ANTIMICROBIAL SUSCEPTIBILTY PROFILE OF URINARY TRACT INFECTION: A SINGLE CENTRE HOSPITAL BASED STUDY FROM NEPAL

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ABSTRACT

INTRODUCTION

Urinary tract infection (UTI) is amongst the most common bacterial infections. Identification of causative organism and their in-vitro susceptibility test is essential for the successful treatment of a patient. The study was done to determine different bacterial species causing UTI and their antimicrobial susceptibility profile.

MATERIAL AND METHODS

A total of 332 urine samples from patients attending both inpatient and outpatient departments of UCMS-TH were included in this study. Samples were subjected to culture and sensitivity test with the use of standard bacteriological techniques as described by American Society for Microbiology (ASM).

RESULTS

Twenty three percent of the total urine samples showed significant bacterial growth. Thirteen different bacterial species were isolated. Among these, *Escherichia coli* (50.6%) was the most predominant one followed by Klebsiella species (15.6%), *Staphylococcus aureus* (7.8%) and others. Majority of bacteria isolated was found to be sensitive to imipenem (82%) followed by nitrofurantoin (78%), gentamicin (63.8%) and others.

CONCLUSION

UTI is a commonly encountered case in general practice. Females are commonly affected than males. Majority of bacterial isolates were found resistant towards commonly used first line antimicrobial agents. This type of study should be continued to determine the changing pattern of microbial flora and their antibiogram.

KEYWORDS Antimicrobial susceptibility profile, urinary tract infection, Nepal

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INTRODUCTION

Urinary tract infection (UTI) encompasses a wide variety of clinical entities whose common denominator is microbial invasion of any tissue of the tract from the renal cortex to the urethral meatus. Infection of the prostate and epididymis is also included in the definition.[1] UTI is a serious health problem affecting millions of people each year. It is the most important cause of mortality and morbidity in the world affecting all age groups across the life span.[2] UTI is the second most common infectious presentation in community practice. Worldwide about 150 million people are diagnosed with UTI each year, costing the global economy in excess of six billion US dollars.[3] In Nepal and other developing countries, UTI is the most common bacterial infection causing illness mostly in females due to illiteracy, unhygienic conditions and lack of proper toilet facilities. They are always vulnerable to infections by various organisms.[4]

UTI is treated with antibacterial drugs. The choice of drug and length of treatment depend on the patient's history and the urine tests that identify the offending bacteria. UTI is often treated with different broad-spectrum antibiotics when one with a narrow spectrum of activity may be appropriate because of concerns about infection with resistant organisms.[5] The gold standard for identification of UTI is culture of urine for specific bacteria followed by antibiogram testing.[6] The etiology of UTI and the antibiotic resistance of uropathogens have been changing over the past years, both in community and nosocomial infections.[7] This study was conducted to determine the distribution and antibiotic susceptibility patterns of bacterial strains isolated from patients with UTI at Universal College of Medical Sciences and Teaching Hospital (UCMS-TH), Bhairahawa.

MATERIAL AND METHODS

This study was carried out at UCMS-TH during the period of six months. Study received approval from the institutional review board of UCMS-TH. The methods for the collection, isolation and identification were followed as described by American Society for Microbiology. Five to Ten milliliter midstream urine specimen was collected in a clean, dry sterile and leak proof container from 332 patients clinically suspected of UTI and processed at microbiology laboratory.

Culture of specimen: Culture of each uncentrifuged urine sample was done by semi quantitative method on 5% blood agar (BA) (Hi media, India) and MacConkey agar (MA) (Hi media, India). An inoculating loop of standard dimension was used to take up approximately fixed and a known volume (0.001ml) (± 10% error is accepted) of mixed uncentrifuged urine for inoculation and culture plates were incubated aerobically at 37^0C for 18-24 hours.

Examination of culture plate: The culture plates were observed after 18-24 hours. Colonies were counted. Samples showing $\geq 10^5$ colony forming unit (CFU) per milliliter (ml) of urine were taken significant. Low count significant bacteriuria ($\geq 10^4$- $<10^5$ CFU/ml) was taken into consideration, if there was any indication which could lower the concentration of bacteria in the urine. Mixed growth of more than two contaminating organisms was neglected. Blood agar was observed for haemolysis, colony morphology and MacConkey agar for lactose fermentation and lactose non-fermentation.

