

# Bacterial Uropathogens and Their Antibiogram Among In-Patients in a Tertiary Health Care Center, Siddipet, Telangana

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## ABSTRACT

**Background:** Urinary tract infections (UTIs) are the most common healthcare-associated infections. Objective of the study is to determine the bacteriological profile and antibiotic susceptibility pattern of uropathogens to frame better antibiotic policy, which is essential for practicing antimicrobial stewardship.

**Materials and Methods:** This was a retrospective descriptive study done at the Department of Microbiology, RVMIMS & RC, Siddipet, Telangana in which analysis of the bacterial culture isolates obtained from urine samples received between January 2024 to December 2024 of in-patients was performed.

**Results:** Out of 1401 urine samples from inpatients with signs and symptoms of urinary tract infection, 266 (18.9%) showed significant growth on culture. Female preponderance was noticed. Most common causative organism found in our study was *Escherichia coli* (53.75%) followed by *Enterococcus* species (21.4%) and *Klebsiella pneumoniae* (11.6 %). *Escherichia coli* isolates showed susceptibility of 94% to fosfomycin; 77% to Nitrofurantoin, and 64% to Carbapenems. The susceptibility percentage of *Klebsiella pneumonia* isolates, for nitrofurantoin and carbapenems was 38% and 44% respectively. *Enterococcus* species isolates were 33% susceptible to Fosfomycin and 75% susceptible for Nitrofurantoin. MDR

**Conclusion:** *Escherichia coli* followed by *Enterococcus* species are the most common uropathogens. Nitrofurantoin is the most effective antibiotic against uropathogens like *Escherichia coli*, *Enterococcus* species and *Staphylococcus aureus*. *Klebsiella pneumoniae* and *Acinetobacter baumannii* exhibited higher rate of multi-drug resistance.

**Keywords:** Urinary tract infection (UTI), multidrug resistant organisms (MDRO), antibiotic susceptibility testing (AST)

## INTRODUCTION

Urinary tract infection is one of the most common infections worldwide and the most common form of bacterial infections. Prevalence of Urinary tract infections (UTIs) in India ranges between 10 and 30%

<sup>1</sup>. Bacterial UTIs are most common accounting for > 95% of cases; however, fungal, parasitic and viral UTIs are less common. Risk factors associated with urinary tract infections are age, female gender, pregnancy, instrumentation,

diabetes, nephrolithiasis, prostate enlargement, immunosuppression etc.<sup>1</sup>. Antimicrobial resistance among bacteria has increased over the past few years because of the indiscriminate antibiotic use and over the counter availability of antibiotics. Monitoring the pathogen distribution and antimicrobial susceptibility pattern, which varies in different geographical locations is important to ensure effective empiric antibiotic therapy<sup>2</sup>. This study is driven by the need to understand bacterial profile and evolving antibiotic resistance in the hospital in order to optimize treatment strategies.

## MATERIALS & METHODS

**Study Design:** This retrospective analysis was carried out from January 2024 to December 2024 in a tertiary care hospital. During this period, 1401 urine samples collected from in-patients with signs & symptoms of urinary tract infection were analyzed.

### Inclusion criteria:

- Isolates with significant growth from in-patient's sample
- Patients over 15 years of age

### Exclusion criteria:

- Samples from outpatient departments
- Samples that grew more than two morphotypes
- Duplicate samples

**Laboratory Methods:** The Department of Microbiology conducted retrospective analysis on urine samples collected from the various departments of Institute. Semi quantitative culture and identification of isolates was performed by standard microbiological protocol and antibiotic susceptibility testing (AST) was by conventional & automated systems as per Clinical and Laboratory Standards Institute (CLSI) 100<sup>th</sup> edition guidelines<sup>3</sup>. The laboratory records comprised of the patient's age, sex and department, sample type, isolated organisms and their antibiotic sensitivity profiles. The data were

maintained and analyzed with Microsoft Office Excel.

## RESULT

Out of 1401 urine samples from inpatients with signs and symptoms of urinary tract infection, 266 (18.9%) showed significant growth on culture. Female preponderance was noticed ( $n = 158$ , 59.4%). The most common age group was between 35-50 years among females and 50-60 years among males. Maximum samples were from general medicine (32%) followed by ICU (12.8%). *Escherichia coli* resulted in majority UTI's (53.75%), followed by *Enterococcus* species (21.4%), *Klebsiella pneumoniae* (11.6%) and *Pseudomonas aeruginosa* (6.6%). Frequency and proportions of uropathogens is represented in Table 1. Bacterial uropathogens isolated from in-patients' urine samples revealed the presence of high levels of single and multiple antimicrobial resistances against commonly prescribed drugs depicted in Table 2 & 3. Gram negative uropathogens of Enterobacteriaceae family showed 54% ESBL production & 28% were multidrug resistant organisms (MDRO). Most sensitive antibiotics against *Escherichia coli* were Fosfomycin (94%), Nitrofurantoin (77%), Aminoglycosides (75-80%). Most sensitive antibiotics against *Klebsiella pneumoniae* were Tobramycin (94%), Nitrofurantoin (58%), Gentamicin (50%) and Cotrimoxazole (50%). Among non-fermenter, *Pseudomonas aeruginosa* was most common isolate showing highest sensitivity to Tobramycin & Amikacin (78%), Cefepime (76%), Piperacillin-Tazobactam (74%), Ceftazidime (72%) and Ciprofloxacin (70%). 64% of *Acinetobacter baumannii* complex isolates were MDRO. Gram positive uropathogens were commonly isolated from catheterized patients. Among Gram positive uropathogens, *Enterococcus* species was most common isolate, showing highest sensitivity to Vancomycin (100%), Linezolid (93%) and Nitrofurantoin (67%). Ampicillin sensitivity of *Enterococcus*

species was 50% only. Staphylococcus aureus were MRSA. aureus isolates were low in number but 75%

