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ORIGINAL RESEARCH

Spectrum, antibiotic susceptibility pattern, and predisposing factors for urinary tract infections among patients with bladder outlet obstruction due to benign prostatic hyperplasia at a tertiary hospital in northern Tanzania

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Introduction: Urinary tract infections (UTI) are one of the most common infectious conditions encountered by clinicians globally. However, in ageing men, it is uncommon until after 50 years due to bladder outlet obstruction (BOO) caused by benign prostatic hyperplasia (BPH). This study aimed to evaluate the bacterial spectrum, antibiotic susceptibility pattern, and predisposing factors for UTIs in patients with BOO due to BPH at a tertiary hospital in Tanzania.

Materials and methods: This was a hospital-based, analytical, cross-sectional study conducted at a Tanzanian northern zone tertiary hospital from January 2021 to December 2023, including 464 patients whose urine culture results were analysed using structured data and the Statistical Package for the Social Sciences (SPSS) version 25.

Results: Of the 464 patients, the majority were aged 61–80 years, with a mean age of 72.8 ± 9.10. About 44.8% had comorbid conditions. Bacterial isolates were found in 214 patients (44.1%), and 31.5% had indwelling urinary catheters. *Escherichia coli* (29.9%) was the most prevalent organism. The isolated bacteria showed a high sensitivity to meropenem (90%), amikacin (81%), piperacillin/tazobactam (71%), and nitrofurantoin (79%), but high resistance to amoxicillin/clavulanic acid (71%), ceftriaxone (78%), and ciprofloxacin (76%). Catheter use was the only independent predictor for UTIs (p = 0.05).

Conclusion: UTIs in men with prostate enlargement are worsened by the rising antibacterial resistance (ABR), with catheterisation being the main predicting factor. Recommendations include limiting the empirical use of fluoroquinolones, encouraging nitrofurantoin use, and improving catheter care.

Keywords: urinary tract infections, bladder outlet obstruction, prostate enlargement, antibiotic susceptibility, bacterial spectrum

Introduction

Urinary tract infections (UTIs) are a common condition encountered by physicians worldwide, with over 100 000 hospitalisations annually.[1] UTIs account for about 25% of all geriatric hospitalisations and contribute to approximately 6.2% of mortality from infectious diseases, leading to a high financial burden.[1,2]

In males, UTIs remain uncommon until after 50 years, when prostate enlargement, mostly due to benign prostatic hyperplasia (BPH), starts to interfere with the free flow of urine and causes bladder outlet obstruction (BOO). BPH causing BOO increases the risk of UTI due to incomplete bladder emptying, resulting in residual urine and urine stasis, which promote the growth of microorganisms.[3] The global prevalence of UTI in men with benign prostatic enlargement ranges from 4.4% to 44.7%, with an estimated 4/10 men affected in Tanzania.[4,5] Apart from BOO, urethral catheterisation, a common intervention for BOO to relieve obstruction, increases the risk of UTIs by 20% with each day of use.[6]

The common bacteria causing UTIs in patients with BOO due to BPH include *E. coli*, *Pseudomonas* spp., *Staphylococcus aureus*, *Enterococcus* spp., *Klebsiella pneumoniae*, and *Proteus* spp.[7] However, the pattern of bacterial isolates and their antibacterial susceptibility profile varies greatly from one place to another.[8]

While urine culture and sensitivity are the gold standard for diagnosing UTIs, they are often unavailable, especially when results take up to three days to obtain. Consequently, empirical treatment is standard practice. Despite UTI being common among patients with BOO due to BPH in Tanzania, knowledge about the most common bacteria and their susceptibility profile is lacking. As a result, the inappropriate use of antibiotics for empirical treatment adds to the global burden of multidrug-resistant (MDR) pathogens.[9] In Tanzania, high levels of MDR pathogens in UTIs are reported, partly driven by the inappropriate use of antibiotics, including self-treatment.[9,10] This study aimed to discern the common causes of UTIs and their antibiotic susceptibility patterns among elderly men with BOO due to BPH.

