

## ORIGINAL RESEARCH ARTICLE

# Prevalence of Multidrug Resistant Bacteria in Causing Community Acquired Urinary Tract Infection Among the Patients Attending Outpatient Department of Seti Zonal Hospital, Dhangadi, Nepal

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## Abstract

Involvement of multidrug resistant bacteria in causing community acquired infection is very serious public health issue. The main objective of our study was to determine the prevalence of multidrug resistant bacteria in causing community acquired urinary tract infection. In this study we cultured the 384 mid stream urine samples collected aseptically from the patients attending outpatient department of Seti zonal hospital and having no past history of hospitalization. The organisms isolated were identified by using conventional biochemical tests and antimicrobial susceptibility testing was performed by Kirby Bauer disc diffusion technique. Out of total 384 samples 98 (25.52%) samples showed significant bacterial growth. The most prevalent bacterium isolated was *Escherichia coli*. 42.86% of the bacteria isolated were found to be multidrug resistant (MDR). The involvement of such large numbers of multidrug resistant bacteria in causing community acquired urinary tract infection is very serious issue and cannot be neglected. And some abrupt initiatives should be taken by the responsible authorities to improve or at least avoid the further worsening of the situation.

**Key Words:** Pyelonephritis, bacteriuria Cystine Lactose Electrolyte Deficient (CLED) agar, CLSI

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## Introduction

Urinary tract infection (UTI) is the presence of multiplying bacteria within the urinary tract. The presence of significant numbers of bacteria in aseptically collected urine is the indication of urinary tract infection. Despite the presence of different host defense mechanisms against microbial infection in urinary tract, UTI is present as one of the commonest bacterial infections [1]. It is an important global health problem affecting millions of peoples annually, from all age groups.

Women are more vulnerable to UTI due to presence of shorter urethra and its proximity to perianal region [2]. UTI in men is less common in comparison to that in women but may be very serious when occurred [1]. People with defects which cause the retention of the urine are at high risk of getting UTI. Further increased rate of UTI is seen in patients with catheters or tubes placed in urinary tract and patients with problems with the body's natural defense mechanisms. The most common cause of UTI is *Escherichia coli*. Other bacteria include the other members of the Enterobacteriaceae, *Pseudomonas aeruginosa*, *Staphylococcus saprophyticus*, *Enterococcus* spp. etc [2].

Multidrug resistant bacteria are defined as the bacteria which are resistant to three or more than three different structural classes of the antibiotics [3]. The involvement of multi drug resistant bacteria in causing UTI has created a serious problem for its early proper management. For the proper management of the infections hence to prevent the possible complications like chronic pyelonephritis, chronic renal failure; timely appropriate treatment as suggested by urine culture and sensitivity report is essential. But in most of the part of Nepal including the Farwestern region the urine culture and sensitivity is not performed due to lack of resources and competent manpower.

Studies on the prevalence of UTI due to multidrug resistant bacteria have been carried out frequently in different parts of Nepal but no such studies have been carried out in Farwestern region. Hence the prevalence of UTI caused due to multidrug resistant bacteria is unknown in this region of Nepal. Further the antimicrobial susceptibility patterns of different bacteria for commonly used antibiotics are not also clear in this region. Therefore the suspected patients of UTI are treated just on the basis of guess most of times

resulting in treatment failure and development of more drug resistance among the bacteria. Hence this study will present the clear picture of antimicrobial susceptibility patterns of different bacteria for commonly used antibiotics and the involvement of the multidrug resistant bacteria in causing UTI in far western region of Nepal. Seti zonal hospital is the referral center for whole Farwestern region. Antimicrobial susceptibility pattern of the bacteria isolated from the patients (having no past history of hospitalization) with UTI attending the outpatient department of Seti zonal hospital was determined and prevalence of UTI due to multidrug resistant bacteria was calculated.

## Materials and methods

A cross sectional study was conducted among the patients suspected of urinary tract infection visiting outpatient department of Seti zonal hospital from June 2013 to December 2013. The samples were collected from only those patients who do not have past history of hospitalization. Total 384 midstream urine specimens collected aseptically were cultured on Cystine Lactose Electrolyte Deficient (CLED) agar by using semi-quantitative culture technique. The colonies of the bacteria from the samples with significant growth ( $\geq 10^5$ cfu/ml) after 48 hrs of aerobic incubation at 37° C were isolated and were identified up to species level with the help of colony morphology, staining reactions and conventional biochemical tests. The common biochemical tests used were oxidase test, catalase test, urease test, sulphide indole motility test, citrate utilization test, triple sugar iron test, lysine decarboxylase test, methyl-red voges proskauer test, coagulase test etc. During isolation and identification purity plate culture was used for quality control. Antimicrobial susceptibility testing was performed according to the Clinical Laboratory Standard Institute (CLSI 2013) guidelines by modified Kirby-Bauer disc diffusion method using Mueller Hinton agar (MHA). The diameter of each zone of inhibition (in mm) was measured and results were interpreted with the help of zone size interpretive chart. Control strains *E. coli* (ATCC 25922) and *Staphylococcus aureus* (ATCC 25923) were used for the standardization of the antibiotic susceptibility testing.