Identification of isolates: Identification of significant isolates was done by using standard microbiological technique that involves morphological appearance of the colonies, Gram staining reactions and biochemical properties.

Antibiotic susceptibility test: The antibiotic sensitivity tests of the pathogens isolated from urine specimen against different antibiotics was determined by Kirby- Bauer method of disk diffusion technique as recommended by Clinical and Laboratory Standards Institute (CLSI) using Mueller Hinton agar. *Staphylococcus aureus*, American Type Culture Collection (ATCC) 25923, *Escherichia coli* ATCC 25922 were also tested as a part of quality control.

RESULTS

A total of 332 urine samples submitted to the microbiology laboratory for culture and sensitivity from patients suspected to have UTI within the study period were analyzed. Out of the total 332 patients, majority cases 204 (61.5%) were from outpatient department and 128 (38.5%) were patients admitted to the hospital.

Out of 332 urine specimens, only 77 (23%) of the specimens showed significant bacterial growth which is shown in figure 1.

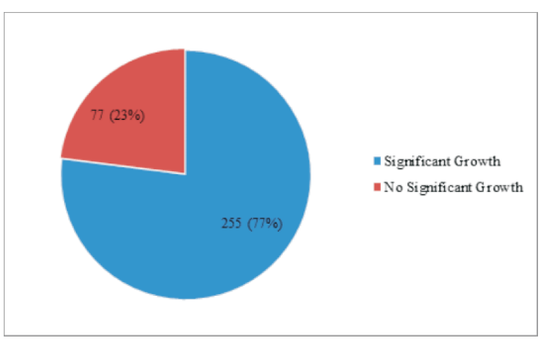

Figure 1. Pattern of culture result (N=332)

Out of 77 growth positive patients, number of UTI was higher

in female patients 50 (64.9%) followed by male 27 (35.1%). Growth pattern in male and female patients is shown in figure 2.

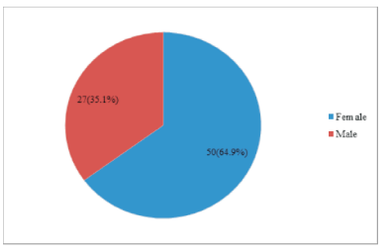

Figure 2. Growth pattern in male and female patients (n=77)

Among the total bacterial isolates, majority 62 (81%) were gram-negative bacteria and 15(19%) were gram positive bacteria which is shown in figure 3.

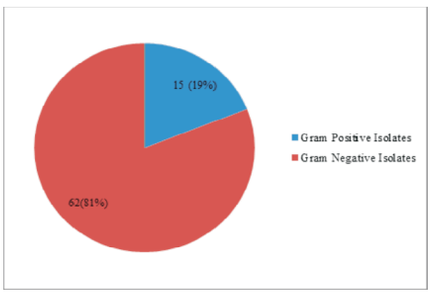

Figure 3. Gram-positive versus gram-negative bacterial growth (n=77)

Out of 77 bacterial isolates, isolated from 332 urine samples in our study, 13 different bacterial species were isolated. Among the isolates, *Escherichia coli* was isolated from 39 patients (50.6%) and was found to be the most predominant organism followed by Klebsiella spp 12 (15.6%), *Staphylococcus aureus* 6 (7.8%) and others which are tabulated in table 1.

Table 1. Pattern of bacterial isolates causing UTI (n=77)

S.N	Organism isolated	Number	%
1.	*Escherichia coli*	39	50.6
2	Klebsiella spp *(K.pneumoniae , K. oxytoca)*	12	15.6
3	*Staphylococcus aureus*	6	7.8
4	Enterococcus spp	5	6.5
5	Proteus spp *(Proteus vulgaris, Proteus mirabilis)*	5	6.5
6	Coagulase negative Staphylococcus spp	4	5.2
7	*Pseudomonas aeruginosa*	2	2.6
8	Citrobacter spp *(C.freundii, C. koseri)*	2	2.6
9	Acinetobacter spp	1	1.3
10	*Morganella morganii*	1	1.3
	Total	**77**	**100%**

Among the antibiotics used, the most sensitive antibiotic was found to be imipenem (82%) followed by nitrofurantoin (78%), gentamycin (63.8%), ceftriaxone (55.5%), norfloxacin (48.5%), cotrimoxazole (47.2%) and ampicillin (43.4%). Susceptibility pattern of bacterial isolates towards different antibiotics is shown in table 2.

