IRSTI 76.29.43 https://doi.org/10.26577/IAM.2021.v2.i2.01

Mohammad Hashim Kamran

Kabul University of Medical Science, Kabul,Afghanistan
e-mail: m.hashimkamran@gmail.com

URINARY TRACT INFECTION IN PATIENTS WITH BENIGN PROSTATIC HYPERPLASIA ADMITTED FOR PROSTATECTOMY

Urinary Tract Infection (UTI) in patients with Benign Prostatic Hyperplasia (BPH) causes UTI related complication before and after prostatectomy, reduction in their health-related quality of life and overall well-being, thus the knowledge of UTI may play a complementary role in management.The aim of this research was to study the prevalence of urinary tract infection (UTI), its causative organism and antibiotic susceptibility.

All BPH patients who were admitted for prostatectomy were included to the study. Information on age, presence of an indwelling catheter, other factors related to UTI and antibiotic susceptibility results were obtained and analyzed using IBM SPSS version 26.

Three hundred twenty six patients were studied. The age range of study participants was 51 to 89 years and displayed a median of 70 year (IQR=12). More than half of study participants 168 (51.5%) were between 61 to 70 years. Bacterial isolates were noted in 96 (29.4%) patients. Escherichia Coli noted in (25.3%) specimens was the most common organism isolated. The bacterial isolates were mostly sensitive to imipenem, meropenem, and fosfomycin, but showed greater resistance to cefotaxime, ceftazideme and cefazulin accordingly. The age of study participants was significantly greater for those who had bacteriuria (Mdn = 70) years than those who did not have bacteriuria (Mdn = 67), U = 9569, P = 0.048. The same it was significant for PSA level (P = 0.000) but were not significant for prostate size (P = 0.558).

Less than one third of BPH patients had UTI (29.4%), E. Coli was the most common microbial cause of UTI in study participants it was the cause in one fourth of cases (25%), Imipenem group of antibiotic was the most sensitive antibiotics in study participants (93.9%), Cefotaxime was the most resistant antibiotics (66.7%)

Key words: Urinary Tract infection, benign prostatic hyperplasia, bacteriuria.

Introduction

UTI is a bacterial invasion-induced inflammatory response of the urothelium that is normally accompanied by bacteriuria and Pyuria [1], or the presence of bacteria in the urinary tract is referred to as urinary tract infection [2]. Upper UTIs (pyelonephritis) and lower UTIs (cystitis, prostatitis) are categorized according to the site of infection, and uncomplicated and complicated UTIs are classified according to underlying conditions and structural or functional disorders of the urinary tract [3].

Urinary tract infection (UTI) is one of the most common infections in both outpatient and inpatient settings around the world, with 150 million people affected each year [4], every year, more than 8 million people visit a doctor's office in the United States [5]. The Centers for Disease Control and Prevention (CDC) estimates that UTIs cause 13,000 deaths per year, despite the fact that most patients only experience a variety of painful and irritating symptoms [6].

There are three components that make up a UTI. First, the patient must have clinical symptoms that point to a urinary tract infection. Dysuria alone or with fever, suprapubic discomfort, gross hematuria, costovertebral angle tenderness, or new or worsening urgency or urinary incontinence are all recognized clinical criteria in older adults [7].

Despite the fact that bladder outlet obstruction can affect both men and women, it is more common in older men. When the opening between the bladder and the urethra is partly or fully blocked, it happens at the base of the bladder. As a result, the disorder slows or prevents the bladder from emptying urine [8]. The most popular predisposing pathologies for urinary tract infection in adults with bladder outlet obstruction are benign prostatic hyperplasia and prostate cancer [9] BPH is characterized by hyperplasia of the prostatic stromal and epithelial cells, which results in the development of large, fairly distinct nodules in the periurethral region, which can cause partial or nearly complete obstruction of the

urethra when large enough [10], Frequency, urgency, nocturia, trouble initiating urination, a sense of incomplete bladder emptying, reduced stream force, and stream interruption are all symptoms associated with BPH [11]. The causes of BOO differ between men and women. Noncancerous enlargement of the prostate, also known as benign prostatic hyperplasia, is the most common cause in men (affecting up to 70% of men over the age of 70) [12]

Urinary retention caused by benign prostatic hyperplasia (BPH) puts men at risk for urinary tract infection [13]. The addition of this complication to patients with obstructing prostates not only worsens their already poor health-related quality of life and social well-being, but also causes post-operative morbidity and puts a strain on health-care finances [14].

