP. Patients with increasing age were more likely to harbour an UTI than those who did not ($p = 0.02$). This was confirmed in the subgroup of patients without preoperative transurethral catheter ($p < 0.01$) (Table 3).

In univariable logistic regression analysis, there was neither an association between prostate size and the risk of developing UTI (OR 0.9, 95% CI 0.9-1.0, $p = 0.6$) nor between preoperative PVR and UTI (OR 1.0, 95% CI 0.9-1.0, $p = 0.1$). The other assessed variables including BMI, PSA, presence of transurethral catheter and diabetes had no predictive value for the risk of developing an UTI. Only increasing age was statistically associated with the odds of developing an UTI (OR 1.1, 95% CI 1.0-1.2, $p = 0.03$). This remained true in not-catheterised individuals (OR 1.2, 95% CI 1.0-1.5, $p = 0.03$). When specifically evaluating for the patients aged 70 and above, the UTI-frequency was significantly higher than in youngers ($p = 0.03$).

Data analysis from the surgical reports revealed that 38 men (39.6%) had a significant middle lobe of the prostate and 23 (23.9%) received a suprapubic catheter intraoperatively. The median operation time was 55 minutes (IQR 30-75). The histological result revealed in 61 of the patients (63.5%) benign fibroglandular prostatic hyperplasia and in 35 (37.7%) signs of prostatitis within the surgical specimen. Nine of the patients with prostatitis in the histological report had a preoperatively indwelling transurethral catheter, two had a positive urine culture before the surgical procedure and two had both.

The median postoperative time of catheterisation was 2 days (IQR 2-3). In patients who received a suprapubic catheter intraoperatively, it stayed *in situ* for a median postoperative time of 4 days (IQR 3-16). Patients were hospitalised for a median time of 4 days (IQR 3-5). In the postoperative urine culture, which was collected in 38 patients within 30 days postoperatively, 16 patients (42.1%) had bacteriuria and 9 patients (24.3%) had UTI (Table 1). Three of the patients with significant bacterial growth before surgery were within the group with postoperative UTI. The identified bacterial strains are listed in Supplementary Table 1.

Discussion

The results of our analysis on 96 patients with LUTS secondary to bladder outlet obstruction associated with benign prostatic hyperplasia treated

Table 2: Comparison of clinical variables between patients with and those without UTI.

Variable	n total	No UTI Median	No UTI IQR	UTI Median	UTI IQR	p
Age (years)	66	68.6	63.2-74.6	76.6	72.7-78.7	0.02
PSA (ng/dl)	64	2.9	1.3-4.7	5	2.4-5.5	0.23
BMI (kg/m^2)	66	26.9	24.0-29.6	24.9	21.2-26.4	0.08
PV (ml)	58	60.0	37.7-80.0	40	33-60	0.69
PVR (ml)	52	150.0	45-500	615	144-900	0.03
	n total	**No UTI n**	**No UTI %**	**UTI n**	**UTI %**	
PVR > 180 ml	27	21	77.8	6	22.2	0.12
PVR > 300 ml	21	16	76.2	5	23.8	0.11
Catheterism	25	19	76	6	24	0.07
Urolithiasis	3	3	100	0	0	1.00
Diabetes	11	10	90.9	1	9.1	1.00

Abbreviations: BMI: Body Mass Index; PSA: Prostate Specific Antigen; PV: Prostate Volume; PVR: Postvoid Residual Volume; UTI: Urinary Tract Infection.

Table 3: Comparison of clinical variables between UTI groups after adjustment for the effect of a preoperative indwelling transurethral catheter.

