SHORT COMMUNICATION

# Bacterial Uropathogens and their Antibiotic Sensitivity Pattern at a Tertiary Care Hospital in Birgunj, Nepal

**Bhargava Dipak[1*], Pandit Bijay Raj[1], Shidiki Amarullah[1], Gupta Ravi Shankar[1].**

[1]Department of Microbiology, National Medical College & Teaching Hospital, Birgunj, Nepal.

## ABSTRACT

Urinary tract infection is the second most common infection following respiratory tract infection. Among the outdoor and the indoor patients it is one of the common clinical state of affairs. For the effective management of this common clinical condition isolation of the common bacterial uropathogens and their antibiotic sensitivity profile is obligatory. In this present brief work an effort has been made to isolate the common bacterial uropathogen and their susceptibility pattern to the regularly used antimicrobial agents. We carried out this work in the Microbiology department of National Medical College from June 2016 to December 2016. In our study beside clean catched mid stream urine sample, catheterized urine sample and suprapubic aspirates are also collected. In our study we included a total of 516 UTI samples of patients. In our work 319 (62%) culture positive urine samples were from outpatient patient department while 197 (38%) were from inpatient department. Among both the outdoor and the indoor patient *E. coli* was the predominant organism followed by *Klebsiella, Staphylococci, Enterococci* and *Pseudomonas*. In our present work we found that the common bacterial isolates from the indoor patient showed higher degree resistance towards Aminopenicillin, Piperacillin, Nitrofurantoin, Ciprofloxacin and Nalidixic acid. Common bacterial uropathogens were found to be sensitive against Norfloxacin, Nitrofurantoin and Cephalosporins like Cefuroxime and Ceftazidime. It has also been found that beside *E. coli* other bacterial uropathogens were effective against third generation Cepahalosporins and Amikacin. This study clearly denotes that antibiotic sensitivity test should be carried out for determination of optimal treatment regimen against UTI.

**Keywords:** Antibiotic sensitivity test, *E.coli*, Uropathogens, UTI

***Corresponding Author:** Prof. Dr. Dipak Bhargava, Department of Microbiology, National Medical College & Teaching Hospital, Birgunj, Nepal. Email: db_mid@yahoo.co.in

## INTRODUCTION

Urinary tract infection (UTI) encompasses a wide variety of clinical manifestation whose common denometer is microbial invasion of any tissues of the urinary tract starting from the renal cortex to urethral meatus, it also include the prostrate and epididymis. Following respiratory tract infection UTI is the second most common infection. It contributes to one of the major cause of morbidity and mortality in the world affecting all age groups across the life span and in both genders and usually requires medical treatment.[1] About 150 million people are diagnosed with UTI each year, costing the global economy in excess of 6 billion dollars.[2] UTI infection seems to be higher in women and 20 -50% will suffer at least one clinical episode of UTI during their lifetime.[3]

In spite of the extensive range of availability of the antibiotics UTI remains the most frequent bacterial infection in the human population.[4] In this part of the world antibiotics are usually given empirically prior to the laboratory results of urine culture are

available. To make certain appropriate therapy, recent knowledge of the organisms that cause UTI and their antibiotic susceptibility is obligatory.[5] Choice of suitable antibiotics may vary even over short periods, on site of isolation and on diverse environments. To revise this information periodic evaluation of antibacterial activity is indispensable.

In this scenario an effort has been made to carry out this study among the hospitalised patients with UTI and also for the patients attending the outpatient departments. We hope detection of the pathogens causing UTI and their antibiotic susceptibility pattern in clinical set up is mandatory and helpful in improving the efficacy of empirical treatment.

