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Research Article

Antimicrobial drug resistance pattern of uropathogens isolated from patients with urinary tract infection at Chitwan Medical College

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ABSTRACT

Background & Objectives:

Urinary tract infections (UTIs) represent one of the most frequently occurring bacterial infections in all age ranges, with their incidence rising significantly in the elderly. Antibiotic resistance in recent years has become a major threat to public health globally. This study aimed to identify the antimicrobial drug resistance pattern of uropathogens isolated from patients with UTI.

Material and Methods: A descriptive cross-sectional study was conducted to assess antimicrobial drug resistance pattern of uropathogens isolated from patients with UTI at chitwan medical college, from 15st January 2025 to 15th April 2025. A total of 140 reports with culture positive sample with UTI that came to microbiology lab during the study period and those fulfilling the inclusion criteria was included in the study. Data regarding patient information, bacterial isolates, their susceptibility to various antibiotics and other information were collected, compiled, entered and analyzed. The results are presented in frequency and percentage.

Results: Among the identified pathogens, Escherichia coli was the most frequently isolated organism. The highest resistance among these isolates was observed against Nalidixic acid (70.3%) followed by Ampicillin (67.3%), Cefalotin (63.4%) and Ticarcillin (61.4%). UTI was found to be more prevalent in the female gender and majority of the patients were from 61-75 years.

Conclusion: E. coli was the most commonly isolated organism. Urinary pathogenesis showed resistance to commonly used antibiotics.

Keywords: Antimicrobial Resistance, E. coli, Urinary tract infection

INTRODUCTION

UTI is considered as the chiefly encountered bacterial infections in both primary care and hospital settings [1]. UTIs are more prevalent in females than in males, primarily because the female urethra is structurally shorter [2]

and close anatomical proximity between the genital tract and the urethra [3].

Globally, approximately 150 million individuals are diagnosed with UTIs each year, leading to an estimated healthcare expenditure of over 6 billion dollars annually [4]. In Nepal, it is estimated that approximately 13% to 37% of adults seek hospital care for UTIs [5-7].

Among the various uropathogens, the most frequently isolated organisms include Escherichia coli, Enterococcus faecalis, Staphylococcus aureus, Enterococcus species, and Klebsiella species [8-10]. However, many of these organisms have developed resistance to a wide range of antimicrobial agents, including cotrimoxazole, ampicillin, amoxicillin, and nitrofurantoin [9-12]; piperacillin and nalidixic acid [9-13]; erythromycin and chloramphenicol [10]; fluoroquinolones [14-15]; tetracyclines and carbenicillin [16]; as well as third-generation cephalosporins [17].

Even newer and more potent antimicrobial agents are not exempt from emerging resistance, thereby narrowing effective treatment options to a limited group of drugs such as carbapenems, colistin, and Fosfomycin [18].

In many regions of Nepal, access to urine culture and antimicrobial susceptibility testing remains inadequate, resulting in frequent misdiagnosis and inappropriate antibiotic use including self-medication for UTIs [19].

UTIs are a major public health concern, especially in resource-limited settings like Nepal where diagnostic facilities are often unavailable. The primary aim of this study is to assess the prevalence, antimicrobial resistance patterns, and common causative organisms of UTIs among patients attending CMC. This study seeks to generate evidence that can guide the rational use of antibiotics, improve diagnosis and treatment practices, and ultimately reduce the burden of UTIs in the community.

MATERIALS AND METHODS

A descriptive cross-sectional study was conducted to assess antimicrobial drug resistance pattern of uropathogens isolated from patients with urinary tract infection at chitwan medical college, from 15st January 2025 to 15th April 2025. Convenience sampling method was utilized to collect data. A total of 140 reports available during the specified study period was included in this study. All culture positive sample reports with UTI that came to microbiology lab during the study period and those fulfilling the inclusion criteria was included in the study. Infection reports belonging to all the age group and both the sex were reviewed during the study. The samples were processed using standard microbiological procedures and protocols. All reports with a diagnosis of UTI and culture positive were included in the study. Patients with urine culture reports showing no growth of microorganisms were excluded from the study.

Prior to data collection, the study was approved by Institutional Review Committee of Chitwan Medical College (Ref No. CMC-IRC/081/082/094). Data regarding patient information, bacterial isolates, their susceptibility to various antibiotics and other information were collected, compiled, entered and analyzed using Statistical Package for Social Sciences (SPSS) version-23.0 and Microsoft office excel 2010. The

results are presented in frequency and percentage.

RESULTS

During the study period 140 data were collected, out of them 97 (69%) were female and 43 (31%) were male indicating that UTI is slightly more prevalent in the female gender as shown in Fig.1. Their mean age was 52.49±20.97. Majority of the patients were from 61-75 years (25.7%) and least between 1-15years (2.9%) are presented in Table 1.

Table 1: Age-range distribution of study population

Age range	Frequency	Percentage
1-15	4	2.9
16-30	26	18.6
31-45	20	14.3
46-60	32	22.9
61-75	36	25.7
76 and above	22	15.7

Among the identified pathogens, Escherichia coli was the most frequently isolated organism, comprising 72.1% of the cases. This was followed by Klebsiella pneumoniae ssp pneumoniae (18.6%), Enterobacter aerogenes (2.1%) respectively as shown in Table 2.

