MedS Alliance
Journal of Medicine and Medical Sciences
https://doi.org/10.3126/mjmms.v1i2.46496

Original Investigation

Antibiotic Susceptibility Pattern of Bacterial Uropathogens causing Urinary Tract Infection in Patients attending Provincial Hospital, Janakpurdham, Nepal

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ARTICLE INFO

Article history:
Received: 29 October 2021
Revised: 11 December 2021
Accepted: 29 December 2021

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Citation:
Jha S K, Thakur S K, Yadav L N, Kumari J. Antibiotic Susceptibility Pattern of Bacterial Uropathogens causing Urinary Tract Infection in Patients attending Provincial Hospital, Janakpurdham, Nepal. MedS. J. Med. Sci. 2021;1(2):46-50.

ABSTRACT

INTRODUCTION: Distribution and susceptibility of UTI-causing pathogen varies according to place and time. Area specific monitoring studies, aimed to gain knowledge about the type of uropathogens and their susceptibility pattern, help clinicians choose the correct empirical treatment and reduce antibiotic resistance as well as treatment time and financial burden. **MATERIALS AND METHODS:** A hospital based cross-sectional study was carried out in provincial hospital, Madhesh province, Janakpurdham, Nepal from May 2021 to September 2021. Urine samples from 450 clinically suspected cases of UTI were collected and tested bacteriologically following standard procedure. Antibiotic susceptibility test was performed by the disk diffusion according to Clinical Laboratory Standard Institute (CLSI) guidelines. **RESULTS:** Of 450 urine samples,110(24.4%) showed significant bacterial growth. E. coli 57(51.82%) was the most common isolated followed by Pseudomonas aeruginosa18(16.36%). Most of the isolates were sensitive to Amikacin (AK), Amoxycillin Clavulanic Acid(AMC), Nitrofurantoin (NIT) whereas most of the gram positive and gram-negative isolates were resistant to Cefixime (CFM), Ampicillin (AMP), Cotrimoxazole (COT). **CONCLUSIONS:** This study showed that E. coli isolates were the predominant uropathogens and AMC is the most effective antibiotic. Most isolates were resistant to Cefixime (CFM), Ampicillin (AMP) and Cotrimoxazole (COT). The presence of highly resistive bacterial isolates, to some of the commonly prescribed drugs, limits the antibiotic prescription options. Drug resistance pattern is an ever-evolving process then isolates become resistant to commonly used drugs. So, frequent surveillance studies are conducted to update clinicians on effectiveness of empirical treatment for UTI.

Keywords: Antimicrobial susceptibility, Escherichia coli (E. coli), Urinary tract infection

INTRODUCTION

Urinary Tract Infection (UTI) refers to the presence of microbial pathogens within the urinary tract leading to an inflammatory response in the epithelium [1]. UTI is the commonest bacterial infection encountered by clinicians with estimated annual global incidence of 250 millon [2, 3]. The cases of UTI among Nepalese patients attending hospital ranges from 23.1% to 37.4% [4]. UTI is usually classified by infection site- urine (bacteriuria), bladder (cystitis), kidney (pyelonephritis), prostate (prostatitis) and can be asymptomatic bacteria (ASB) or symptomatic that occurs in a normal genitourinary tract with no prior instrumentation is considered as uncomplicated, whereas complicated infection is diagnosed in normal genitourinary tract that has either structural or functional abnormalities, including instrumentation [5,6]. More than 95% cases of UTI are due to bacterial causes among which in more than 80% Escherichia coli is the cause [7].Treatment of UTI cases are often started empirically and therapy is based on the antimicrobial resistance pattern [8]. However, a large proportion of antibiotic usages have contributed resistant bacterialinfections resulting in an increased prevalence of antibiotic resistance worldwide [9-12]. Resistance rate and pattern to the most commonly prescribed drugs for UTI treatment varies

considerably in different areas worldwide. The estimation of local etiology and susceptibility profile could support the most effective empirical treatment [13]. Therefore, investigating bacterial distribution pattern and their susceptibility is fundamental for care givers and health planners to guide the expected treatment and interventions. Thus, the aim of this study was to determine bacterial distribution and evaluate their antibiotic susceptibility pattern to commonly used antibiotics.

