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Prevalence and Antibiotic Resistance Patterns of Bacteriuria in Patients Attending Bharatpur Hospital, Nepal

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ABSTRACT

Background

Urinary tract infections (UTIs) are a major global health issue, causing significant morbidity. Early detection and effective treatment are crucial, but rising antibiotic resistance poses a challenge. This study investigates the prevalence of bacteriuria, demographic variations, and antimicrobial resistance patterns to guide better UTI management strategies.

Methods

A cross sectional study was carried out among patient attending Bharatpur Hospital for a period of five months. A total of 1,111 midstream urine samples were analyzed. Bacterial isolates were identified, and their distribution was analyzed to evaluated the demographic variations in UTI prevalence and resistance pattern.

Results

Among 1,111 urine samples, 693 (62.38%) were from females and 418 (37.62%) from males. Culture positivity was higher in females (76%) than males (24%), with sexually active women most affected (54.16%). E. coli (80.61%) was the predominant isolate, followed by *K. pneumoniae* (9.38%) and other less common bacteria. Antibiotic resistance was high, with *E. coli (*71.4%) and *K. pneumoniae* (85.7%) showing significant multidrug resistance (MDR). Nitrofurantoin was the most effective antibiotic, while cefixime and ciprofloxacin showed high resistance.

Conclusions

Bacteriuria was more prevalent in females, with E. coli as the dominant uropathogen. High multidrug resistance, particularly to cefixime and ciprofloxacin, highlights the need for further research, regular surveillance, and effective antibiotic stewardship.

Keywords: antibiotics; bacteriuria; multi-drug resistance; morbidity.

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INTRODUCTION

Urinary tract infections (UTIs) are among the most prevalent bacterial infections, affecting millions worldwide and posing a significant healthcare urden. [1] Bacteriuria is a key indicator of UTIs and can lead to serious complications if left untreated.[2,3] The increasing prevalence of antimicrobial resistance (AMR) among uropathogens further complicates treatment, reducing the efficacy of commonly used antibiotics. [4,5] Identifying the prevalence of bacteriuria and understanding the antibiotic resistance patterns of uropathogens are critical for effective management and antibiotic stewardship. In Nepal, the burden of antimicrobial resistance (AMR) is rising due to widespread use of empirical antibiotics and it presents a major challenge. Escherichia oli remains the predominant uropathogen [6] , however, studies have reported increasing resistance to commonly used antibiotics, including fluoroquinolones, cephalosporins, and beta-lactams [7,8,9] This growing resistance not only complicates treatment but also increases the risk of recurrent infections and hospitalizations. Bharatpur Hospital, a tertiary referral center in central Nepal, provides care to a diverse patient population, making it an ideal site for assessing bacteriuria profiles and local antibiotic resistance patterns. Understanding the local prevalence of bacteriuria and antibiotic susceptibility profiles in this setting is crucial for optimizing empirical therapy and improving patient outcomes This study aims to determine the prevalence of bacteriuria and evaluate the antibiotic resistance patterns of uropathogens among patients attending Bharatpur Hospital, Nepal. The findings will contribute to national AMR surveillance efforts, aid clinicians in selecting appropriate empirical treatments, and support the implementation of effective antibiotic stewardship programs to combat drug-resistant UTIs.

METHODS

This is a cross-sectional study done at Bharatpur Hospital between August 2024 and December 2024, after ethical clearance from institutional review committee. The study population included both inpatient and outpatient individuals across all age groups who exhibited clinical suspicion of UTIs. Midstream urine samples were collected and subjected to culture-based analysis. Bacterial identification was performed using microscopic examination, Gram staining, and biochemical testing. Antimicrobial susceptibility testing (AST) was conducted using the disk diffusion method in accordance with standard guidelines.

RESULTS

Among the 1,111 tested individuals, 37.62% were male and 62.38% female. Bacteriuria was detected in 14.3% (158/1,111) of cases, with females positive accounting for 76% (120/158) and males 24% (38/158). Among females, sexually active age group (20-45) had the highest positivity (54.16%), followed by menopausal (above 46), (33.34%) and adolescent (12.5%) groups (Table 1).

Table 1. Demographic distribution.

Risk group	Male	Female	Total n(%)
Frequency (%)	418(37.62)	693(62.38)	1111(100)
Culture positive n(%)	38(24.0)	120(76.0)	158(100)

Among Female			Total n(%)
Adolescent n(%)	Menopause n(%)	Sexually active n(%)	
88(12.70)	233(33.62)	372(53.68)	693(100)
15(12.5)	40(33.34)	65(54.16)	120(100)

E. coli was the most prevalent isolate (80.61%), followed by *K. pneumoniae* (9.38%). *E. faecalis*, *P. aerogenes* (2.5% each), P. vulgaris (1.25%), P. mirabilis (0.63%), and S. aureus (3.13%) were less common (Figure 1).