Materials and methods

This was a hospital-based, analytical study conducted at Kilimanjaro Christian Medical Centre (KCMC) from January 2021 to December 2023. KCMC is a referral hospital in the northern zone of Tanzania, with established coverage of patients referred from the northern and eastern regions and districts of Tanzania. The hospital attends to approximately 500 patients daily (outpatients and inpatients). It has a well-equipped main clinical laboratory, with a microbiology department that performs various tests, including urine culture and sensitivity testing.

The Urology institute is one of the surgical speciality within KCMC. The institute provides coverage for outpatient visits and has an inpatient capacity of up to 40 beds. The study involved men with BOO due to BPH, with urine culture results collected from January 2021 to December 2023. Independent variables included age, residence, marital status, use of catheters, post-void residual urine, bacteriological profile, and antibacterial susceptibility profile. The dependent variable was bacterial UTIs.

A data extraction sheet was used to gather information on patient characteristics and bacterial and susceptibility profiles. All eligible participants were identified from the Urology Department's records and their recorded hospital registration numbers. The registration numbers were used to trace patients' files and obtain information on demographics, urine culture results, urinary catheter presence, post-void urine volume, and transabdominal ultrasound-weighed prostate volume. All data were extracted and stored confidentially using identification numbers without patient identifiers.

The data was entered, cleaned, and analysed using SPSS version 25. Continuous variables were summarised using measures of central tendency and dispersion, while categorical variables were summarised using proportion and frequency tables. Multivariate logistic regression was applied to detect associations between variables. Statistical significance was set at $p < 0.05$.

Ethical clearance was sought from the Kilimanjaro Christian Medical University College Research Ethics and Review Committee (number PG99/2023). Permission was also obtained from the head of the hospital laboratory services for extracting laboratory results from the laboratory registry.

Results

During the study period, a total of 1 425 subjects were registered. We excluded 871 subjects due to incomplete information, and an additional 90 subjects with coexisting BOO conditions were excluded. The remaining 464 subjects were analysed. The mean age was 72.8 years (standard deviation ± 9.10), with 317 (68.3%) in the 61–80 years age group. Out of 464 subjects, 214 (44.1%) had positive urine culture results (Table I).

The three most common bacterial isolates were *E. coli* (64, 29.9%), *Citrobacter* spp. (44, 20.6%), and *Klebsiella* spp. (38, 17.8%) (Table II).

Table I: Sociodemographic and baseline characteristics of patients (*n* = 464)

Variable	*n*	%
Age (years)		
41–60	43	9.3
61–80	317	68.3
81–100	104	22.4
Mean ± SD	72.8 ± 9.10	
Place of residence		
Kilimanjaro	341	73.5
Arusha	47	10.1
Tanga	28	6
Manyara	9	1.9
Other regions*	39	8.4
Comorbidity		
Comorbid	233	50.2
Non-comorbid	231	49.8
Presence of catheter		
Catheterised	208	44.8
Not catheterised	256	55.2
Post-void residual (ml) (*n* = 256)		
≤ 100	132	28.4
101–200	74	15.9
201–300	30	6.5
> 300	20	4.3
Mean ± SD	125.22 ± 99.32	
Prostate volume (ml)		
< 40	133	28.7
40–80	231	49.8
> 80	100	21.6
Mean ± SD	60.42 ± 35.08	
Urine culture results		
Positive	214	46.1
Negative	250	53.9

* Other regions were Dodoma, Iringa, Tabora, Singida, Shinyanga, Rukwa, Dar es Salaam, and Zanzibar.
SD – standard deviation

Table II: Spectrum of bacteria causing UTI among patients with BOO due to BPH

Uropathogen isolated	*n*	%
Escherichia coli (GN)	64	29.9
Citrobacter spp. (GN)	44	20.6
Klebsiella spp. (GN)	38	17.7
Pseudomonas aeruginosa (GN)	25	11.7
Proteus spp. (GN)	9	4.2
Staphylococcus aureus (GP)	8	3.7
Enterobacter spp. (GN)	6	2.8
Enterococcus spp. (GP)	6	2.8
Serratia spp. (GN)	4	1.9
Coagulase-negative *Staphylococcus* (GP)	3	1.4
Non-fermentative bacilli (GN)	3	1.4
Acinetobacter spp. (GN)	2	0.9
Morganella morganii (GN)	1	0.5
Coliform (GN)	1	0.5