## Analysis for multidrug resistant bacteria:

Based on susceptibility patterns of isolates, bacteria resistant to  $\geq 3$  classes of antibiotic were considered as Multi Drug Resistant (CLSI 2013).

## Data Analysis

The data obtained was entered into MS excel and analyzed using SPSS version 11.0. P-values  $< 0.05$  were considered statistically significant.

## Results

Out of total 384 midstream urine samples, 98 (25.52%) samples showed significant bacterial growth. 29/154 (18.83%) males and 69/230 (30.00%) females had significant bacteriuria. The association of significant bacteriuria in male and female patients was found to be statistically significant ( $p < 0.05$ ).

Among 98 significant bacteriuria cases, 6 different microorganisms were isolated. Among these isolates, *E. coli* (53.06%) was found to be the most predominant organism followed by *Klebsiella pneumoniae* (21.43%), *Pseudomonas aeruginosa* (12.24%), *Proteus vulgaris* (7.14%), *Staphylococcus aureus* (4.08%) and *Proteus mirabilis* (2.04%) (**Table no.1**).

**Table no.1:** Different bacteria isolated from urine of the patients.

Name of the bacteria	Numbers isolated (%)
<i>Escherichia coli</i>	52 (53.06%)
<i>Klebsiella pneumoniae</i>	21 (21.43%)
<i>Pseudomonas aeruginosa</i>	12 (12.24%)
<i>Proteus vulgaris</i>	7 (7.14%)
<i>Staphylococcus aureus</i>	4(4.08%)
<i>Proteus mirabilis</i>	2 (2.04%)

## Susceptibility of gram negative bacteria towards different antibiotics

Among the common antibiotics used against all Gram negative bacteria, the most effective antibiotic was found to be gentamicin (57.45%) followed by ceftriaxone (51.06%), nitrofurantoin (45.75%), Co-trimoxazole (32.98%), ofloxacin (29.79%), nalidixic acid (15.96%), and ampicillin (5.32%) (**Table no. 2**).

**Table no.2:** Susceptibility of gram negative bacteria towards different commonly used antibiotics.

Antibiotics	Numbers of sensitive gram negative bacteria (%)
Gentamicin	57.45
Ceftriaxone	51.06
Nitrofurantoin	45.75
Co-trimoxazole	32.98
Ofloxacin	29.79
Nalidixic acid	15.96
Ampicillin	5.32

Among the 4 gram positive bacteria all isolates were *Staphylococcus aureus*. All of them were susceptible to gentamicin and 3(75.00%) were susceptible to ceftriaxone. Half of the *S. aureus* isolates were susceptible to ampicillin, co-trimoxazole and ofloxacin each. 1(25.00%) isolate was found to be susceptible to nalidixic acid and nitrofurantoin each.

### Multidrug resistance among various Bacteria

Out of 98 isolates, 42 (42.86%) were found to be MDR. 48.08% of the *E. coli*, 19.05% of the *K. pneumonia*, 50% of the *P. aeruginosa*, 85.71% of the *P. vulgaris* and 25% of the *Staphylococcus aureus* were found to be MDR. No isolates of *P. mirabilis* were MDR (Table no. 3).

**Table no.3:** Multidrug resistance among different bacteria.

Name of bacteria	Number of multi drug resistant bacteria (%)
<i>Escherichia coli</i>	48.08
<i>Klebsiella pneumoniae</i>	19.05
<i>Pseudomonas aeruginosa</i>	50
<i>Proteus vulgaris</i>	85.71
<i>Staphylococcus aureus</i>	25
<i>Proteus mirabilis</i>	0

### Discussion

Out of total 384 urine samples 98 (25.52%) samples showed significant growth. Similar type of result was obtained by Sharma et al (27.3%) [4]. Females are more prone to UTI than males. In the present study also, same fact was observed where the rate of growth positivity was found to be 30.00% (69/230) in females and 18.83% (29/154) in males. Our findings were consistent with the findings by Shrestha et al [5] who reported the culture positivity of 29.8% in females and 15.2% in males. In a similar study by Baral et al. [6] the growth positivity was 33.5% among female patients and 23.7%, in male patients. This higher growth

positivity seen in females was found to be statistically significant ( $p < 0.05$ ) and is due to their anatomical structure (short urethra and proximity to anal orifice) leading to easy access for enteric bacteria. Among the total 98 bacterial isolates, 94(95.92%) were Gram negative bacilli and only 4 (4.08%) were found to be Gram positive cocci. The results were in the favor of the findings of Shrestha et al [5] and Karki et al [7]. In the study by Shrestha et al [5] among the total 80 bacterial isolates, 75 (93.8%) were Gram negative bacilli and only 5 (6.3%) were Gram positive cocci. Similarly Karki et al [7] found 91.1% of the isolates from urine to be Gram negative bacilli and 8.8% of them to be Gram positive cocci.