Table 2. Sensitivity pattern of bacterial isolates towards different antibiotics

Antibiotics	No of isolates tested	No of isolates sensitive, n %	No of isolates resistant, n %
Imipenem	77	63 (82)	14 (18)
Nitrofurantoin	77	60 (78)	17 (22)
Gentamycin	72	46 (63.8)	26 (36.2)
Ceftriaxone	72	40 (55.5)	32 (44.5)
Norfloxacin	77	37 (48.5)	40 (51.5)
Cotrimoxazole	72	34 (47.2)	38 (52.8)
Ampicillin	76	33 (43.4)	43 (56.6)

DISCUSSION

This study shows the distribution and antibiotic susceptibility pattern of bacterial species isolated from patients with UTI in microbiology department of UCMS-TH, Bhairahawa. In this study, urine samples of different age groups from indoor and outdoor patients were included. Out of the total 332 patients, 128 cases (38.5%) were from patients admitted to the hospital (indoor patients) and 204 (61.5%) were from out patients department (outdoor patients).

The total growth positive rate (23%) observed in this study was lower in comparison to the finding of Rijal A et al (49%). However, this was in agreement with other study conducted by Kattel HP et al (26.6%), Mishra et al (28.3%) and Kumari et al (25.7%).[8-10]

In the present study, UTI occurred more in females (64.9%) than in males (35.06%).Study conducted by Chaudhari et al found 74.40% were female and 25.60% were male.[11] Another study done by Pradhan B et al showed female patients comprise 75.0 % of positive culture isolates.[12] This showed the higher prevalence of UTI occuring in females. Females are more frequently affected by UTI (particularly cystitis) due to colonization of urethra with colonic gram-negative bacteria because of its proximity to anus, short length of urethra and sexual intercourse.[13]

Mostly, UTI are originated from colonic bacteria which comprise mainly gram negative bacteria. In our study, out of total bacterial isolates, 81% were gram-negative bacilli and only 19% were gram positive cocci. This study is similar to study done by Kattel HP et al in Kathmandu in which 79% isolates were gram-negative bacilli and 21% were gram-positive bacteria.[8] Our study showed that *E. coli* (50.6%) was

found to be the most predominant organism followed by Klebsiella species (15.6%), *Staphylococcus aureus* (7.8%) and others. Similar results were also reported by Chaudhari et al (*E.coli*-66% and Klebsiella species-12%).[11] Shrestha et al reported (2016), *E.coli* (71.3%), *K. pneumoniae* (9.8%), *K.oxytoca* (8.6%), Proteus species (4.6%) and other isolates from UTIs.[14]

Our study also looked at antibiotic sensitivity and resistance patterns to the micro-organisms isolated. Knowledge about local microbiological patterns is essential for rationalizing both prophylaxis and treatment regimens.[15] The antibiotic susceptibility in our study showed the highest percentage of sensitivity with Imipenem (82%) followed by nitrofurantoin (78%) which is similar to the study done by Rijal A et al Kattel HP et al and Yadav K et al.[6,8,16] On the other hand, ampicillin was found to be least effective drugs against the isolated organisms followed by cotrimoxazole. Higher resistant to ampicillin and cotrimoxazole was also observed by various other researchers.[8,16] The improper use and easy access of antibiotics as well as poor monitoring of antibiotic sensitivity pattern during the management of UTI in clinical practice results in high percentage of resistance to commonly prescribed drugs.[17]

CONCLUSION

Gram-negative bacteria were the major cause of urinary tract infection. *Escherichia coli* was the commonest organism. Majority of gram-negative bacteria showed susceptibility towards imipenem, nitrofurantoin and gentamicin. However, this type study should be continued to determine the changing pattern of microbial flora and their antibiogram. It is recommended to follow culture and sensitivity report before prescribing antimicrobial drugs for treatment of suspected UTI.

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CONFLICT OF INTEREST

The authers declare no conflict of interest.

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