# Antibiotic Susceptibility Pattern of Bacterial Uropathogens Causing Urinary Tract Infection

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*ABSTRACT:*

*Introduction: Urinary tract infections (UTIs) are the commonest infections in man mainly caused by Escherichia coli and other different members of family Enterobacteriacae. Enterococci and coagulase negative Staphylococci are important gram positive bacteria.Uncontrolled antibiotic usage has contributed to the worldwide emergence of resistant strains.Objectives: Assess responsible uropathogens and evaluate their antibiotic susceptibility pattern to the commonly used antimicrobial agents.Methods: The study was performed on UTI cases from January 2016 to June 2016. 1216 (708 females and 568 males) urine samples were analyzed. Antibiotic susceptibility testing (AST) was read according to Clinical Laboratory Standards Institute (CLSI) guide lines.Results: Culture positive bacteriuria was detected in 154 cases (12.66%) — 96 isolates were E. coli. All the bacterial isolates showed high levels of antimicrobial resistances against the commonly prescribed drugs; least resistance for drugs such as Meropenem and Cefepine.Conclusion: Routine surveillance and monitoring studies should be conducted for the most effective empirical treatment of UTI.*

**Keywords: Urinary tract infections, Escherichia coli, antimicrobial agents, antimicrobial resistances**

## I. INTRODUCTION

Urinary tract infections (UTIs) are one of the commonest infections causing illness in man with an annual incidence of approximately 250 million cases worldwide. [1, 2] UTI is the presence of microbial pathogens in the urinary tract epithelium leading to asymptomatic or symptomatic infections.

There are many different etiological agents causing UTI although the commonest pathogens are the members of Enterobacteriacae mainly *Escherichia coli* being responsible for about 75-90% causes of uncomplicated UTI infection. [3] The other gram negative pathogens causing UTI are *Klebsiella* spp., *Proteus mirabilis* and *Pseudomonas aeruginosa*; however, *Enterococci* and coagulase negative *Staphylococci* are the most frequently encountered gram positive bacteria in UTI.[4]In complicated urinary tract infections and hospitalized patients however, organisms such as *Enterococcus faecalis* and *Pseudomonas* spp. are comparatively more common--depending upon the age, sex, catheterization, and hospitalization histories. [5]

Treatment of UTIs cases is often started empirically and uncontrolled antibiotic usage has contributed to the worldwide emergence of resistant bacterial strains. [6] Resistance rates, however, vary considerably in different areas world-wide. Thus, the aim of this study was to determine uropathogens and evaluate their in-vitro susceptibility pattern to commonly used antimicrobial agents.

## II.  MATERIALS AND METHODS

The study was performed on UTI cases attending a tertiary care hospital in Eastern India from January to June 2016. A total of 1216 clean catch midstream urine samples were collected in sterile containers from the patients complaining of UTI. Bacterial uropathogens were isolated by streak culture procedure on both blood and MacConkey agar and incubated aerobically at 37 °C for 24 hours. [7].

All the bacteria were identified using morphological, microscopy and biochemical tests following standard procedures described by Cowan and Steel and Cheesborough. [8, 9]

Antibiotic sensitivity testing (AST) was done only for pathogenic bacteria by the Disc Diffusion Method of Bauer et al [10] and susceptibility of isolates was read according to Clinical Laboratory Standards Institute (CLSI) guide lines. [11] The reference strains used as control were *E. coli* (ATCC 25922), *S. aureus* (ATCC25923) and *P. aeruginosa* (ATTC 27853).

Data were collected and analyzed.Ethical clearance was obtained prior to data collection and written informed consent was obtained from all the patients.

## III. RESULTS

Majority of the patients—710-(58.39%) were living in urban areas of which 995(81.82%) were outpatients. Of this1216 patients-- 708 patients (58.22%) were females; 331/708 (46.75%) were in the age group of 19--39 years, 601/708 (84.89%) married. The age range of the patients was between 15–82 years (Tabel 1).

**TABLE 1:-Characteristics of study participants**

| LOCATION | NUMBER (N=1216) | PERCENTAGE | | |
|---|---|---|---|---|
| URBAN | 710 | 58.388% =58.39% | | |
| RURAL | 506 | 41.611% =41.61% | | |
| SEX | NUMBER  (N=1216) | PERCENTAGE | | |
| MALE | 508 | 41.776% =41.78% | | |
| FEMALE | 708 | 58.223% =58.22% | | |
| AGE | MALE | FEMALE | TOTAL | PERCENTAGE |
| ≥ 18 yrs | 186 | 168 | 354 | 29.11% |
| 19-39yrs | 123 | 331 | 454 | 37.34% |
| 40-59 yrs | 126 | 174 | 300 | 24.67% |
| ≥ 60 yrs | 73 | 35 | 108 | 8.88% |
| TOTAL | 508 | 708 | 1216 | 100 % |

Out of 1216 cultured urine specimens, culture positive bacteriuria were detected only in 154(12.66%) of the cases. Of this— 96 (62.34 %) of the isolates were *E. coli* and only 28 isolates (18.18%) was *K.*

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*pneumoniae.* Other gram negatives bacteria were found in small numbers. Gram positive bacteria like *S. aureus* and *CONS* was detected in 10 (6.49%) and 3(1.95 %) cases respectively (Table 2) .