## MATERIAL AND METHODS

The study was carried out in the Department of Microbiology at National Medical College and Teaching hospital in Birgunj, Nepal from 1st June 2016 to 31st December 2016. Clean catched mid stream urine samples were maximum beside that catheterized urine samples and suprapubic aspirates are also collected. A sum of 516 urine specimens of inpatients (IPD) and outpatients (OPD) suspected to have urinary tract infections were cultured and analyzed. Urine samples were inoculated by calibrated loop technique by transferring 0.001 ml. of urine and plated on Cysteine Lactose Electrolyte deficient (CLED) agar and Macconkey agar plates. The cultured plates were observed for bacterial colonies after 24 hours of aerobic incubation at 37°C. For gram negative bacilli more than 105 colonies per ml of mid stream urine sample, whereas for gram positive cocci 103-105 colonies per ml were considered significant.[6,7] The bacterial colonies were identified and confirmed based on their growth characteristics, gram staining and standard biochemical characteristics.[6,7] Antibiotic susceptibility test was carried out to currently used antibiotics using Kirby Bauer disc diffusion technique on Mueller–Hinton Agar (MH) or MH agar + 5% sheep blood, as recommended by the CLSI guidelines.[8] The antibiotic discs and their concentrations which are used in this study are as: Nitrofurantoin (300 mcg), Ceftriaxone (25mcg), antibiotics of Aminoglycosides such as Amikacin (10mcg), Gentamycin (10mcg), Quinolones such as Ciprofloxacin (5 mcg), Norfloxacin (10mcg), Nalidixic acid (30mcg), various Cephalosporins like Cefuroxime (30mcg), Cefotaxime (30mcg), Ceftazidime (30mcg), Aminopenicillin and Piperacillin (100mcg). The antibiotic discs and Mueller Hinton Agar media were procured from Hi Media, India. The control strain used in this study were *Escherichia coli* ATCC 25922 and *Staphylococcus aureus* ATCC 25923.

## RESULTS

Among the 516 UTI samples of patients, 197 were indoor patients (102 females and 95 males) and 319 (229 females and 90 males) were from outpatient departments. The percentage of bacterial uropathogens isolated after culture were depicted in Table 1.

**Table 1. Percentage of Bacterial uropathogens from UTI patients**

| Organisms | Outpatient (%) | Inpatient (%) |
|---|---|---|
| *E.coli* | 67.0 | 39.5 |
| *Klebsiella species* | 18 | 28 |
| *Proteus species* | 1.5 | 2 |
| *Pseudomonas species* | 4 | 9 |
| *Citrobacter species* | 2 | 0 |
| *Acinetobacter species* | 3 | 7 |
| *Staphylococcus species* | 10 | 6 |
| *Enterococcus species* | 3 | 14 |

Maximum percentage of strains isolated from the indoor patients showed resistance towards Aminopenicillin. Among the both indoor and outdoor group of patients *E.coli* shows maximum effectivity towards first generation of Cephalosporins. In our study organisms like *Klebsiella* species and *Pseudomonas* species were found to be more sensitive against Amikacin and third generation Cephalosporins, while they are very much ineffective against *Enterococcus* and *Acinetobacter* species.

In the present work Aminopenicillin, Piperacillin, Nitrofurantoin, Ciprofloxacin and Nalidixic acid shows less sensitivity to commonly isolated bacterial uropathogens. More than 45% of the outdoor patients were *E.coli* was found to be the common isolate showed higher degree of resistance towards Aminopenicillin and Nalidixic acid. Whereas Norfloxacin, Nitrofurantoin and Cephalosporins like Cefuroxime and Ceftazidime were very much sensitive. The present work also denotes that UTI were the bacterial uropathogen was other than that of *E.coli*, third generation Cepahalosporins and amikacin was found to be sensitive (Table 2).