**Table1: Frequency and proportions of uropathogens**

Uropathogens	Frequency	Percentage
Escherichia coli	143	53.75 %
Enterococcus species	57	21.4%
Klebsiella pneumoniae	31	11.6%
Pseudomonas aeruginosa	17	6.6%
Proteus species	10	3.75%
Acinetobacter	4	1.5%
Staphylococcus aureus	4	1.5%

**Table 2: Antibiotic sensitivity pattern (% sensitive) of gram negative uropathogens**

Antibiotics	Escherichia coli (N=143)	Klebsiella pneumoniae (N=31)	Pseudomonas aeruginosa (N=17)	Proteus species (N=10)	Acinetobacter (N=4)
Ampicillin (AMP)	17%	NT	NT	NT	NT
Ceftriaxone (CTX)	23%	28%	NT	22%	23%
Amoxyclav (AMC)	33%	40%	NT	29%	IR
Ampicillin/Sulbactam (A/S)	50%	46%	NT	38%	33%
Gentamicin (G)	75%	52%	NT	65%	28%
Ciprofloxacin (CIP)	11%	17%	71%	8%	25%
Levofloxacin (LEV)	14%	41%	70%	28%	27%
Cotrimoxazole (COT)	8%	55%	IR	33%	32%
Piperacillin / Tazobactam (PIT)	51%	50%	74%	40%	26%
Nitrofurantoin (NIT)	77%	58%	NT	IR	NT
Norfloxacin (NOR)	23%	55%	NT	NT	NT
Cefixime (CXM)	12%	12%	NT	17%	NT
Cefepime (CPM)	38%	40%	76%	17%	22%
Imipenem (IMP)	64%	44%	72%	67%	19%
Meropenem (MRP)	70%	54%	76%	64%	24%
Ertapenem (ETP)	67%	54%	IR	55%	NT
Tobramycin (TOB)	80%	78%	78%	50%	47%
Amikacin (AK)	74%	43%	78%	55%	21%
Tetracycline (TE)	50%	72%	NT	48%	NT
Cefoperazone /sulbactam (CFS)	50%	42%	NT	50%	18%
Ceftazidime (CAZ)	26%	24%	72%	14%	26%
Fosfomycin (FOS)	94%	NT	NT	NT	NT
Aztreonam (AT)	34%	47%	NT	33%	NT

**Table 3: Antibiotic sensitivity pattern (% sensitive) of gram positive uropathogens**

Antibiotics	Enterococcus species (N=57)	Staphylococcus aureus(N=4)
Ampicillin (AMP)	50%	NT
Pencillin (PEN)	28%	NT
Cefoxitin (CX)	NT	33%
Tetracycline (TET)	20%	83%
Cotrimoxazole (COT)	IR	81%
Vancomycin (VA)	100%	100%
Linezolid (LZ)	93%	92%
Gentamicin (G)	21%	77%
Levofloxacin (LEV)	8%	16%
Ciprofloxacin (CIP)	51%	12%
Nitrofurantoin (NIT)	67%	75%
Norfloxacin (NOR)	40%	NT
Fosfomycin (FOS)	43%	NT

## DISCUSSION

UTI being most common among various infections, it's important to know distribution of bacterial agents isolated and their antibiotic susceptibility pattern in order to treat appropriately and to aid in combating multi-drug resistant (MDR) pathogens. In the present study, the urinary tract infection occurrence is 18.9%. Prevalence of urinary tract infections in various population group in different parts of India ranged from 17% to 63%<sup>2, 4,5,6,7,8,9</sup>. In present study UTI occurrence was seen commonly in females of age group 35-50 years and in males it was in older age group (>50 years), which aligned with other studies<sup>1,4,6,7</sup>. Among males UTI was noticed in older age group, due to diabetes, urinary retention and catheterization. *Escherichia coli* was the predominant pathogen (53.75%), responsible for the majority of UTIs, followed by *Enterococcus* species (21.4%), *Klebsiella pneumoniae* (11.6%) and *Pseudomonas aeruginosa* (6.6%). This pattern is in concurrence with studies by Gahlot et al<sup>6</sup> and Anne T et al<sup>9</sup> indicating that *Escherichia coli* is the most common uropathogen. *Enterococcus* species were isolated mostly from catheterized patients. Antibiotic susceptibility testing revealed that *Klebsiella pneumoniae* and *Acinetobacter baumannii* exhibited resistance to multiple antibiotics, including beta-lactam / beta-lactamase inhibitors, third and fourth generation cephalosporins, quinolones, aminoglycosides, cotrimoxazole and Carbapenems. This trend was reported variably in other studies in various parts of India depending on local resistance pattern. This is attributed to the irrational use of antibiotics and the lack of proper antibiotic stewardship. Regular data surveillance and framing antibiotic guidelines aid to optimize treatment outcomes and minimize antimicrobial resistance in healthcare settings.

Limitations: Since this is a retrospective study, we could not track the patient's clinical manifestations and certain risk factors.

## CONCLUSION

The occurrence, frequency and antibiotic sensitivity of uropathogens changes over time and location thus emphasizing a need for regular surveillance and monitoring any change in their pattern. This study helps the institute to frame antibiotic policy for choosing appropriate empirical antibiotic therapy to treat patients and thus curb the rise in resistant strains. Frequent awareness sessions and community role plays to local public along with patients regarding compliance to prescribed drug regimen and avoiding over the counter antibiotics is necessary to avoid misuse of antibiotics.

### *Declaration by Authors*

**Ethical Approval:** Approved

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**Conflict of Interest:** The authors declare no conflict of interest.

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