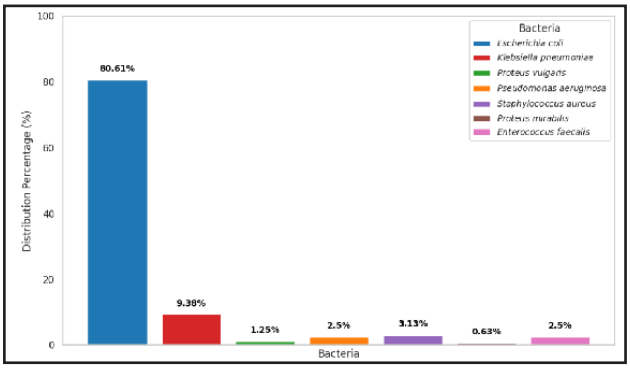

Figure 1. Distribution of Bacteria.

E. coli (MDR: 71.4%) showed high resistance to cefixime (66.2%) and ceftriaxone (46.9%) but remained

susceptible to nitrofurantoin (6.2%) and gentamicin (8.5%). K. pneumoniae had the highest MDR rate (85.7%), with strong resistance to ciprofloxacin (57.1%) and cefixime (57.1%). P. vulgaris (MDR: 71.4%) was fully resistant to nitrofurantoin but susceptible to ciprofloxacin and ceftriaxone. E. faecalis (MDR: 42.9%) and S. aureus (MDR: 57.1%) showed 100% resistance to ceftriaxone and cefixime. P. mirabilis was completely resistant to nitrofurantoin,

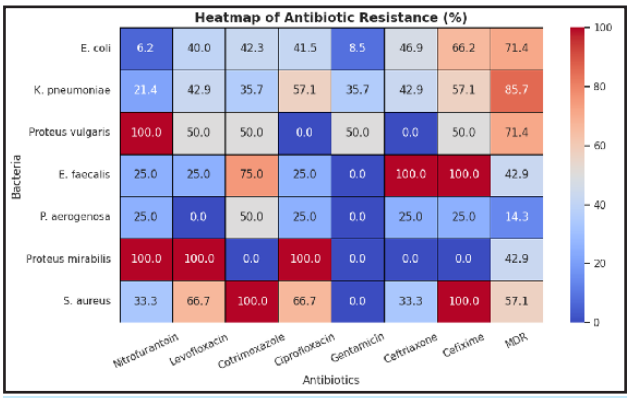

Figure 2. Antibiotics resistance pattern.

levofloxacin, and ciprofloxacin. P. aeruginosa had the lowest MDR rate (14.3%) (Figure 2).

DISCUSSION

In this study, the UTI prevalence was 14.3%, lower than the 25.52% reported at Seti Zonal Hospital[15] and significantly lower than the 29.5% found in a cross-sectional study at Bharatpur Hospital (2017–2018). In contrast, a study in Nigeria reported a much higher prevalence (60%)[16], while UTI prevalence in Latin America was 10.6%, with healthcare-associated cases reaching 19.6%. These variations may be influenced by geographical differences, hygiene practices, and socio-economic conditions. This study found a significant disparity in UTI prevalence between males and females with UTIs being more than three times as common in females. Similar findings were reported by[9], where 61.6% of UTIs occurred in females and 38.4% in males. These results align with previous studies[18], which indicate that UTIs are more frequent in females due to anatomical and physiological factors.[11] Our study found the reproductive phase of female had 1.6 times more cases than menopause and 4.2 times more than adolescence, highlighting increased susceptibility. That could be due to, in premenopausal women, recurrent UTIs are linked to factors such as sexual activity, spermicide use, maternal UTI history, and childhood UTIs. In postmenopausal women, estrogen deficiency plays a key role, along with a history of UTIs before menopause.[12] This study found a high prevalence of uropathogens, with E. coli as the dominant isolate. This is likely due to its natural habitat in the gastrointestinal tract and its proximity to the urethra, facilitating colonization. Pathogenic uropathogenic E. coli (UPEC) possesses virulence factors like adhesins (fimbriae/pili), enabling attachment to the urinary tract and resistance to urine flow.[13] These findings align with studies in other regions of Nepal, where E. coli was also the most prevalent UTI pathogen.[14] This consistency may be linked to common risk factors, including hygiene practices, access to clean water, and antibiotic misuse, contributing to E. coli dominance in UTIs.The relatively low prevalence of Klebsiella pneumoniae observed in this study aligns with findings from other studies in Nepal.[15] The presence of Enterococcus faecalis, Proteus vulgaris, and Staphylococcus aureus suggests regional variations in bacterial profiles, likely influenced by environmental factors, healthcare practices, and antibiotic prescribing habits. In contrast, studies from urban hospitals have reported higher occurrences of *Klebsiella pneumoniae*, highlighting the impact of geographic and demographic factors on bacterial distribution.[16]