BOO – bladder outlet obstruction, BPH – benign prostatic hyperplasia, GN – Gram-negative, GP – Gram-positive, spp. – species, UTI – urinary tract infection

Table III: Sensitivity profile of bacteria isolated among patients with BOO due to BPH

	Number of sensitive samples, *n* (%)																		
Uropathogen isolated	**CIP**	**AML**	**CRO**	**CEZ**	**CFM**	**CPM**	**CET**	**NIT**	**MEM**	**AMK**	**VAN**	**GEN**	**TET**	**CD**	**ERY**	**CT**	**SXT**	**AMC**	**TZP**
E. coli	12 (24)	4 (13)	11 (22)	12 (36)	0 (0)	9 (39)	9 (31)	42 (79)	44 (90)	50 (81)	0 (0)	33 (61)	2 (67)	0 (0)	0 (0)	0 (0)	7 (16)	12 (29)	24 (71)
Citrobacter spp.	14 (47)	2 (12)	21 (55)	14 (48)	0 (0)	7 (64)	9 (43)	18 (60)	36 (92)	33 (80)	0 (0)	21 (61)	2 (100)	0 (0)	0 (0)	1 (100)	14 (48)	7 (26)	15 (71)
Klebsiella spp.	15 (65)	0 (0)	19 (54)	15 (54)	0 (0)	8 (50)	11 (44)	16 (59)	28 (90)	29 (81)	0 (0)	20 (67)	1 (50)	0 (0)	0 (0)	0 (0)	11 (38)	10 (45)	11 (65)
Pseudomonas spp.	8 (57)	0 (0)	1 (25)	10 (59)	0 (0)	6 (75)	0 (0)	1 (100)	17 (81)	17 (81)	0 (0)	9 (60)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)	14 (82)
Proteus spp.	5 (56)	2 (50)	8 (89)	3 (100)	0 (0)	4 (80)	2 (100)	3 (33)	8 (100)	6 (86)	0 (0)	4 (57)	1 (100)	0 (0)	0 (0)	0 (0)	5 (63)	4 (100)	5 (83)
Staphylococcus spp.	4 (50)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	5 (83)	0 (0)	0 (0)	3 (75)	4 (50)	1 (50)	2 (100)	0 (0)	0 (0)	5 (71)	0 (0)	0 (0)
Enterobacter spp.	3 (60)	0 (0)	2 (40)	3 (100)	1 (100)	1 (50)	3 (75)	1 (20)	5 (100)	6 (100)	0 (0)	1 (33)	1 (100)	0 (0)	0 (0)	0 (0)	1 (20)	1 (25)	3 (100)
Enterococcus spp.	0 (0)	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	5 (100)	1 (50)	1 (100)	3 (60)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Serratia spp.	3 (75)	1 (33)	4 (100)	4 (100)	0 (0)	3 (100)	2 (100)	1 (33)	4 (100)	4 (100)	0 (0)	4 (100)	0 (0)	0 (0)	0 (0)	0 (0)	2 (67)	1 (33)	4 (100)
Coagulase spp.	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (100)	1 (50)	0 (0)	2 (100)	0 (0)	0 (0)	2 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)
GN bacilli	0 (0)	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (67)	0 (0)	0 (0)
Acinetobacter spp.	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	2 (100)	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)	0 (0)
Morganella spp.	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Coliform	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)
Total	65 (43)	11 (16)	67 (43)	63 (52)	1 (20)	38 (54)	37 (43)	96 (66)	148 (88)	150 (82)	8 (67)	98 (61)	9 (69)	4 (67)	1 (17)	1 (100)	47 (35)	38 (35)	76 (74)