Urinary tract infection was seen in 35.9% and 34.6 percent of patients with benign prostatic hyperplasia and prostate cancer, respectively. The most popular microbiological agent isolated was Escherichia coli, and Nitrofurantoin, which has a high sensitivity to the pathogens, should be considered in the empirical treatment of the infection. The only independent indicator of infection wasthe existence of an indwelling urethral catheter. As a result, preventative measures for catheter-associated infections in these patients should be implemented [15].

Outpatient urine culture epidemiology provides valuable insight into the evolving prevalence and antibiotic susceptibilities of various uropathogens. Escherichia coli, which causes nearly two-thirds of cases in patients over 65 years old with uncomplicated cystitis, is the most common pathogen, followed by Klebsiella oxytoca (15% of cases), and Proteus mirabilis (15% of cases) (7% of cases). Gram-negative bacteria are found in more than 90% of cases of cystitis in older adults when taken together. 4 Catheter-associated UTI (CAUTI) has a more diverse microbiology [2].

In order to avoid septicemia and recurrent UTI, successful antibiotic therapy as well as adequate Urological intervention to eliminate predisposing factors and restore as much as possible the normal anatomy and function of the urinary tract are needed for the treatment of UTI in the presence of urinary tract obstruction [16].

In order to determine the most effective empirical antibiotic treatment for these patients, it is critical to have a good understanding of the possible species and local resistance trends. The rising prevalence of health-care-associated infections and the emergence of antibiotic resistance illustrate the importance of obtaining a definitive diagnosis, treating with effective antibiotics, and avoiding broad-spectrum antibiotics. Antibiotic resistance is on the rise, and it's starting to have an impact on the effectiveness of empirical antimicrobial therapy for urinary tract infections. The use of effective narrow-spectrum antibiotics depends on a correct diagnosis of urinary infections [17].

In Kazakhstan when choosing antimicrobial therapy, the Protocols for diagnosis and treatment recommend a microbiological study to determine antibacterial drug sensitivity, which was not done in 100% of cases, and initial treatment was empirically prescribed, with drugs from the cephalosporin group (Ceftriaxone) in 34%, nitrofurans (Furazi-din) in 42% and flouroquinolones (Levofloxacine) in 24% of cases. In the majority of cases, alterna- tive drugs were prescribed to treat acute cystitis, despite the fact that first-line treatment currently involves fosfomycin trometamol, pivmecillins, and nitrofurantoin macrocrystals, which according to the findings of this study were not used at all. Al- ternative antibacterial medications were prescribed in the majority of cases (71%) for the initial treat- ment of urinary tract infections. The majority of antibacterial medication dose regimens, dosage frequency, and treatment course did not follow cur- rent guidelines [18].

Materials and Methods

The study, retrospective and descriptive cross sectional in nature, was done at the urology department Scientific Center of Urology over a 2 years period (January 2019 – December 2020). BPH patients who were referred to the urology department and admitted for prostatectomy formed the study population. Three hundred twenty six patients who met the inclusion criteria within the period were studied.

Inclusion criteria

All BPH patients in whom operation is indicated and admitted for prostatectomy.