**Table 2 Resistant percentage of bacterial isolates against commonly used antibiotics**

| Antibiotics | E. coli % | | Klebsiella species% | | Proteus species % | | Pseudomonas species % | | Citrobacter species % | | Acinetobacter species % | | Staphylococcus species % | | Enterococcus species % | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OP | IP | OP | IP | OP | IP | OP | IP | OP | IP | OP | IP | OP | IP | OP | IP |
| Aminopenicillin | 85 | 92 | 78 | 93 | 71 | 88 | ND | ND | 34 | 57 | 72 | 100 | 35 | 63 | 53 | 68 |
| Piperacillin | ND | ND | ND | ND | ND | ND | 27 | 33 | ND | ND | 46 | 53 | ND | ND | ND | ND |
| Nitrofurantoin | 16 | 21 | 46 | 54 | 73 | 84 | ND | ND | 12 | 17 | 83 | 91 | 15 | 22 | ND | ND |
| Ceftriaxone | 52 | 58 | 57 | 67 | 37 | 44 | 29 | 36 | 55 | 51 | 69 | 3 | 53 | 58 | 62 | 54 |
| Amikacin | 15 | 18 | 26 | 16 | 21 | 13 | 36 | 43 | 9 | 16 | 24 | 41 | ND | ND | 51 | 56 |
| Gentamicin | 28 | 46 | 48 | 65 | 47 | 58 | 37 | 56 | 13 | 23 | 58 | 72 | 18 | 28 | 38 | 52 |
| Ciprofloxacin | 54 | 73 | 47 | 67 | 42 | 45 | 34 | 53 | 35 | 42 | 37 | 49 | 50 | 62 | 24 | 41 |
| Norfloxacin | 16 | 19 | 23 | 29 | ND | ND | 36 | 47 | 9 | 14 | 34 | 45 | ND | ND | 51 | 53 |
| Nalidixic acid | 58 | 79 | 68 | 77 | 67 | 39 | ND | ND | 45 | 64 | 79 | 91 | ND | ND | ND | ND |
| Cefuroxime | 3 | 7 | 13 | 21 | 0 | 8 | 0 | 0 | 21 | 11 | 16 | 19 | 26 | 31 | 42 | 49 |
| Cefotaxime | 2 | 9 | 15 | 19 | 0 | 10 | 22 | 29 | 19 | 14 | 28 | 51 | 31 | 37 | 33 | 47 |
| Ceftazidime | 3 | 8 | 9 | 16 | 1 | 0 | 41 | 52 | ND | ND | 23 | 32 | ND | ND | 21 | 28 |

OP – Outpatient, IP – Inpatient, ND – Not Done

## DISCUSSION

In this study a sincere effort has been made to evaluate the bacterial uropathogens causing UTI and their antimicrobial susceptibility pattern in Birgunj, Nepal. This work gives valuable laboratory information which helps us to compare the situation of UTI in Birgunj and surrounding areas with that of other studies. From table 1 it can be said that the bacterial uropathogens causing UTI in the outpatient and inpatient is quite varied. UTI are caused by microbial invasion and subsequent multiplication in urinary tract.[9] In community and hospital settings the etiology of UTIs and the antimicrobial susceptibility of UTI causing bacteria have been changing over the years.[10,11] In our work 319 (62%) culture positive urine samples were from outpatient department while 197 (38%) were from inpatient department. In the United states, UTIs account for seven million office visits and 1,00,000 hospitalizations annually, making them the most common bacterial infections in outpatient settings.[12] This study shows that in both the indoor and outdoor patient *E.coli* was the predominant organism. The second commonest organism was *Klebsiella* followed by *Staphylococci, Enterococci* and *Pseudomonas* species. The pattern of isolated organisms was in total agreement with a study conducted in Delhi by Varma et al. in 2002.[13] Similarly a study conducted in Chitwan Medical College in Bharatpur by Acharya et al. in 2011 found that *E.coli* was the predominant organisms.[14]

The present study also highlighted the resistant percentage of bacterial uropathogens against commonly used antibiotics. In our study it has been seen that the isolated bacterial uropathogens shows maximum degree of resistance towards Aminopenicillin and Nalidixic acid. While in the outdoor and indoor patients it has been seen that the bacterial uropathogens gives maximum degree of sensitivity towards Cephalosporins, Nitrofurantoin, Amikacin and Ceftriaxone. Though Amikacin and Ceftriaxone is effective but it is also the fact that the resistance of the bacterial uropathogens towards these two antibiotics is rapidly progressing. It can be also suggested to the clinicians should be conscious of the increasing resistance of the bacterial uropathogens to commonly prescribed antibiotics. However our study was in consensus with the work of Kolawole et al. and Bajaj et al.[15,16]