No transurethral catheter	n total	No UTI Median	No UTI IQR	UTI Median	UTI IQR	p
Age (years)	41	68.1	63.9-74.4	78.1	70.8-81.6	< 0.01
PSA (ng/dl)	41	1.8	1.3-3.8	2.1	1.2-3.6	0.62
BMI (kg/m^2)	41	25.7	23.7-28.9	25.5	24.7-28.7	0.46
PV (ml)	39	60	37.9-80.0	45	33-83	0.67
PVR (ml)	29	70	21-180	90	89-600	0.07
		No UTI n	**No UTI %**	**UTI n**	**UTI %**	
PVR > 180 ml	8	7	87.5	1	12.5	0.5
PVR > 300 ml	4	3	75	1	25	0.3
Urolithiasis	3	3	100	0	0	1.0
Diabetes	5	5	100	0	0	1.0
Transurethral catheter	**n total**	**No UTI Median**	**No UTI IQR**	**UTI Median**	**UTI IQR**	**p**
Age (yrs)	25	73.9	61.2-79.6	73.7	68.8-77.6	0.59
PSA (ng/dl)	23	4.8	3.3-6.9	5.5	4.3-8.9	0.91
BMI (kg/m^2)	25	28.9	24.0-32.4	22.8	20.4-26.8	0.08
PV (ml)	19	60	40-80	40	37-40	0.24
PVR (ml)	23	500	400-10000	400	194-900	0.80
		No UTI n	**No UTI %**	**UTI n**	**UTI %**	
PVR > 180 ml	19	14	73.7	5	26.3	1.00
PVR > 300 ml	17	13	76.5	4	23.5	0.63
Diabetes	6	5	83.3	1	16.7	1.00

Urolithiasis omitted in subgroup of catheterised patients as there were no patients in this group. Abbreviations: BMI: Body Mass Index; PSA: Prostate Specific Antigen; PV: Prostate Volume; PVR: Postvoid Residual Volume; UTI: Urinary Tract Infection.

with TURP indicated that PVR (p = 0.1), PV (p = 0.6) or preoperative PSA level in the serum (p = 0.4) are not predictive factors for the risk of developing UTI. The only identifiable risk factor for developing an UTI was advancing age (OR 1.1, 95% CI 1.0-1.2, p = 0.03). After adjustment for the potential confounder of a

preoperatively indwelling transurethral catheter, increasing age remained a significant risk factor for developing an UTI (OR 1.2, 95% CI 1.0-1.5, p = 0.03).

According to the literature, the frequency of UTI is lower in young men and increases with patient age. The incidence of a significant bacteriuria is estimated to rise to 0.05 per person-year in men aged 65-74 years. Due to the aging population, rates of outpatient care for male UTI have augmented in the last decade [5]. Patient's age ≥ 65 years has also been shown to increase the occurrence of UTI after TURP [18]. This might be explained with immunosenescence, posttraumatic and/or degenerative changes in the prostate and decreased defence mechanisms of the urethral mucosa [23]. Also, post-infectious micturition disorders can lead to PVR and urine stasis [24]. The findings of our retrospective study showed that elderly patients had a greater UTI frequency, comparing patients with median age of 68.6 vs. 76.6 years (p = 0.02). This observation has been confirmed also in the subgroup of patients without indwelling transurethral catheter prior to TURP (median age 68.1 vs. 78.1 years, p = 0.004). In univariate analysis, age increased the odds for developing UTI (OR 1.1, 95% CI 1.0-1.2, p = 0.03) in all patients and also in patients without catheter (OR 1.2, 95% CI 1.0-1.5, p = 0.03). Therefore, we suggest that patients' age is a predictive factor for developing UTI in patients with LUTS, scheduled for surgery. After validation of this finding in larger well-designed cohorts, it may be necessary to devise a strategy for age-specific antibiotic prophylaxis focussing on the needs of the geriatric population.