Exclusion criteria

- Patients with prostate cancer
- Patients with urethral stricture
- Patients with urinary bladder neck sclerosis
- Patients in whom conservative treatment was
- considered

Following informed consent of the hospital official for using the database of patients, a da-

ta collection form was designed and developed for each patient to record demographic char- acteristics, symptoms, and urine microbiology outcome. The size of the prostate on abdominal ultrasonography, as well as the prostate-specif- ic antigen value, was recorded for all patients. Postvoid residual urine volume was recorded on-ly in patients without acute retention of urine. Data were inserted and cleaned in Microsoft Ex-cel 2010, then imported for statistical analysisin IBM SPSS version 26 data analysis package. Descriptive analysis, qui square test, logistic re- gression and for comparison of median of con- tinuous variables a Mann Whitney U test were done the results presented in the form of tables, frequencies, and percentages. $P < 0.05$ was con- sidered significant.

Results

Three hundred twenty six patients with BPH who are admitted for prostatectomy during two years of 2019 and 2020 were studied, 194 (59.5%) of participants were admitted in 2019 and 132 (40.5%) were admitted in 2020, The age range of study participants was 51 to 89 years and displayed a median of 70 year (IQR=12). The PSA range of study participants was 0.002w5 to 100 nanogram/milliliter and displayed a Mdn PSA level of 6.185 ng/ml (IQR = 9.221), The range of postvoid residual urine of the study participants was 0 to 1737 milliliter and displayed a Mdn postvoid residual urine of 35 ml (IQR = 80), the prostate size range of study participants was 24 to 250 grams and displayed Mdn of prostate size of 63.5 gr (IQR = 29) (Table 1).

Table 1 – Median and IQR of age, PSA, PVRU and prostate size of Patients with BPH 2019 – 2020 (N=326)

variables	Median	IQR	Minimum	Maximum
Age, year	70	12	51	89
Prostate Specific Antigen	6.185	9.221	0.02	100
Postvoid residual urine, ml	35	80	0	1737
Prostate size, gr	63.5	29	24	250

According to documents of patients from ultrasonography of urinary bladder 98 (30.1%) of study participants had urethral catheter or cystostomy and 228 (69.9%) participants did not have, most of them had cystostomy instead of urethral catheter, probably due to large prostate size which has obstructed the prostatic urethra or cystostomy was considered saver than applying urethral catheter for urethral mucosa. 24 (7.4%) of study participants had urinary bladder stone and 302 (92.6%) did not have urinary bladder stone, nine (2.8%) of study participants had urinary bladder diverticula and 317 (97.2%) of participants did not have (Table 2)

Table 2 – prevalence of urinary catheter, bladder stone and bladder diverticula in patients with BPH during 2019 – 2020 (N=326)

Variables	Yes N (%)	No N (%)
Urethral catheter or cystostomy	98 (30.1%)	228 (69.9%)
Urinary bladder stone	24 (7.4%)	302 (92.6%)
Urinary bladder diverticula	9 (2.8%)	317 (97.2%)

In 326 study participants who had BPH, urine culture have been done for all participants routinely, 230 (70.6%) patients were culture negative and 96 (29.4%) patients were culture positive. From 96 positive cultures (29.4 %), only 33 patients had antibiotic susceptibility test for antibiotic selection remained 63 patients had only culture reports, because susceptibility test is not done routinely maybe due to economic issues, hence these cultures without susceptibility tests have been omitted from further analysis. In 33 susceptibility test eighteen different species of bacteria were found, The most common pathogen was Escherichia coli (E. coli, 25.3 %), the second most common was Staphylococcus Saprophyticus (12.5 %), the third, fourth and fifth most common pathogens were staphylococcus Epidermidis, Enterobacter Coloacae and Enterococcus Faecalis accordingly (Figure 1).