The antibiotic resistance profiles in this study highlight concerning patterns across bacterial species. *E. coli* (n=130) showed the highest resistance to Cefixime (66.2%) and Ceftriaxone (46.9%), commonly prescribed for UTIs. Resistance to Levofloxacin (40%) and Ciprofloxacin (41.5%) was also significant. However, Nitrofurantoin (6.2%) and Gentamicin (8.5%) showed low resistance, making them potential empirical treatment options. These findings align with other studies reporting 71% and 78% resistance to cefixime and ciprofloxacin in pediatric uropathogenic E. coli isolates, likely due to extended-spectrum beta-lactamase (ESBL)-producing strains.[17] Klebsiella pneumoniae (n=14)

exhibited high resistance to Ciprofloxacin and Cefixime (57.1%), while Nitrofurantoin (21.4%) and Gentamicin (35.7%) showed lower resistance, suggesting possible treatment alternatives. However, variations exist, as other studies reported 60% Nitrofurantoin resistance while Gentamicin resistance remained consistent.[18] Compared to data from Koshi Zonal Hospital, Ciprofloxacin resistance (61.9%) was similar, but Cefixime resistance (18.8%) was significantly lower, possibly due to differences in antibiotic policies and patient demographics.[19] Proteus vulgaris (n=2) exhibited complete resistance to Nitrofurantoin and moderate resistance to most antibiotics, except for Ciprofloxacin and Ceftriaxone, where no resistance was observed. Enterococcus faecalis (n=4) was highly resistant to Cotrimoxazole (75%) and cephalosporins (100%), but relatively susceptible to Gentamicin (25%) and Ciprofloxacin (25%), consistent with global aminoglycoside susceptibility patterns. Klebsiella aerogenosa (n=4) showed moderate resistance (25%-50%) to most antibiotics but remained fully susceptible to Gentamicin and Levofloxacin. Proteus mirabilis (n=1) demonstrated 100% resistance to Nitrofurantoin, Levofloxacin, and Ciprofloxacin, raising treatment concerns. Staphylococcus aureus (n=3) showed high resistance to Cotrimoxazole and Cefixime (100%), moderate resistance to Levofloxacin (66.7%), but minimal resistance to Gentamicin and Ceftriaxone.

Multidrug resistance (MDR) was alarmingly high, with E. coli and Proteus vulgaris (71.4%) exhibiting resistance to multiple antibiotic classes, reflecting evolving resistance mechanisms such as ESBL production and efflux pump activation.[20] The highest MDR rate was observed in Klebsiella pneumoniae (85.7%), posing a significant treatment challenge. This resistance is attributed to enzymatic inactivation, porin loss, efflux pump overexpression, and biofilm formation.[21] These findings underscore the urgent need for antimicrobial stewardship and continuous surveillance to combat rising resistance trends. The study observed 42.9% MDR in Enterococcus faecalis and Proteus mirabilis and 57.1% in Staphylococcus aureus, though some studies report 100% MDR in these species.[22] This variation may stem from differences in antibiotic selection for susceptibility testing and genetic variability among bacterial strains. Staphylococcus aureus, often linked to methicillin resistance, has shown 79% MDR in other studies.[23]

In contrast, Klebsiella aerogenosa exhibited the lowest MDR (14.3%), suggesting a limited ability to develop resistance compared to Klebsiella pneumoniae. This aligns with reports indicating moderate MDR rates in meta-analyses.[24] Proper infection control measures are essential to prevent the spread of MDR Klebsiella aerogenosa in healthcare settings.

CONCLUSIONS

To combat rising resistance, rational antibiotic use, routine urine culture testing, and strict infection control practices are crucial. Promoting low-resistance antibiotics like Nitrofurantoin and Gentamicin, alongside frequent surveillance and public awareness campaigns, can help mitigate resistance. Investments in diagnostic facilities, hospital hygiene, and new antibiotic research are vital to improving treatment outcomes and reducing MDR-related complications.

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Conflict of interest: None

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