



## “Uropathogens and its antibiotic sensitivity pattern in Tertiary care Hospital, Jaipur”

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### ABSTRACT

Urinary tract infections are the commonest health problem demanding frequent consultation. Moreover, emergence of multidrug resistance among organisms is an issue of increasing concern. This study was conducted to determine bacterial pathogens causing Urinary tract infections and their antibiogram. Urine sample of 100 patients were cultured, identified and antimicrobial susceptibility was performed by standard methods. Out of 100 patients, 58 (58%) samples were found to be significant bacteriuria and remaining 42(42%) samples were either non significant or sterile urine. *E. coli* and *Klebsiella pneumoniae* were the most prevalent (14% and 7% respectively) among the Gram-negative pathogens and *Staphylococcus aureus* (MRSA) among the Gram-positive organisms (9%) followed by *Enterococcus spp.*(11%). All GNB showed 100% susceptibility to imipenem and GPC to linezolid and nitrofurantoin. Large majority of isolated multidrug resistant organisms were found to be pathogenic hence, Isolation practices, antibiotic policies and effective surveillance are needed to be improved.

### KEYWORDS

Urinary tract infections, Gram-negative bacteria, Multidrug resistance.

### INTRODUCTION

UTIs are among the second most common bacterial infection after respiratory tract infections. UTIs are also the most common hospital acquired infection, accounting for as many as 35% of nosocomial infections and an important cause of morbidity and mortality in community as well. Worldwide, about 150 million people are diagnosed with UTI each year<sup>1</sup>. Prevalence of UTIs also depends upon patient's age and sex. During pregnancy the incidence of bacteriuria increases as a result of anatomical and hormonal changes that favor the development of UTIs. These infections can lead to serious infections in both mother and fetus.

UTI may also occur by hematogenous or blood borne, route<sup>2</sup>. Even though several different microorganisms, that is protozoa, parasites, fungi and viruses can cause UTI, bacteria are the major causative organisms and are accountable for more than 95% of UTI cases<sup>3</sup>. Most common etiological agents causing UTIs are *Escherichia coli*, *Klebsiella spp.*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, *Acinetobacter spp.*, *Enterococcus spp.* and *Staphylococcus spp.*<sup>4</sup>.

UTI is not a single disease but a group of specific infections each with a different epidemiology, pathogenesis, clinical presentation and outcome. Due to different resistance mechanisms spreading among uropathogens and leading to multi-resistant strains their treatments are frequently difficult in hospital settings. Hence, the present study was undertaken to define the common bacterial profile in Urinary Tract Infection and to study the resistance patterns to common antibiotics and to provide empiric therapy to the clinicians in treating Urinary tract infections.

### Material and Methods

The present study was carried out in the time span of 6 months from Jan 2015 to June 2015 in the Department of Microbiology NIMS Medical College, Jaipur. A total of 100 urine samples were received in diagnostic microbiology for culture and sensitivity. All specimens belonged to patients suspected of having UTIs. Clean catch midstream urine specimen was collected carefully for optimal results, especially in females. A wet mount preparation was analyzed for the presence of pus cells. Urine sample is used for making smears for gram stain and for inoculating blood agar and MacConkey agar or Cysteine Lactose Electrolyte Deficient (CLED) media. The specimens were cultured on Blood agar, MacConkey

agar and CLED agar and incubated at 37°C for 18-24 hours. Identification of bacterial isolates was done by their characteristic appearance on the media, Gram's staining, motility testing (by hanging drop method), biochemical tests (Catalase, Coagulase, Indole, Methyl red, voges-proskauer, Citrate, Urease, Triple sugar iron, PPA, Oxidase test), antimicrobial susceptibility tests by Modified Kirby Bauer's disc diffusion method following the clinical laboratory standard institute (CLSI guidelines, 2014). Positive urine culture was determined by significant bacteriuria i.e., isolation of one or two pathogens based on “Kass concept of significant bacteriuria” with >10<sup>5</sup> colony forming units per ml and presence of pyuria (>6 pus cells per high power field)<sup>5</sup>. The panel of antibiotics (discs in mcg) tested was as follows: Nitrofurantoin(NT) (30), Norfloxacin(NO) (10), Co-trimoxazole (COT) (25), Tobramycin(TOB) (10), Cefuroxime(CXM) (30), amikacin(AK) (30), linezolid(LZ) (30), vancomycin(VA) (30), ampicillin(AMP) (10), amoxyclav (AMC) (30), cefaperazone/salbactam (CFS) (105), aztreonam(AO) (30), ciprofloxacin (CP) (5), piperacillin/tazobactam (PT) (85) and imipenem (IPM) (10).