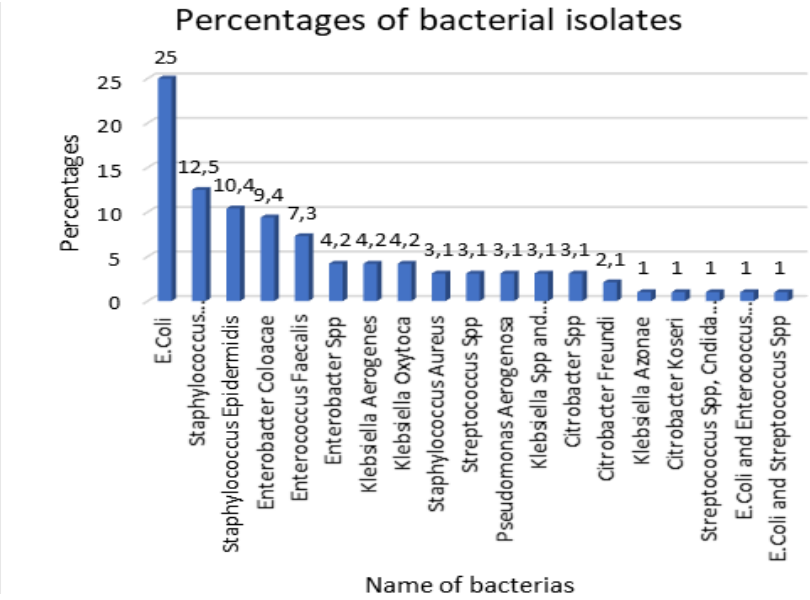

Figure 1 – Microbial isolates in urine cultures of benign prostatic hyperplasia patients with UTI

From 96 culture positive, in 90 (93.8%) of them have been grown single bacteria gram negative or positive, in 6 (6.2%) of them have been grown more than one type of bacteria in 5 of them were grow two bacterias and only in one case there were three bacterias. In 96 patients with culture positive 54 (56.3%) were gram negative bacteria, 40 (41.7%) were gram positive bacteria and in 2 cases (2.1%) there were both gram negative and positive.

The bacterial isolates on susceptibility testing were mostly sensitive to imipenem (93.9%), meropenem (90.9%), tazobactam/piperacillin (88.8%), fosfomycin (84.4%), gentamicin (75.8%), amikacin (69.27%), ceftriaxone (60.6%), levofloxacin (57.6%), ciprofloxacin (48.5%), cefazolin (45.5%), ceftazidime (36.4%) and cefotaxime (33.3%) (Figure 2).

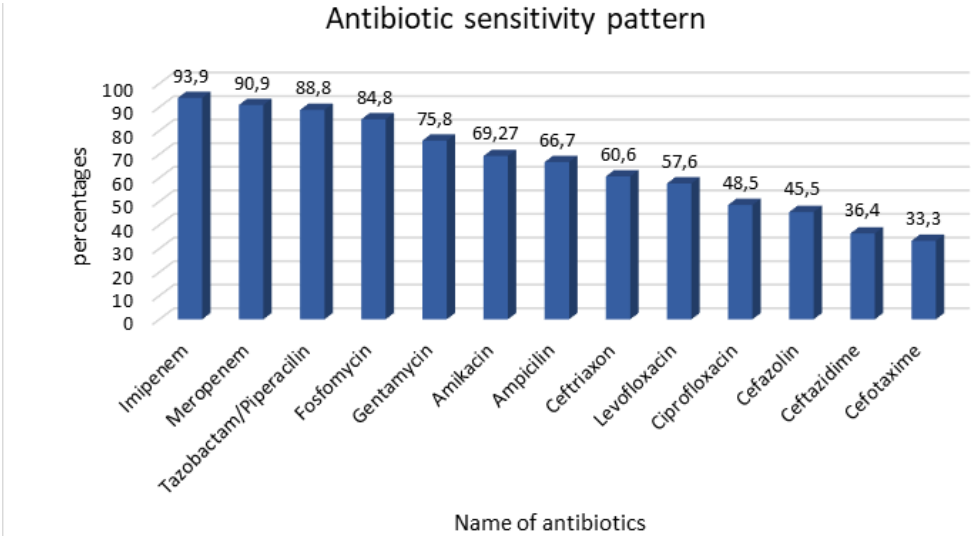

Figure 2 – Antibiotic sensitivity pattern among bacterial isolates in 97 urine cultures

Antibiotics to which the isolates were mostly resistant included cefotaxime (66.6%), ceftazidime (63.6%), and cefazolin (54.5%)(Figure 3).