AMC – amoxiclav, AMK – amikacin, AML – amoxicillin, BOO – bladder outlet obstruction, BPH – benign prostatic hyperplasia, CD – clindamycin, CET – cefotaxime, CEZ – ceftazidime, CFM – cefixime, CIP – ciprofloxacin, CPM – cefepime, CRO – ceftriaxone, CT – colistin, ERY – erythromycin, GEN – gentamicin, GN – Gram-negative, MEM – meropenem, NIT – nitrofurantoin, spp. – species, SXT – trimethoprim/sulfamethoxazole, TET – tetracycline, TZP – piperacillin/tazobactam, VAN – vancomycin

Table IV: Resistance profile of bacteria isolated among patients with BOO due to BPH

	Number of resistant samples, *n* (%)																	
Uropathogen isolated	**CIP**	**AML**	**CRO**	**CEZ**	**CFM**	**CPM**	**CET**	**NIT**	**MEM**	**AMK**	**VAN**	**GEN**	**TET**	**CD**	**ERY**	**SXT**	**AMC**	**TZP**
E. coli	38 (76)	27 (87)	40 (78)	21 (64)	3 (100)	14 (61)	20 (69)	11 (21)	5 (10)	12 (19)	0 (0)	21 (39)	1 (33)	0 (0)	0 (0)	37 (84)	29 (71)	10 (29)
Citrobacter spp.	16 (53)	15 (88)	17 (45)	15 (52)	0 (0)	4 (46)	12 (57)	12 (40)	3 (8)	8 (20)	0 (0)	13 (39)	0 (0)	0 (0)	0 (0)	15 (52)	20 (74)	6 (29)
Klebsiella spp.	8 (35)	2 (100)	16 (46)	13 (46)	0 (0)	8 (50)	14 (56)	11 (41)	3 (10)	7 (19)	1 (100)	10 (33)	1 (50)	0 (0)	0 (0)	18 (62)	12 (55)	6 (35)
Pseudomonas spp.	6 (43)	0 (0)	3 (75)	7 (41)	0 (0)	2 (25)	1 (100)	0 (0)	4 (19)	4 (19)	0 (0)	6 (40)	0 (0)	0 (0)	0 (0)	1 (100)	1 (50)	3 (18)
Proteus spp.	4 (44)	2 (50)	1 (11)	0 (0)	0 (0)	1 (20)	0 (0)	6 (67)	0 (0)	6 (14)	0 (0)	3 (43)	0 (0)	0 (0)	0 (0)	3 (37)	0 (0)	1 (17)
Staphylococcus spp.	4 (50)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (17)	0 (0)	0 (0)	1 (25)	4 (50)	1 (50)	0 (0)	3 (100)	2 (29)	0 (0)	0 (0)
Enterobacter spp.	2 (40)	2 (100)	3 (60)	0 (0)	0 (0)	1 (50)	1 (25)	4 (80)	0 (0)	0 (0)	0 (0)	2 (67)	0 (0)	0 (0)	0 (0)	4 (80)	3 (75)	0 (0)
Enterococcus spp.	2 (100)	1 (33)	2 (100)	1 (100)	1 (100)	1 (100)	1 (100)	0 (0)	1 (50)	0 (0)	2 (40)	0 (0)	1 (50)	1 (100)	1 (100)	2 (100)	1 (100)	0 (0)
Serratia spp.	1 (25)	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (67)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (33)	2 (67)	0 (0)
Coagulase spp.	2 (100)	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)
GN bacilli	1 (100)	3 (100)	2 (100)	1 (50)	0 (0)	1 (100)	1 (50)	2 (100)	3 (100)	1 (33)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1 (33)	3 (100)	1 (100)
Acinetobacter spp.	0 (0)	1 (100)	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)	1 (100)	1 (50)	0 (0)
Morganella spp.	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
Coliform	1 (100)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)

AMC – amoxiclav, AMK – amikacin, AML – amoxicillin, BOO – bladder outlet obstruction, BPH – benign prostatic hyperplasia, CD – clindamycin, CET – cefotaxime, CEZ – ceftazidime, CFM – cefixime, CIP – ciprofloxacin, CPM – cefepime, CRO – ceftriaxone, ERY – erythromycin, GEN – gentamicin, GN – Gram-negative, MEM – meropenem, NIT – nitrofurantoin, spp. – species, SXT – trimethoprim/sulfamethoxazole, TET – tetracycline, TZP – piperacillin/tazobactam, VAN – vancomycin