Table 2: Micro-organism isolated

Micro-organism	Frequency	Percentage
E coli	101	72.1
Klebsiella pneumoniae ssp pneumoniae	26	18.6
Enterobacter cloacae complex	2	1.4
Pseudomonas aeruginosa	1	.7
Serratia fonticola	2	1.4
Citrobacter koseri	1	.7
Klebsiella oxytoca	2	1.4
Proteus mirabilis	1	.7
Enterobacter aerogenes	3	2.1
Citrobacter freundii	1	.7
Total	140	100.0

In the present study, E. coli was isolated in 54.4% of urine culture-positive cases. The

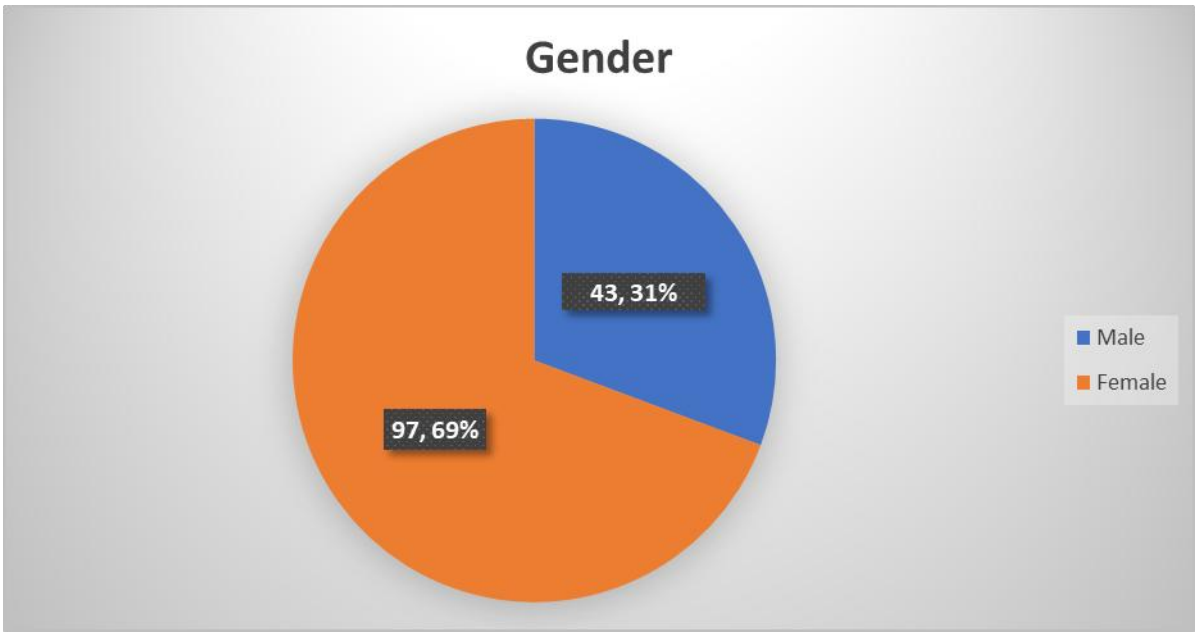

Figure 1: Gender wise distribution of study population (n=140)

highest resistance among these isolates was observed against Nalidixic acid (70.3%) as shown in Table 3.

In this study, Klebsiella species were found to be the second common pathogen causing UTI among all isolates. The highest resistance for this pathogen was observed against Ticarcillin (88.5%) as shown in Table 3.