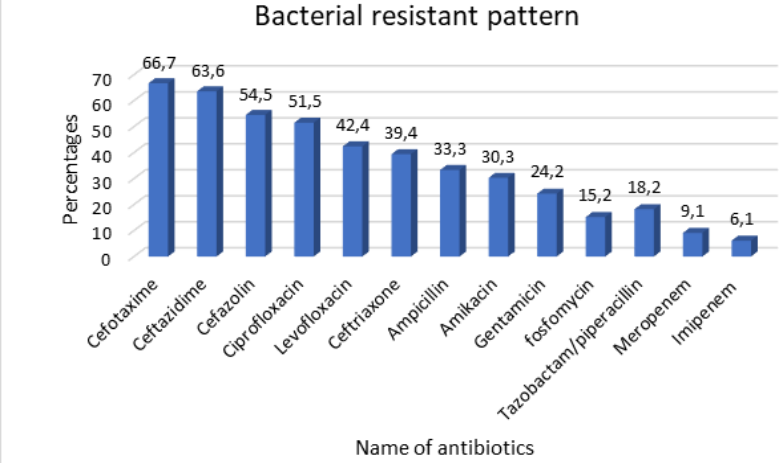

Figure 3 – Bacterial resistant pattern to the antibiotics among bacterial isolates in 97 cultures

The susceptibility of E. coli to common antibiotics is shown in figure 4. As mentioned before in 12 cultures with sensitivity tests E. Coli was grown.

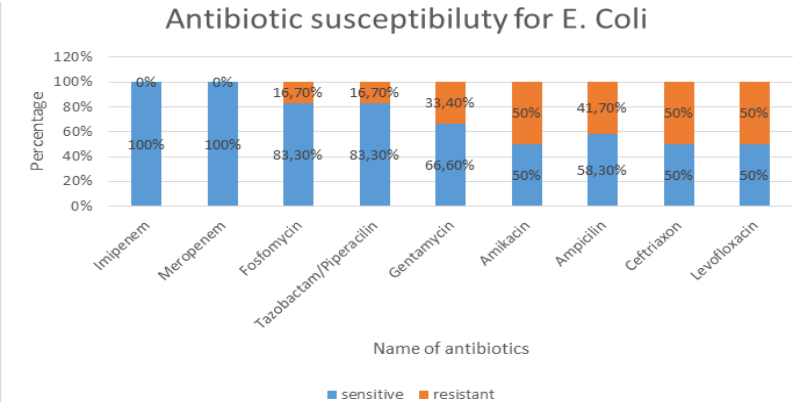

Figure 4 – Antibiotic susceptibility test for E.Coli

Also a Mann Whitney test was performed and indicated that level of PSA was significantly greater for study participants whose urine culture was pos- itive or had bacteriuria (Mdn = 6.49) than for those whose urine culture was negative or did not have bacteriuria (Mdn = 3.76), U = 8177.5, P = 0.000. The age of study participants was significantly greater for those who had bacteriuria (Mdn = 70) years than those who did not have bacteriuria (Mdn = 67), U = 9569, P = 0.048 (Table 3)

Table 3 – Statistical tests of difference of age and PSA between those who had bacteriuria and those who did not have bacteriuria

variables	Bacteriuria (n=97)	No Bacteriuria (n=229)	Test of differences	
	Median	Median	Z-value	P-value
PSA level, ng/l	6.49	3.76	-3.765	0.000
Age, years	70	67	-1.978	0.048

There were a weak correlation between prostate specific antigen and prostate size (p=0.044, Pearson correlation 0.111) but this correlation was not significant between age and prostate specific antigen (p=0.54, Pearson correlation 0.107).