Table V: Predisposing factors associated with UTI among men with BOO due to BPH

	Isolated bacteria	Crude OR	*p*-value	Adjusted OR		*p*-value
Factor	Yes	No	95% CI		95% CI	
Presence of catheter						
Yes	146 (31.5)	62 (13.4)	0.15 (0.10 to 0.23)	< 0.001	6.39 (4.22 to 9.68)	< 0.001
No	68 (14.7)	188 (40.5)	1.0			
Comorbidity status						
Comorbid	107 (23.1)	126 (27.2)	1.02 (0.71 to 1.46)	0.93	-	-
Non-comorbid	107 (23.1)	124 (26.7)	1.0			
Post-void residual volume (ml)						
> 180	19 (7.4)	42 (16.4)	0.74 (0.39 to 1.39)	0.35	-	-
≤ 180	49 (19.1)	146 (57.0)	1.0			
Prostate volume (ml)						
> 80	58 (12.5)	46 (10.6)	0.66 (0.43 to 1.01)	0.05	1.0 (0.61 to 1.63)	0.99
≤ 80	156 (33.6)	201 (43.3)	1.0			
Patient age (years)						
> 75	94 (20.3)	88 (19.0)	0.69 (0.48 to 1.01)	0.05	0.83 (0.54 to 1.26)	0.37
≤ 75	120 (25.9)	162 (34.9)	1.0			

BOO – bladder outlet obstruction, BPH – benign prostatic hyperplasia, CI – confidence interval, OR – odds ratio, UTI – urinary tract infection

Antibacterial sensitivity profile of bacteria causing UTI among men with BOO due to BPH

The most isolated bacteria showed the highest sensitivity towards meropenem (90%), amikacin (81%), nitrofurantoin (79%), and piperacillin/tazobactam (71%) (Table III).

Antibacterial resistance profile of bacteria causing UTI among men with BOO due to BPH

From the resistance profile, tremendous resistance was shown towards the commonly prescribed antibiotics ceftriaxone (78%), and ciprofloxacin (76%) (Table IV).

Predisposing factors for bacterial UTI among men with BOO due to BPH

Men with an indwelling catheter had higher odds (odds ratio 6.39, confidence interval 4.22 to 9.68) of being diagnosed with UTI than those without a catheter. Comorbidities such as diabetes mellitus, stroke, hypertension, Parkinson's disease, post-void residual volume > 180 ml, prostate volume, and age were found to be positively associated with UTI; however, their association did not reach statistical significance (Table V).

Discussion

UTIs remain a significant health challenge globally, particularly among elderly men. Our study sought to identify the bacterial isolates and their antibiotic susceptibility patterns among patients with BOO due to BPH. The study's findings underscore the complexity of managing UTIs in this cohort, highlighting key factors such as antibacterial resistance (ABR), an indwelling catheter as an UTI risk, and the bacteriological profiles in different geographical settings.

A notable finding in our study is the high prevalence of Gram-negative bacterial isolates, with *E. coli*, *Klebsiella spp.*, and *Citrobacter spp.* most frequently identified. These findings align with previous studies in sub-Saharan Africa, where *E. coli* is commonly implicated in UTIs among male patients with BOO.[6] This pattern also reflects global trends, where *E. coli* remains the leading causative organism in UTIs, although regional variations in bacterial profiles exist.[8]

The predominance of Gram-negative organisms can be attributed to the host intestinal bacterial flora as the likely source of these organisms, and their pili and fimbriae may be a major reason for their virulence in the urinary tract.[7,11] The relatively low occurrence of Gram-positive cocci, such as *Staphylococcus aureus*, mirrors findings from other studies, which report a less frequent role of these organisms in UTIs among patients with BOO.[12,13]

The presence of an indwelling catheter as a risk for UTIs is particularly pronounced in this cohort, with the use of urinary catheters identified as a strong independent predisposing factor. Similar findings were reported by Akinpelu et al.[14] and Nasution et al.[15] The reason for this might be that urethral catheterisation is one of the most common interventions for relieving urinary retention, a sequela of BOO.[14,15]