MATERIALS AND METHODS

Study design and setting

This cross-sectional study was conducted from June 2021 to October 2021 on UTI cases, attending provincial hospital Janakpur in outpatient department (OPD), Indoor, Intensive care unit (ICU) and Emergency, under Internal Medicine unit. A total of 450 urine samples were sent for culture, and antibiotic sensitivity test was performed. All the positive culture of 110 cases were included in this study. Patients who received antibiotics within last 15 days or less before sample collection were excluded from the study. Also, patients below the age of 15 years were not included.

Sample and procedures

Bacterial isolation, identification and Antibiotic Susceptibility testing

Isolation of uropathogens was performed by a surface streak procedure on Blood agar, Mac Conkey agar, CLED (cystine–lactose–electrolyte-deficient agar or medium) agar & Mannitol salt agar (Hi-media Pvt. Ltd. India) using calibrated loops for semi quantitative method and incubated aerobically at 37^0 C for 24 hours, and those cultures which becomes negative at the end of 24hrs incubations were further incubated for 48hrs [9].

A specimen was considered positive for UTI if a single organism was cultured at a concentration of ≥105 cfu/ml. [9]. Antimicrobial susceptibility of isolates was tested for all bacterial uropathogens by the disk diffusion according to Clinical Laboratory Standards Institute (CLSI) guidelines [14].ocol following Monica Cheesebrough, 2002 [11].

Statistical analysis and data management

Data were entered and analyzed in Microsoft Excel [version2010, Microsoft corporation, USA. Frequencies and percentages were expressed. Pie chart was used to present culture positive. Discrete variables were compared using the Chi-square test. Statistical significance were considered at value of the $p< 0.05$.

Ethical considerations

An approval and permission for this study was taken from Provincial hospital before commencing this study.

RESULTS

Total 450 eligible urine samples were processed among which 110(24.4%) were cultured positive (Figure-1) and hence UTI.

Figure-1: Culture positive among the tested sample (n=540)

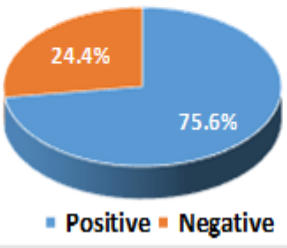

Table1| Gender and age distribution of UTI patients (n=110)

Age group	Male [n (%)]	Female [n (%)]	Total (%)
15-39	20(18.18)	48(43.64)	68(61.82)
40-59	5(4.55)	2(1.82)	7(6.36)
>=60	25(22.73)	10(9.09)	35(31.82)
Total	50(45.45)	60(54.55)	110(100)
Chi-square=18.48, p-value=0.0001			

Table 2| Distribution of bacterial uropathogens isolated from UTI suspected patients (n=110)

Isolates	Number	percentage
E. coli	57	51.82
P. aeruginosa	18	16.36
K. pneumonia	9	8.18
K. oxytoca	4	3.64
Serratia	4	3.64
Staph. Aureus	4	3.64
Acinetobacter	3	2.73
Enterococci	2	1.82
Hafnia	2	1.82
Staph. Epidermidis	2	1.82
Citrobacter	1	0.91
Proteus mirabilis	1	0.91
Serratia marcescens	1	0.91
Staph. saprophyticus	1	0.91
Str. Pyogen	1	0.91
Total	**110**	**100**

Table 3| Sensitivity pattern of bacterial isolates from urine culture (n=110)