By performing Chi square test we found significant relationship between having urethral catheter or cystostomy and pyuria, bacteriuria, hematuriaand proteinuria. The test results and cross tabulationof urethral catheter with pyuria, bacteriuria, hematu-ria and proteinuria are shown in table 4.

Table 4 – Statistical tests of the chi square among the patients having BPH

Outcome variables which were tested with urethral catheter or cystostom		Cross tabulation of different factors		Chi square test result	
		Urethral catheter or cystostom		Chi square value	Sig. v
		yes	No		
Pyuria	Yes	62	77	95%	0.000
	No	36	151		
Bacteriuria	Yes	50	47	95%	0.000
	No	48	181		
Hematuria	Yes	58	75	95%	0.000
	No	40	153		
Proteinuria	Yes	54	72	95%	0.000
	No	44	156		

The test for DM as a risk factor for UTI and pyuria, bacteriuria, hematuria and proteinuria was not significant. And also there were no significant relationship between urinary bladder stone and pyuria, bacteriuria, hematuria and proteinuria by performing qui square tests.

Discussion

The prevalence of bacteriuria in our study participants was 29.4% and it was different in many studies. In two studies one pre TURP urine culture with prevalence of 23.5% [19] and other post TURP urine culture with prevalence of 15.5% [20] were reported the prevalence of bacteriuria lower than we reported. While in four other studies on BPH patients bacteriuria was reported higher as 35.6%, 44.7%, 70% and 76.6% respectively than our result [14], [17], [21], [22]

In our study the most common pathogen was Escherichia coli (E. coli, 25%), the second most common was Staphylococcus Saprophyticus (12.5 %), the third, fourth and fifth most common pathogens were staphylococcus Epidermidis (10.4%), Enterobacter Coloacae (9.4%) and Enterococcus Faecalis (7.3%) respectively. In other studies the same like our study the E. Coli was the predominant bacteria responsible for UTI in BPH patients but with higher percentages than our study as 31.81 % [23], 33,3 % [14], 33 % [2], 47.6% [22], 60% [17], while Dybowski et al studied the same study participants in three different periods and the results were almost the same like we found, and E. Coli was the most common organism with 22%, 25% and 27 % in three periods respectively [23].

In our study the second most common bacteria in culture positive patients was staphylococcus saprophyticus 12.5%, while in most of other studies the second most common bacteria was Klebsiella species with different percentages like 28.78% Mishra17.3% [14], 15% [2], 8,2% [17], in our study the percentage of all Klebsiella species were 5.2%.

In our study the bacterial isolates on susceptibility testing were mostly sensitive to imipen- em (93.9%), meropenem (90.9%), tazobactam/ Piperacillin (88.8%) and fosfomycin (84.4%), this finding is nearly the same as Agbugui et al reported; The bacterial isolates on susceptibility testing were mostly sensitive to imipenem (90.5%), meropenem (88.9%), and nitrofurantoin (85.7%) [22]but Delcaru et al reported the susceptibility test of their study participants as follows: The enterobac- terial strains exhibited high antibiotic susceptibility rates to fosfomycin (100%), gentamicin (77.14%), nitrofurantoin (75.71%), ceftazidime (74.29%), sulfamethoxazole (62.86%), amoxicillin–clavulanic acid (61.43%), cefuroxime (60%), flouroquinolones (52.86%), and tetracycline (48.57%) [17] which is different from our study and this difference can be due to not testing carbapenem group of antibiotics in their susceptibility tests.

Conclusion

Less than one third of BPH patients had UTI (29.4%), E. Coli was the most common microbial cause of UTI in study participants it was the cause in one fourth of cases (25%), Imipenem group of antibiotic was the most sensitive antibiotics in study participants (93.9%), Cefotaxime was the most resistant antibiotics (66.7%).