There is a strong link between developing UTI and the duration of catheter use, where prolonged use increases UTI risk.[15] Although the duration of catheterisation was not evaluated in this study, we believe that most of our cases had been catheterised before reaching our tertiary centre. Catheterisation, while essential for managing BOO, inadvertently increases the risk of introducing pathogenic organisms into the urinary tract, with each additional day of catheter use compounding this risk.[11] This underscores the need for judicious catheter management strategies, including the timely removal and use of alternative urinary drainage methods where possible to minimise the risk of infection.[15,16]

Moreover, the antibiotic susceptibility patterns revealed in this study highlight a troubling trend of increasing resistance to

commonly prescribed antibiotics, including fluoroquinolones and cephalosporins. The high resistance rates to ciprofloxacin (76%) and ceftriaxone (78%) in isolates such as *E. coli* and *Klebsiella spp.* are concerning, particularly in the context of empirical treatment practices prevalent in resource-limited settings, like Tanzania.[17] These findings are consistent with the global rise in antimicrobial resistance, particularly in low- to middle-income countries, where the inappropriate and overuse of antibiotics contributes significantly to the emergence of MDR pathogens.

The study's identification of meropenem and amikacin as the most effective agents against these isolates provides a valuable insight for clinical management. However, the increasing reliance on these broad-spectrum antibiotics may exacerbate the problem of resistance over time.[3,16,18] The findings also highlight the importance of continuous surveillance and the development of local antibiograms to guide appropriate empirical treatment, as the resistance profiles of pathogens can vary considerably by region and institution.[8]

While comorbidities such as diabetes mellitus, stroke, and hypertension were not found to have a statistically significant association with UTI occurrence in this study, their role in predisposing individuals to recurrent infections remains important. Patients with these underlying conditions often experience impaired immune responses and may face difficulties in managing urinary retention, further exacerbating the risk of UTI.[1]

Similarly, the study found that prostate volume and post-void residual urine were not strongly associated with UTI risk, contrary to findings from other studies that have linked these factors to increased infection rates. This discrepancy may be due to regional differences in patient populations, the relatively small number of patients with extremely high prostate volumes, or significant post-void residual volumes in our cohort.

The lack of access to urine culture and sensitivity testing in many resource-limited settings, as reported in this study, represents a major challenge in UTI management. Without reliable diagnostic tools, clinicians often resort to empirical antibiotic therapy, which may not be effective.[13,19] This practice, while necessary in certain circumstances, highlights the urgent need for improved diagnostic infrastructure and the development of more rapid, cost-effective methods for identifying urinary pathogens and their resistance profiles. Furthermore, the widespread use of empirical antibiotics, especially in rural or underserved regions, may contribute to the increasing prevalence of MDR organisms, as evidenced by our study's findings.

The male population with BOO presents a unique challenge regarding UTI prevention and management. Ageing is associated with a decline in immune function and an increased susceptibility to infections, compounded by factors such as prostatic enlargement, comorbidities, and the frequent need for catheterisation.[1,13] Our findings emphasise the importance of comprehensive management strategies, which not only address the immediate UTIs but also aim to prevent antimicrobial resistance and recurrence through appropriate antibiotic stewardship, as well as optimal catheter management.

Conclusion

UTIs are common among men with BOO due to BPH, with *E. coli*, *Citrobacter* spp., and *Klebsiella* spp. commonly isolated. Catheterisation is a significant risk factor for UTIs among men with BOO due to prostate enlargement. The highest bacterial sensitivity was observed towards meropenem, amikacin, and nitrofurantoin, with alarming levels of resistance to the most prescribed antibiotics, ciprofloxacin and ceftriaxone. Recommendations include reducing the use of fluoroquinolones and considering nitrofurantoin for empirical treatment, while reserving carbapenems for severe cases. Effective catheter care is central to preventing UTIs. To improve patient care, surveillance of local antimicrobial resistance and the creation of region-specific treatment guidelines are crucial.

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Ethical approval

Ethical approval for the study was granted by the Kilimanjaro Christian Medical University College Research Ethics and Review Committee (number PG99/2023) in Moshi, Tanzania.

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