### Result

A total of 100 Urine samples of all ages and both sexes were studied. In the present study, Out of 100 samples 58 (58%) samples were found to be significant bacteriuria and remaining 42(42%) samples were either non significant or sterile urine. Maximum number of cases were females 58(58%), among which 23 (23%) female samples were sterile and 33(33%) were positive and male was 42(42%), among which 19(19%) male samples were sterile and 25(25%) were positive samples. Out of 33 positive female samples, 3(3%) sample were species other than *Candida albicans*.

The occurrence of bacterial pathogens varies with age, in that, age group ranging from 21-40years 17(29.32%) recorded higher isolates while age group 11- 20years recorded the least 9(15.52%). Major bacterial isolates were *E. coli* (14 %), followed by *Klebsiella pneumoniae* (7 %), *Staphylococcus aureus* (9 %), *Enterobacter spp.* (6 %), *Enterococcus spp.* (11%), *CoNS spp.* (3%), and *Pseudomonas aeruginosa* (2 %). Other organisms are represented in table 1.

Table:1 Frequency of Uropathogens in UTI

Isolate	Total	(%)
E. coli	14	14%
Enterobacter spp.	6	6%
Klebsiella pneumoniae	7	7%
Staphylococci aureus(MRSA)	9	9%
Pseudomonas aeruginosa	2	2%
Non Candida albicans	3	3%
Acinetobacter spp.	1	1%
Enterococcus spp.	11	11%
Citrobacter spp.	1	1%
CONS spp.	2	2%
Sterile	42	42%

*E. coli* and *Klebsiella pneumoniae* were the most prevalent (14% and 7% respectively) among the Gram-negative pathogens and *Staphylococcus aureus* (MRSA) among the Gram-positive organisms (9%) followed by *Enterococcus spp.*(11%). All GNB showed 100% susceptibility to imipenem.

In *Klebsiella pneumoniae*, 100% resistance was shown by Cefuroxime. High rates of resistance to aztreonam cefuroxime were demonstrated by all GNB [Table2].

Among the Gram- positive bacterial isolates *Staphylococcus aureus* MRSA showed high sensitivity to nitrofurantoin (100%), linezolid (100%) and lesser sensitivity was seen to vancomycin (88.89%). The highest resistance to all the gram positive cocci was seen in norfloxacin (93.27%), followed by cefuroxime (63.64%) and co-trimoxazole (58.25%) [Table3]. *Escherichia coli* and *K. pneumoniae*, the most prevalent pathogen, showed low susceptibility to most of the agents except Imipenem, nitrofurantoin, tobramycin amikacin and cefoperazone/sulbactam.

Table: 2 Antibiotic resistance patterns of the GNB isolates in percentage (%) is shown

Antibiotic GNB	E.Coli (n=14)	K. pneumoniae (n=7)	Enterobacter spp. (n=6)	Pseudomonas aeruginosa (n=2)	Acinetobacter spp.(n=1)	Citrobacter spp.(n=1)	TOTAL(31)
Nitrofurantoin	21.43%	28.57%	50%	50%	100%	0	42%
Amikacin	21.43%	42.86	50%	0	100%	0	36%
Norfloxacin	71.42%	71.43%	83.33%	50%	100%	100%	79%
Ampicillin	85.71%	85.71%	100%	100%	0	100%	79%
Cefoperazone/Sulbactam	28.57%	85.71%	57.14%	50%	0	100%	54%
Tobramycin	42.86%	28.57%	100%	0	0	100%	45%
Cefuroxime	85.71%	100%	100%	100%	100%	100%	98%
Piperacillin/Tazobactam	21.43%	42.86%	50%	0	0	0	19%
Azteronam	71.42%	85.71%	100%	100%	100%	100%	97%
Imipenem	0	0	0	0	0	0	0