References

1. K. G.-S. Christian et al., «Resistance pattern of uropathogenic bacteria in males with lower urinary tract obstruction in Kumasi, Ghana,» African J. Microbiol. Res., vol. 8, no. 36, pp. 3324–3329, Sep. 2014, doi: 10.5897/ajmr2014.6894.
2. N. W. Cortes-Penfield, B. W. Trautner, and R. L. P. Jump, «Urinary Tract Infection and Asymptomatic Bacteriuria in Older Adults,» Infectious Disease Clinics of North America, vol. 31, no. 4. W.B. Saunders, pp. 673–688, Dec. 01, 2017, doi: 10.1016/j.idc.2017.07.002.
3. C. I. Kang et al., «Clinical practice guidelines for the antibiotic treatment of community-acquired urinary tract infections,» Infect. Chemother., vol. 50, no. 1, pp. 67–100, Mar. 2018, doi: 10.3947/ic.2018.50.1.67.
4. S. Kh oshnood, M. Heidary, R. Mirnejad, A. Bahramian, M. Sedighi, and H. Mirzaei, «Drug-resistant gram-negative uropathogens: A review,» Biomedicine and Pharmacotherapy, vol. 94. Elsevier Masson SAS, pp. 982–994, Oct. 01, 2017,doi: 10.1016/j.biopha.2017.08.006.
5. A. Flores-Mireles, T. N. Hreha, and D. A. Hunstad, «Pathophysiology, treatment, and prevention of catheter-associated urinary tract infection,» Top. Spinal Cord Inj. Rehabil., vol. 25, no. 3, pp. 228–240, 2019, doi: 10.1310/sci2503-228.
6. T. A. Waller, S. A. L. Pantin, A. L. Yenior, and G. G. A. Pujalte, «Urinary Tract Infection Antibiotic Resistance in the United States,» Primary Care – Clinics in Office Practice, vol. 45, no. 3. W.B. Saunders, pp. 455–466, Sep. 01, 2018, doi: 10.1016/j.pop.2018.05.005.
7. N. L. Werner, M. T. Hecker, A. K. Sethi, and C. J. Donskey, «Unnecessary use of fluoroquinolone antibiotics in hospitalized patients,» BMC Infect. Dis., vol. 11, no. 1, p. 187, Jul. 2011, doi: 10.1186/1471-2334-11-187.
8. M. May, S. Brookman-Amissah, B. Hoschke, C. Gilfrich, K. P. Braun, and F. Kendel, «Post-Void Residual Urine as a Predictor of Urinary Tract Infection-Is There a Cutoff Value in Asymptomatic Men,» J. Urol., vol. 181, no. 6, pp. 2540–2544, Jun. 2009, doi: 10.1016/j.juro.2009.01.103.
9. C. F. Heyns, «Urinary tract infection associated with conditions causing urinary tract obstruction and stasis, excluding urolithiasis and neuropathic bladder,» World Journal of Urology, vol. 30, no. 1. World J Urol, pp. 77–83, Feb. 2012, doi: 10.1007/s00345-011-0725-9.
10. F. Cruz and F. Desgrandchamps, «New Concepts and Pathophysiology of Lower Urinary Tract Symptoms in Men,» Eur. Urol. Suppl., vol. 9, no. 4, pp. 472–476, Jul. 2010, doi: 10.1016/j.eursup.2010.04.003.
11. M. Adomi et al., «Factors associated with long-term urinary catheterisation and its impact on urinary tract infection among older people in the community: A population-based observational study in a city in Japan,» BMJ Open, vol. 9, no. 6, Jun. 2019, doi: 10.1136/bmjopen-2018-028371.
12. J. S. Lam, K. L. Cooper, and S. A. Kaplan, «Changing aspects in the evaluation and treatment of patients with benign prostatic hyperplasia,» Medical Clinics of North America, vol. 88, no. 2. W.B. Saunders, pp. 281–308, 2004, doi: 10.1016/S0025-7125(03)00147-0.