Another prevalent phenomenon, especially in elderly men, is the inability of the bladder to empty completely [24]. This can be the result of detrusor underactivity and/or bladder outlet obstruction [25]. The amount of PVR can be influenced by multiple factors such as drug abuse, hydration status and urinary habits [8]. Reliable values of PVR in men can only be achieved by repeated measurements as there is a high day-to-day variation [8,9]. Various urologists consider PVR as indication for surgical treatment for benign prostatic obstruction [26]. However, analyses of the association of PVR with UTI have revealed contradictory results. Hampson, et al. conducted a retrospective analysis in 342 patients and found no significant increase in the rate of UTI in patients with PVR > 100 ml [10]. Truzzi, et al. observed a positive urine culture in 53 of 196 of asymptomatic patients. They proposed that the cut-off of ≥ 180 ml PVR has a positive predictive value for bacterial growth of 87.0% and a negative predictive value of 94.7% [11]. The Cottbus and Biometric Working Group detected in a positive urine culture in 70 of 225 patients that were scheduled for prostate biopsy. There was a correlation between PVR and UTI of r = 0.5. However, they were not able to identify a sufficiently sensitive and specific PVR cut-off to distinguish patients who are more likely to harbour a positive urine culture [12,13]. In the present study, the UTI rate was 10.9%. In 31 patients (45.6%), PVR was greater than 180 ml. The frequency of UTI was not higher in these patients compared to those with less PVR (p = 0.12). We remarked a statistically significant greater PVR in those with UTI (median 150 vs. 615 ml, p = 0.03) in the overall study cohort. However, we could not confirm PVR as predictor for the risk developing UTI neither in the overall study population (p = 0.5) nor in the subgroup of those with PVR > 180 ml (p = 0.2). Our cohort was underpowered and as PVR could contribute to the risk of UTI, this should be revaluated in a larger better-designed study.

Urinary obstruction with urine stasis has also been identified as risk factor for developing an UTI [24]. Prostate enlargement can have various underlying conditions like genetics, age, metabolic syndrome and inflammation [27]. Microbial cultures analysed from prostatic tissue resected in TURP and preoperative urine revealed different strains. The prostate can be seen as independent infectious source proposing intraprostatic bacterial growth as potential source for postoperative infectious complications [15]. However, there is a paucity of reliable indicators identifying preoperatively prostatitis requiring intraoperative administration of antibiotic prophylaxis. Another aspect that comes along with PV is its correlation to PVR, which might be predisposing for inflammation. A modest correlation of PVR with PV (r_s = 0.2) has been shown in a random sample of men, aged 40 to 79 years without prior prostate surgery or cancer. The median PVR was lower than usual with 9.5 ml (IQR 2.5-35.4) and the median PV was also lower than usual with 26.6 ml (IQR 20.9-35.1) in their study population [8]. Men with PVR of > 50 ml were 2.4 times more likely to have a PV > 30 ml [8]. Compared to this study, our study patients were older with a median age of 70.5 years (IQR 65.5-76.8) and had a higher median PVR of 152 ml (IQR 50-500) and a higher median PV of 55 ml (IQR 37.7-76). This reflects that medical care seeking men, planned for elective surgery in an hospital, are a selected group of patients with higher burden of disease and generally more advanced disease [28]. We could not replicate the correlation of PVR with PV (r_s = 0.1) in our study population. Also, in our patients, PV was not identified as risk factor for developing UTI in men undergoing TURP for obstructive LUTS.

Our study has several limitations. First, we performed PVR only once in the preoperative setting though the test-retest reliability is low, and variance is possible. Also, measurement of PVR via catheterism would have been more precise [29]. However, Amole, et al. considered transabdominal ultrasonography as a reliable method assessing the PVR in patients with benign prostatic hyperplasia [30]. Another additional relevant data which would have been interesting to