	NUMBER OF STRAINS (%) SENSISTIVE TO														
ORAGANISM	AK	AMP	AMC	CPM	CFM	CTR	C	CIP	COT	GEN	IPM	LE	NIT	PTZ	DOX
E. coli (57)	49 (86)	15 (26.3)	46 (80.7)	15 (26.3)	7 (12.3)	13 (22.8)	34 (59.6)	33 (57.9)	7 (12.3)	46 (80.7)	36 (63.2)	40 (70.2)	42 (73.7)	31 (54.4)	14 (24.6)
P. aeruginosa (18)	15 (83.3)	9 (50)	17 (94.4)	0 (0)	0 (0)	0 (0)	12 (66.7)	9 (50)	0 (0)	12 (66.7)	9 (50)	6 (33.3)	14 (77.8)	3 (16.7)	4 (22.2)
K. pneumoniae (9)	7 (77.8)	3 (33.3)	9 (100)	0 (0)	0 (0)	2 (22.2)	4 (44.4)	2 (22.2)	2 (22.2)	1 (11.1)	7 (77.8)	3 (33.3)	7 (77.8)	6 (66.7)	0 (0.0)
K. oxytoca (4)	3 (75)	3 (75)	4 (100)	0 (0)	0 (0)	4 (100)	4 (100)	1 (25)	4 (100)	3 (75)	0 (0)	3 (75)	3 (75.0)	1 (25.0)	0 (0.0)
Serratia (4)	0 (0)	4 (100)	3 (75)	4 (100)	0 (0)	0 (0)	4 (100)	4 (100)	4 (100)	0 (0)	0 (0)	1 (25)	4 (100.0)	4 (100)	0 (0.0)
Staph. Aureus (4)	4 (100)	1 (25)	4 (100)	2 (50)	0 (0)	0 (0)	2 (50)	2 (50)	0 (0)	4 (100)	2 (50)	4 (100)	4 (100.0)	4 (100)	2 (50.0)
Acinetobacter (3)	3 (100)	3 (100)	3 (100)	0 (0)	0 (0)	0 (0)	1 (33.3)	0 (0)	0 (0)	2 (66.7)	2 (66.7)	2 (66.7)	3 (100.0)	0 (0)	1 (33.3)
Enterococci (2)	2 (100)	0 (0)	2 (100)	1 (50)	0 (0)	2 (100)	0 (0)	2 (100)	0 (0)	2 (100)	1 (50)	1 (50.0)	2 (100.0)	1 (50.0)	1 (50.0)
Hafnia (2)	2 (100)	1 (50)	2 (100)	1 (50)	0 (0)	1 (50)	0 (0)	2 (100)	0 (0)	2 (100)	2 (100)	2 (100.0)	1 (50.0)	2 (100.0)	1 (50.0)
Staph. Epidermidis (2)	2 (100)	1 (50)	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	2 (100)	1 (50)	2 (100.0)	1 (50.0)	2 (100)	1 (50.0)
Citrobacter (1)	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	1 (100.0)	1 (100.0)	0	0 (0.0)
Proteus mirabilis (1)	0 (0)	0 (0)	1 (100)	1 (100)	0 (0)	1 (100)	1 (100)	1 (100)	0 (0)	1 (100)	0 (0)	1 (100.0)	1 (100.0)	1 (100.0)	0 (0.0)
Serratia marcescens (1)	0 (0)	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	1 (100)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0.0)	1 (100.0)	1 (100.0)	0 (0.0)
Staph. Saprophyticus (1)	1 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (100)	0 (0)	0 (0)	1 (100)	1 (100)	1 (100.0)	0 (0.0)	1 (100.0)	0 (0.0)
Str. Pyogens (1)	1 (100.0)	1 (100)	1 (100)	0 (0)	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)	1 (100)	0 (0)	1 (100.0)	1 (100.0)	1 (100.0)	0 (0.0)
Total (110)	90 (81.8)	43 (39.1)	96 (87.3)	25 (22.7)	7 (6.4)	23 (20.9)	65 (59.1)	57 (51.8)	18 (16.4)	77 (70)	62 (56.4)	68 (61.8)	85 (77.3)	58 (52.7)	24 (25.8)

Of 110 cases, there were 50(45.5%) samples of male and 60(54.5%) of female. These results indicate that the occurrence of UTI was higher in female patients than in males patients. The highest susceptible to UTI was below 40 years age group of patients (61.82%) followed by 60 or more years (31.82%). The highest occurrence of UTI in female was found below the age of 40 years (43.64%). However, in male the highest susceptible age group to UTI was above 60 years (22.73%). A significant association was observed for gender and age group (p=0.0001) among UTI patients [Table1].