13. B. A. Dybowski et al., «Catheter-associated bacterial flora in patients with benign prostatic hyperplasia: Shift in antimicrobial susceptibility pattern,» BMC Infect. Dis., vol. 18, no. 1, Nov. 2018, doi: 10.1186/s12879-018-3507-9.
14. K. Asafo-Adjei, J. Mensah, A.-K. Labi, N. Dayie, and E. Donkor, «Urinary Tract Infections among Bladder Outlet Obstruction Patients in Accra, Ghana: Aetiology, Antibiotic Resistance, and Risk Factors,» Diseases, vol. 6, no. 3, p. 65, Jul. 2018, doi: 10.3390/diseases6030065.
15. M. A. Tolani, A. Suleiman, M. Awaisu, M. M. Abdulaziz, A. T. Lawal, and A. Bello, «Acute urinary tract infection in patients with underlying benign prostatic hyperplasia and prostate cancer,» Pan Afr. Med. J., vol. 36, pp. 1–9, May 2020, doi: 10.11604/pamj.2020.36.169.21038.
16. M. Ohkawa, M. Shimamura, S. Tokunaga, T. Nakashima, and M. Orito, «Bacteremia resulting from prostatic surgery in patients with or without preoperative bacteriuria under perioperative antibiotic use,» Chemotherapy, vol. 39, no. 2, pp. 140–146, 1993, doi: 10.1159/000239117.
17. C. Delcaru et al., «Antibiotic resistance and virulence phenotypes of recent bacterial strains isolated from urinary tract infections in elderly patients with prostatic disease,» Pathogens, vol. 6, no. 2, Jun. 2017, doi: 10.3390/patho- gens6020022.
18. G. Muldaeva, A. Beisenayeva, L. Arystan, A. Baymanova, and L. Haydargaliyeva, «The point prevalence survey research of antibacterial drugs' prescription for outpatient treatment of urinary system infections,» Open Access Maced. J. Med. Sci.,vol. 7, no. 15, pp. 2551–2555, Aug. 2019, doi: 10.3889/oamjms.2019.622.
19. A. May et al., «Comparison of the risk of postoperative infection between transurethral vaporesection and transurethral resection of the prostate,» Lasers Surg. Med., vol. 46, no. 5, pp. 405–411, 2014, doi: 10.1002/lsm.22240.
20. Y. H. Li, G. Q. Li, S. M. Guo, Y. N. Che, X. Wang, and F. T. Cheng, «Clinical analysis of urinary tract infection in patients undergoing transurethral resection of the prostate,» Eur. Rev. Med. Pharmacol. Sci., vol. 21, no. 20, pp. 4487–4492, Oct. 2017, Accessed: Jan. 25, 2021. [Online]. Available: https://pubmed.ncbi.nlm.nih.gov/29131269/.

21. M. A. Tolani, A. Suleiman, M. Awaisu, M. M. Abdulaziz, A. T. Lawal, and A. Bello, «Acute urinary tract infection in patients with underlying benign prostatic hyperplasia and prostate cancer,» Pan Afr. Med. J., vol. 36, pp. 1–9, May 2020, doi: 10.11604/pamj.2020.36.169.21038.

22. J. Agbugui, E. Obarisiagbon, and I. Osaigbovo, «Bacteriology of urine specimens obtained from men with symptomatic benign prostatic hyperplasia,» Niger. J. Surg., vol. 22, no. 2, p. 65, 2016, doi: 10.4103/1117-6806.177415.

23. P. P. Mishra, V. Prakash, K. Singh, H. Mog, and S. Agarwal, «Bacteriological profile of isolates from urine samples in patients of benign prostatic hyperplasia and or prostatitis showing lower urinary tract symptoms,» J. Clin. Diagnostic Res.,vol. 10, no. 10, pp. DC16–DC18, Oct. 2016, doi: 10.7860/JCDR/2016/21973.8734.