Table 3: Antibiotic resistance with isolated microorganism

	E coli n=101 n (%)	Klebsiella pneumoniae ssp pneumoniae n=26 n(%)	Enterobacter cloacae complex n=2 n(%)	Serratia fonticola n=2 n(%)	Citrobacter koseri n=1 n(%)	Klebsiella oxytoca n=2 n(%)	Proteus mirabilis n=1 n(%)	Enterobacter aerogens n=3 n(%)	Citrobacter freundii n=1 n(%)
Amikacin	10 (9.9)	4 (15.4)	1 (50)			1 (50)		1 (33.3)	
Amoxicillin/ Clavulanic Acid	25 (24.8)	5 (19.2)	1 (50)		1 (100)	1 (50)		3 (100)	1 (100)
Ampicilin	68 (67.3)	22 (84.6)	1 (50)	2 (100)		1 (50)	1 (100)	3 (100)	1 (100)
Cefalotin	64 (63.4)	9 (34.6)	2 (100)	2 (100)	1 (100)	1 (50)		3 (100)	1 (100)
Cefixime	61 (60.4)	8 (30.8)	2 (100)	2 (100)		1 (50)		3 (100)	1 (100)
Cefoxitin	32 (31.7)	7 (26.9)	1 (50)	2 (100)		1 (50)		2 (66.7)	1 (100)
Ceftazidime	41 (40.6)	6 (23.1)	1 (50)	1 (50)		1 (50)		3 (100)	1 (100)
Ceftriaxone	57 (56.4)	7 (26.9)	1 (50)	2 (100)		1 (50)		2 (66.7)	
Ciprofloxacin	55 (54.5)	12 (46.2)	1 (50)	2 (100)		1(50)	1 (100)	1 (33.3)	
Ertapenem	8(7.9)	6(23.1)	1(50)	2(100)		2(100)		1 (33.3)	
Fosfomycin	0	5 (19.2)	2 (100)	1 (50)		1 (50)		1 (33.3)	
Gentamycin	15 (14.9)	6 (23.1)	1 (50)	2 (100)	1 (100)	1 (50)		2 (66.7)	
Nalidixic Acid	71 (70.3)	10 (38.5)	1 (50)	2 (100)		1 (50)		1 (33.3)	
Nitrofurantoin	2 (1.9)	10 (38.5)	1 (50)	1 (50)		2 (100)	1 (100)	2 (66.7)	
Norfloxacin	49 (48.5)	9 (34.6)	1 (50)	1 (50)		1 (50)		2 (66.7)	
Ofloxacin	51 (50.5)	9 (34.6)	1 (50)	1 (50)		1 (50)		3 (100)	1 (100)
Piperacillin / Tazobactam	25 (24.8)	9 (34.6)	1 (50)	2 (100)	1 (100)	1 (50)		3 (100)	1 (100)
Ticarcillin	62 (61.4)	23 (88.5)	1 (50)	2 (100)		2 (100)		1 (33.3)	
Trimethoprim / Sulfamethoxazole	31 (30.7)	7 (26.9)	1 (50)	2 (100)		1 (50)		2 (66.7)	

DISCUSSION

The result of our study indicates that UTI is more prevalent in female (69%) than male gender (31%). Similar result has been reported by other researchers where prevalence of female was more than male [20,21]. This may be because the female urethra is structurally shorter and less effective at preventing bacterial entry [2]. This increased susceptibility may also be attributed to the close anatomical proximity between the genital tract and the urethra [3].

In the present study, majority of the UTI cases were from 60-75 years of age. This finding is comparable to the previous study done in Nepal where UTI prevalence was higher in the age group above 60 years (34%) [22]. The increased prevalence of UTIs in older adults may be influenced by age-associated alterations in the urinary system and the presence of other underlying health conditions [23,24]. This result gives an indication that advanced age is risk factor for development of UTI in Nepal.

As per the results perceived in this study, the most prevailing organism was E. coli (72.1%). The finding of this study matches with the findings of other study done by Baral et al. [25] where similar results were mentioned (81.3%).

The findings in this study clearly suggests that Klebsiella pneumoniae ssp pneumoniae (18.6%) as the second commonest UTI causing organism and the similar result has been reported in a survey by Tantry et al. [26] In contradiction to this, a study done in Nepal claimed Citobacter spp. as the second most common organism [25].

In the present study, E. coli was isolated in 54.4% of urine culture-positive cases. The highest resistance among these isolates was observed against Nalidixic acid (70.3%) and Ampicillin (67.3%), followed by Cefalotin (63.4%). This was in line with the study conducted by Mohammed et al. where similar type of results was found [27]. This finding was in contrast to the studies done by Habte at el. [28] where high level of resistance was found with amoxicillin and co-trimoxazole. Conversely, Nitrofurantoin showed the greatest effectiveness, with 98.1% of E. coli isolates being sensitive to it, making it the preferred antibiotic based on susceptibility patterns. This corresponds with the data obtained by other investigators [29].

In this study, Klebsiella species were found to be the second common pathogen causing UTI among all isolates. The highest resistance for this pathogen was observed against Ticarcillin (88.5%) followed by Ampicillin (84.6%) which was in accordance with the study done by Manjunath et al. [30]. On the other hand, Amikacin demonstrated the highest level of efficacy, with 84.6% of Klebsiella pneumoniae ssp pneumoniae isolates showing sensitivity to it which was consistent with prior study where amikacin (82.24%) showed highest efficacy with Klebsiella pneumoniae ssp pneumoniae isolates. This indicates that Amikacin could be considered the most suitable antibiotic based on the observed susceptibility profile for this pathogen [22].

The least isolated species in our study was found to be P. mirabilis, Citrobacter freundii and Citrobacter koseri and most of the commonly used antibiotics have shown resistance against these organisms which is in line with the study done by Jamil et al. [31]

This study is, however, not devoid of limitation. This was a hospital-based study with only 140 patients, and it included data from one tertiary hospital. To find out the true prevalence of UTI across the country,

larger studies involving multiple centers are needed.

CONCLUSION

This study identified E. coli as the most common causative organism of urinary tract infections. Notably, a high level of resistance to nalidixic acid was observed among E. coli isolates. Furthermore, significant resistance patterns were also noted in other uropathogens, indicating a growing concern of antimicrobial resistance. These findings highlight the urgent need for continuous surveillance, rational use of antibiotics, and the development of updated, evidence-based treatment guidelines to effectively manage UTIs and combat the rising threat of antibiotic resistance.

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