However higher degree of resistance of bacterial uropathogens to commonly used antibiotics may be attributed to the lower socio-economic status and insufficient awareness among the people in the outskirts as compared to the capital of the country leading to indiscriminate use of antibiotics and delay in seeking medical treatment. The increasingly widespread use of nonculture methods for the diagnosis of UTI is a major challenge to monitoring of resistance pattern. The knowledge of antimicrobial susceptibility of bacterial uropathogens is a prerequisite for proper treatment and control of the disease. At

this time, bacterial uropathogens must be grown in culture to conduct tests for antimicrobial susceptibilities. This study clearly denotes that this is the high time to develop a set of rules for judicial use of antibiotics and local chemist as well as clinician should be train for importance of rational use of antibiotics. Systemic surveillance of antibiotic sensitivity test should be carried out for determination of optimal treatment regimen.

## REFERENCES


1. Omoregie R, Erebor JO, Ahonkhai I, Isibor JO, Ogefere HO. Observed changes in the prevalence of uropathogens in Benin City, Nigeria. New Zealand Journal of Medical Laboratory Science. 2008; 62: 29-3.
2. Kattel HP, Mishra SK, Acharya J, Rijal BP. Antibiotic sensitivity profile of different uropathogens in a tertiary care center in Nepal. Journal of Nepal Association of Medical Laboratory Science. 2012; 11(1): 19-33.
3. Leigh D. Urinary tract infections. In: Edward Arnold, editors. Topley and Wilson's Principle of Bacteriology, Virology and Immunology. 8th ed, London: 1990. p. 198-211.
4. Sharma S. Current Understanding of Pathogenic mechanisms in UTIs. Ann Natl Acad Med Sci. 1997; 33(1):31-8.
5. Gruneberg GN. Antibiotic sensitivities of urinary pathogens: 1971-1982. J Antimicrob Chemother. 1984; 14: 17-23.
6. Collee JG, Duguid JP, Fraser AG, Marmion BP, Simmons A. Laboratory strategy in diagnosis of infective syndromes. In Mackie and McCartney Practical Medical Microbiology. 14th edition Churchill Livingstone Longman Singapore Publisher Ltd. 1996. p. 88.
7. Baron EJ, Peterson LR, Finegold SM. Microorganisms encountered in the urinary tract. In: Baron EJ, Finegold SM, editors. Bailey and Scott's diagnostic microbiology. 9th ed, Mosby publishers, St. Louis Missouri: 1994. p. 256.
8. Matthew AW, Franklin RC, William AC, et al. In: Clinical and Laboratory Standards Institute (CLSI), editors. Performance standards for antimicrobial disc susceptibility test, Approved standard. 9th ed, Pennsylvania: Wayne, 2006. p. 26.
9. Boye A, Siakwa PM, Boampong JN, Koffuor GA, Ephraim RKD, Amoateng P, et al. Asymptomatic urinary tract infections in pregnant women attending antenatal clinic in Cape Coast, Ghana E3. J Med Res. 2012; 1(6):74-83.
10. New HC. Urinary tract infections. Amer J Med. 1996; 100 (Suppl.4A): 63-70.
11. Jones RN. Impact of changing pathogens and antimicrobial susceptibility pattern in treatment of serious infections in hospitalized patients. Am J Med. 1996; 100 (Suppl.6A): 3-13.
12. Schappert SM. Ambulatory Care visits to Physician Offices, Hospital Outpatient Depts. and Emergency Depts. United States, 1997. Vital Health Statistics. 1999; 13(143): 1-39.
13. Varma NC, Taneja OP, Saxena SN. Recurrent urinary tract infections in females. J Ind Med Ass. 1972; 58: 155 -8.
14. Acharya VN, Jadav SK. Urinary tract infection: Current status. J Postgrad Med. 1980; 26: 95-8.
15. Hooton TM, Scholes D, Hughes JP, et al. A prospective study of risk factors for symptomatic urinary tract infection in young women. New Engl J Med. 1996; 335: 468-74.
16. Bajaj JK, Karyakarte RP, Kulkarni JD, Deshmukh AB. Changing etiology of urinary tract infection and emergence of drug resistance as a major problem. J Commun Dis. 1999; 31: 181-4.