Table: 3 Antibiotic resistance patterns of the GPC isolates in percentage (%) is shown

Antibiotic GPC	S. aureus MRSA (n=9)	CONS (n=3%)	Enterococcus spp. (n=11%)	Total (n=23)
Nitrofurantoin	0	0	0	0
Norfloxacin	88.89%	100%	90.91%	93.27%
Cefoperazone/sulbactam	28.57%	0	63.64%	30.74%
Amoxiclav	66.67%	33.33%	45.45%	48.48%
Co-trimoxazole	77.78%	33.33%	63.64%	58.25%
Tobaramycin	55.56%	0	72.73%	42.76%
Vancomycin	11.11%	33.33%	18.18%	20.87%

Linezolid	0	0	0	0
Amikacin	28.57%	0	72.73%	33.77%
Piperacillin/tazobactam	28.57%	0	45.45%	24.67%
Cefuroxime	66.67%	33.33%	90.91%	63.64%

**Discussion**

This study has demonstrated that major pathogens causing UTIs are *Escherichia coli* (14%), *Klebsiella pneumoniae* (7%) and *Enterococcus spp.* (11%).

In this study *E. Coli* is the most predominant (14%) causative agent of urinary tract infection. A higher (31.5%) was reported by S. Manikandan *et al.*, (2011)<sup>6</sup>, (37.95%) was reported by Razak Shamataj Kattalagere *et al.*, (2012)<sup>7</sup>. In this study frequency of *Enterococcus spp.* was found to be 6% which was in accordance with S. Manikandan *et al.*, (2010)<sup>6</sup>.

The prevalence of female was 33(56.89%) and the prevalence rates in males were 25(43.11%), which was in accordance with the study by El-Mahmood Muhammad Abubakar (2009)<sup>8</sup> who reported that, out of the 1680 isolated organisms, 1061(45.7%) were from males.

UTI is most commonly seen in the females of age group 21-40 years as 30.91% of samples were in this age group. This might be due to the fact that, most of the people in this age group are more exposed to agents responsible for causing Urinary tract infection. This is comparable with the study carried out by Sood Smita *et al.*, (2012)<sup>9</sup> who reported that age group between 21- 50 years constituted 24.53%.

Our study showed that *E. coli* has a higher frequency compared to other microorganisms in women with UTI than men which is probably because of shortness of urethra and closeness of its outlet to vagina and anus in women. The main cause behind this increasing incidence of UTI with advancing age in males is due to prostate enlargement and neurogenic bladder<sup>10</sup>.

Imepenem used in this study were found to be the most sensitive drug against all isolated uropathogens (GNB). While linezolid and nitrofurantoin were highly effective for *Staphylococcus aureus* (MRSA). The inappropriate usage of wide spectrum antibiotics, insufficient hygiene, immune-suppression, and a prolonged stay in the hospital are some other major etiological factors that elevate the chances of MDR infections<sup>11</sup>. The Antibiogram prepared for the organisms isolated from different infection in this study will guide the physicians in rational use of antibiotics. But in the last, government should take appropriate steps to check against UTI infections. There is a need of concerted efforts on the part of academic researchers and their institutions, industry. Government is crucial if humans are to maintain the upper hand in this battle against bacteria- a fight with global consequences.

**Conclusion**

An increase in the predisposing conditions in recent years, like diabetes, prolonged use of bladder catheters, obstruction, loss of estrogen and lower immunity due to increasing age has resulted in an increased incidence of UTIs. Indiscriminate and long-term use of antibiotics has emerged as an important predisposing factor for lower respiratory tract infections in the study, so there should be judicious use of antibiotics. We conclude that GNB were the predominant isolates of LRT infection followed by GPC. Imepenem were effective among all the antibiotics for Gram-negative and Nitrofurantoin and linezolid were effective among all the antibiotics for Gram-positive. The Present study also highlights the need for periodic surveillance of antimicrobial susceptibility pattern of bacterial isolates, as it would promote the judicious use of antimicrobials given to patients and thus preventing the emergence of drug resistance.

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