collect is voiding volume, thus the voiding efficiency. Second, prostate volumetric measurement was mostly done transabdominally, which could have been more accurately by using transrectal ultrasound [31]. Due to the retrospective character of the study, we had to deal with missing data and we decided to omit some initially planned variables for further analysis. This explains why we did not elucidate the preoperative international prostate symptom score and uroflow parameters for each patient. Also, no prostate culture analysis was done in the investigated patients and we cannot draw conclusions on diversity of bacterial strains in prostate and urine. Furthermore, we recognize that a great part of the overall study cohort (35.5%) had an indwelling transurethral catheter before undergoing surgery. We did not exclude these patients from primary analysis as a lot of men present with transurethral catheter before elective TURP. Our overall study population represents well men with LUTS and our data are generalisable for these patients planned for elective surgery. Noteworthy is that the median time from catheter change to surgery is 20 days which may differ between centres. Therefore, we adjusted for this confounder and performed subgroup analysis for those without preoperative transurethral catheter *in situ*. Other limitations of the study are the retrospective design, the small sample size, especially in the subgroup analyses. Possibly in a larger study cohort, ideally multi-centric, the findings of Truzzi, et al. and May, et al. could have been replicated as they hypothesised PVR as predictive for UTI. Regarding this study field, our findings revealed only a statistically not significant trend ($p = 0.08$). Future studies should also include advanced techniques to detect microbes in the prostate and urine. We omitted analyses on risk factors for postoperative UTI, as results of urinary cultures within 30 postoperative days were only available for 70 patients and would cause a selection bias. In our study cohort, no routine urinary culture was done in the postoperative setting. Furthermore, we could not evaluate on further risk factors for UTI such as previous or family history of UTI and sexual activity due to the retrospective study design.

Conclusion

We rejected our alternal hypothesis and accepted the null hypothesis that that PVR and PV are not associated with risk of developing an UTI in patients with LUTS planned for elective TURP. Increasing patients' age as predicting factor for higher likelihood developing UTI should be further evaluated in future studies with larger sample sizes to define an antibiotic prophylaxis strategy for geriatric men who are planned for an elective TURP.

Conflicts of Interest

All other authors declare that they have no conflict of interest with the subject of the manuscript.

Authors' Contributions

J Stangl-Kremser: Project development, Data analysis, Manuscript writing

M Abufaraj: Manuscript writing/editing

C Pozo-Salido: Manuscript editing

S Brönimann: Data Collection, Manuscript editing

G Schatzl: Protocol/project development

SF Shariat: Project development, Manuscript writing.

Data Availability

Data available on request from the authors.

Ethical Approval

The ethical committee of the Medical University of Vienna approved this study (1482/2018) before retrospective data collection. The methods used in the study were carried out in accordance with the relevant guidelines and regulations.

Informed Consent

Informed consent for data use has been obtained from the individual participants when they were admitted to the hospital.

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Supplementary Table 1: Microbial variables and treatments of patients with UTI before undergoing surgery.

Preoperative urine culture	**CFU/ml**	**Antibiotics (duration)**	**Catheter *in situ***	**Postoperative urine culture**	**CFU/ml**	**Catheter *in situ***
Enterococcus faecium *Coagulase-negative staphylococci* *Streptococci viridans* *Escherichia coli*	10^5 10^3 10^5 10^3	Cefuroxim (1)	no	*Enterococcus faecalis* *Streptococci viridans* *Corynebacteria* Coagulase-negative staphylococci	10^4 10^4 10^3 10^3	no
Mixed flora	10^5	Cefuroxim (1)	no	Mixed flora	10^3	no
Citrobacter koseri *Enterococcus faecalis*	10^5 10^5	Cefuroxim (7)	no	*Enterococcus faecalis* Coagulase-negative staphylococci	10^5 10^2	no
Enterococcus faecalis	10^5	Ciprofloxacin (7)	yes	NA		
Klebsiella oxytoca	10^5	Cefuroxim (7)	yes	NA		
Staphylococcus aureus *Enterococcus faecalis*	10^5 10^5	Cefuroxim (7)	yes	Mixed flora	10^5	no
Escherichia coli *Enterococcus species*	10^5 10^3	Cefuroxim (7)	yes	Coagulase-negative staphylococci	10^4	no
Escherichia coli 3 MRGN *Enterococcus species*	10^5 10^2	Meropenem (7)	yes	*Escherichia coli* 3 MRGN	10^5	yes
Escherichia coli *Enterococcus faecalis*	10^5 10^5	Cefuroxim (7)	no	NA		

N = 9; Abbreviations: NA: Not Available; CFU: Colony Forming Units.