Among 98 significant bacteriuria cases, 6 different species of the bacteria were isolated. Among these isolates, *E. coli* 52 (53.06%) was found to be the most predominant organism followed by *Klebsiella pneumoniae* 21(21.43%), *Pseudomonas aeruginosa* 12(12.24%), *Proteus vulgaris* 7(7.14%), *Staphylococcus aureus* 4(4.08%) and *Proteus mirabilis* 2(2.04%). In a similar study done by Khanal et al, out of 41 isolates isolated from mid stream urine samples 8 different species were isolated among which *E. coli* (65.85%) was found to be most predominant organism followed by *Klebsiella pneumoniae* (9.75%) [8]. The high prevalence of *E. coli* in causing UTI also resembled with the studies by Raza et al in Kathmandu, Nepal [9] and Patel et al in India [10]. *E. coli* can bind to the glycoconjugate receptor (Gal  $\alpha$  1-4 Gal) of the uroepithelial cells of human urinary tract with its unique virulence determinant, the p pilus (Gal-Gal receptor) so as to initiate the infection [11].

As in the study by Gautam et al [12] all the Gram positive isolates were *Staphylococcus aureus* and were obtained from female patients only.

Antibiotic resistance is a serious public health concern and is associated with prolonged hospitalization, high health-care cost, increased morbidity and mortality. In our study, gentamicin (57.45%) was found to be the most effective antibiotic against Gram negative bacteria followed by ceftriaxone (51.06%) and nitrofurantoin (45.75%). In a similar study carried out by Jha and Bapat at Sukhraraj Tropical Hospital, Kathmandu, Nepal 92.5% of urinary isolates were found to be susceptible to gentamicin [13]. In a study by Khanal 50% of gram negative organisms were sensitive to ceftriaxone and 58.34% of the gram

negative isolates were sensitive towards Nitrofurantoin [8]. On the other hand, in our study ampicillin was found to be the least effective drug against Gram negative bacteria (5.32% sensitive). Resistance to penicillins may be determined by the organisms due to the production of penicillin destroying enzymes ( $\beta$ -lactamase). 15.96%, 29.79% and 32.98% of the gram negative bacilli were susceptible to nalidixic acid, ofloxacin and co-Trimoxazole respectively. These results are in accordance with the results of Shrestha [5]. Similar findings were also given by Gautam et al [12] and Sharma et al [4]. Among gram positive cocci Gentamicin was found to be 100% effective where as Nalidixic acid and nitrofurantoin were found least effective with 25% of the isolates being sensitive to each antibiotic.

The exposure of the bacteria to antibiotic causes selective pressure causing the killing of susceptible bacteria allowing the resistant ones to survive. The rapid development of the antibiotic resistance among the bacteria is attributed to the haphazard use of antibiotics [14]. The problem of the drug resistance among bacteria is more prevalent in developing countries due to lack of awareness and lack of effective implementation of the policy that regulates the use of antibiotics.

Out of 98 isolates, 42.86% were found to be multi drug resistant. The finding of the present study was supported by the results of the study done by Khanal [8] and Upadhaya et al [15] noted the MDR causing UTI to be 56.09% and 48% respectively. In our study 48.08% of the *E. coli*, 19.05% of the *K. pneumoniae*, 50% of the *P. aeruginosa*, 85.71% of the *P. vulgaris* and 25% of the *Staphylococcus aureus* were found to be MDR. Similar findings were obtained in the study done by Tuladhar et al [16] in a hospital in Kathmandu, where MDR bacterial strains were detected in 35.21% with the most predominant MDR bacterium being *E. coli* followed by *Klebsiella spp.* Increasing haphazard use of antibiotics and sales of substandard drugs are responsible for development of multi drug resistance among the bacteria [17]. Due to development of drug resistance against commonly used antibiotics among the bacteria the therapeutic options have become limited.

The isolation of the multi drug resistance bacteria from the patients with no past history of

hospitalization indicates that the infection was community acquired. The involvement of such large number of multidrug resistant bacteria in causing community acquired urinary tract infections is very serious issue and cannot be neglected. Some abrupt initiatives should be taken by the responsible authorities to improve or at least avoid the further worsening of the situation.

## Conclusion

Involvement of multidrug resistant bacteria in causing large numbers of community acquired infections is a very serious public health concern. Some necessary initiatives should be taken immediately to control the situation.

## Competing interests

The authors declare that they have no competing interests.

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