Out of total 110 bacterial isolates in urine samples, 90.91% were Gram negative and 9.09% were Gram positive. E. coli was found to be the most dominant bacteria among all isolated uropathogens with the occurrence of 57(51.82%), followed by Pseudomonas aeruginosa 18(16.36%) and Klebsiella pneumoniae 9 (8.18%). Among Gram positive staphylococcus, aureus was most common uropathogens (3.64%) (Table 2).

Bacterial uropathogens isolated from patients with UTI revealed the presence of high level of single and multiple antibiotic sensitivity against commonly prescribed drugs shown in Table 3. E. coli which was the most common cause of UTI showed high percentage of sensitivity to Amikacin (AK) (86%) followed by Gentamycin (GEN) (80.7%), Amoxicillin clavulanic acid (AMC) (80.7%), and Nitrofurantoin (NIT) (73.7%) whereas cefixime (CPM) and cotrimoxazole (COT) were least sensitive (12.3%).

DISCUSSION

Bacterial infection of the urinary tract is one of the common morbidities seeking medical attention [15]. Increasing antimicrobial resistance has been documented worldwide [16-20]. This study provides valuable data to compare and monitor the status of antibiotic sensitivity among uropathogens to improve empirical treatment. In this study, the isolation rate of bacterial from urine was 24.44% which is similar to other studies that accounts for 25.6% [21], 22% [22], though it is lesser than 38.6% [23] and 35.5% [24].

Our study showed a higher occurrence of UTI in females (54.5%) than in males (45.5%) which correlates with other findings [25-28]. The reason behind high prevalence in female is due to close proximity of urethral meatus to the anus, short urethra. E. coli (51.82%) is the most common bacteria isolated from urine samples and this finding is in agreement with others finding too [13, 29, 30]. Second most common isolated bacterium was pseudomonas aeruginosa (16.36%) which was in agreement with some other studies [31, 32].

Though it does not correlate with some studies [33] in which Klebsiella species was the second most common. Resistance to antibiotic has been noted since the first use of these agents and is a worldwide increasing problem [17-20]. E. coli, Pseudomonas are highly sensitive to Amikacin (AK), Amoxicillin clavulanic acid (AMC) and Nitrofurantoin (NIT).

A comparable rate of sensitivity has been reported to these drugs in some previous studies [29,33]. Thus, these drugs could be considered as alternative options in the empirical treatment of UTIs. The cefixime (CFM), Ampicillin (AMP) were found resistant to most of the antimicrobials. So, these drugs should not be used as the empirical treatment for UTI in this community.

CONCLUSIONS

E. coli was the most common isolated organism in UTI patients. Bacterial uropathogens isolated from patients with UTI revealed the presence of high level of single and multiple antibiotic sensitivity against commonly prescribed drugs. Most of the isolates were sensitive to Amikacin, Amoxycillin Clavulanic Acid, Nitrofurantoin whereas most of the gram positive and gram-negative isolates were resistant to Cefixime, Ampicillin, Cotrimoxazole. The isolation of bacterial pathogens with sensitivity pattern of antimicrobial provides valuable data to improve recommendation in specific community for empirical treatment of UTI. As drug sensitivity and resistance is an evolving process, routine surveillance studies should be conducted to guide clinicians with knowledge about the most effective empirical treatment of UTIs.

ADDITIONAL INFORMATION AND DECLARATIONS

Acknowledgements: Authors wish to thank medical superintendent of Provincial hospital for all their supports during this study.

Competing Interests: The authors declare no competing interests.

Funding: Self-funded

Author Contributions: Concept and design: S.K.J, Statistical analysis: S.K.J, Writing of the manuscript: L.N.Y, J.K. Data collection: L.N.Y, S.K.T and J.K. Revision and editing: S.K.J. All

authors have read and agreed with the contents of the final manuscript towards publication.

Data Availability: Data will be available upon request to corresponding authors after valid reason.

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