**TABLE 2:--Frequency of bacterial uropathogens isolated from UTI suspected patients**

| <u>ISOLATE</u> | <u>No.( N=154)</u> | <u>%</u> |
|---|---|---|
| E coli | 96 | 62.34 |
| Klebsiella | 28 | 18.18 |
| Pseudomonas | 8 | 5.19 |
| Acinetobacter | 5 | 3.25 |
| Staphylococcus aureus | 10 | 6.49 |
| CONS | 3 | 1.95 |
| Enterococcus | 3 | 1.95 |
| Candida | 1 | 0.65 |

All the bacterial isolates showed high levels of antimicrobial resistances against the commonly prescribed drugs (Table 3). The antibiotic discs used were: Gentamicin (GM10µg), Nitrofurantoin (NIF 300µg) Ciprofloxacin (CIP 5µg), Trimethoprim+Sulphamethazole (SXT 25µg), Cefuroxime (CXM 30 µg), Cefixime (CFM 5µg), Amikacin (AN30 µg), Ceftazidime (CAZ 30 µg), Meropenem (MEM 10µg), Amoxiclav (AMC 25µg), Cefepine (FEP 30 µg) and Levofloxacin (LVX5µg).

**TABLE 3:--Resistance pattern of bacterial isolates from urine culture**

| Isolate | GM 10 µg | NIF 300 µg | CIP 5 µg | SXT 25 µg | CXM 30 µg | CFM 5 µg | AN 30 µg | CAZ 30 µg | MEM 10 µg | AMC 25 µg | FEP 30 µg | LVX 5 µg |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| E coli | 8 | 8 | 44 | 20 | 5 | 5 | 3 | 14 | 5 | 11 | 3 | 4 |
| Kleb. | 3 | 6 | 11 | 2 | 1 | 6 | 3 | 7 | 1 | 3 | | 1 |
| CONS | | | 1 | 2 | 1 | | | | | 2 | | |
| Staph | 1 | 4 | 5 | 2 | | | | | | 10 | | |
| Entero-coccus | | 1 | 1 | 1 | | 1 | 1 | 1 | | 1 | | |
| Pseudo | 1 | 2 | 3 | | 1 | | 2 | 2 | | | | 2 |
| Acineto | 1 | | 5 | | | 2 | 2 | 3 | 1 | 1 | | |

*E. coli,* the commonest cause of UTI, showed high resistance to all the commonly prescribed drugs. *Klebsiella* spp which is the second most prevalent pathogen of UTI displayed a similar resistance pattern as E.coli; however, all gram negative isolates were resistant to ciprofloxacin as to that of *E. coli* and *K. pneumonia*. However,

nitrofurantion resistance was detected only in 6 K. *pneumoniae* isolates.

In this study, *Staphylococci (Staphylococcus aureus)* and *CONS (i.e. coagulase negative Staphylococcus aureus)* both combined together was responsible for about 8.44% of UTIs. Both these bacteria were resistant to amoxacillin-clavulanic acid combination in 100% and 66.66%

respectively. All the isolates, however, showed least resistance for drugs such as Meropenem and Cefepine (FEP 30 µg).

## IV. DISCUSSION

Urinary tract infection is one of the commonest condition for which medical attention is seeked and [12] effective treatment of such patients depends on identification of the organisms causing the disease and the selection of an effective antibiotic against them.

In this study, the isolation rate of bacteria from urine was 12.66%. *Escherichia coli* (*E. coli*) was the major aetiological agent in both outpatients and inpatients of both sexes accounting for up to 62.34% of cases which is in agreement with the study done by Ronald *et al* [13,] and Beyene *et al*. [14] *Klebsiella pneumoniae (K. pneumoniae)* was the second commonest reported isolate which is in agreement with the findings of Khameneh *et al* [15] and Chin *et al*. [16]

Resistance to antimicrobial agents has been noted and is an increasing world-wide problem [3] but nitrofurantion resistance was detected only in 8 *E. coli* isolates and 6 K. *pneumoniae* isolates.

Thus the isolation of bacterial uropathogens with a high level of resistance rates for commonly used antimicrobials is leaving the clinicians with very few options to choose drug to treat UTIs. Therefore, it is important to urge physician and other health worker in the field on the need of re-evaluation of empiric treatment of UTI.

As drug resistance among pathogens is an evolving process, routine surveillance and monitoring studies should be conducted to provide physicians with knowledge about the most effective empirical treatment of UTIs.'

## V. CONCLUSION

In our study we observed that newer drugs like cephalosporins are becoming resistant and concurrent administration of a β-lactamase inhibitor such as clavulanate is markedly expanding the spectrum of activity of these drugs. Amikacin seems to be a promising therapy for *E.coli* and other Enterobacteriaceae family infection. Resistance to antimicrobial agents is an emerging problem that has prompted clinicians and laboratory researchers to rethink treatment and testing strategies.

The emergence and spread of resistance can however, be reduced through appropriate or careful use of antimicrobials and increasing the awareness of the population to the hazards of inappropriate antimicrobial use through public health education campaign. [17]

In addition, regular antimicrobial susceptibility surveillance is essential for area-wise monitoring of the resistance patterns. An effective national and state level antibiotic policy and draft guidelines should be introduced to preserve the effectiveness of antibiotics for better patient management. [18]

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