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### **Original Research Article**

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# Antibiotic Resistance Pattern of Bacterial Uropathogens Isolated from Nosocomial and Community Acquired Urinary Tract Infections at Tertiary Care Center

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# ABSTRACT

#### Keywords

UTI, Significant Bacteriuria, Uropathogens

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24 August 2019 Available Online: 10 September 2019 UTI is one of the most common causes of morbidity and financial burden encountered in the medical practice. It is one of the most common infections described in the outpatient setting and hospital patients. In almost all cases, empirical antimicrobial treatment initiates before the laboratory results of urine culture are available; thus antibiotic resistance may increase in uropathogens due to the frequent use of antibiotics. This study is aimed to identify the bacterial isolates from nosocomial and community acquired urinary tract infections and the distribution of their antibiotic resistance pattern. The study was done on 1287 urine samples obtained from January 2019 to October June 2019. Out of these, 350 samples were collected from patients attending the outpatient department, and 937 samples we collected from hospitalized patients. These samples were subjected to culture, and the organism is confirmed by routine biochemical reactions, and their antimicrobial sensitivity pattern is tested by the Kirby Bauer Disc diffusion method.

### Introduction

Urinary tract infection remains one of the most common of all bacterial infections to affect persons at any time of their life, leading the patients to seek medical care. Urinary tract infections are among the most common infectious diseases in, both outpatients and hospitalized patients<sup>- [1],[2]</sup> This could be

because the urinary tract is in direct contact with the exterior <sup>[3]</sup> Approximately 10% of humans will have UTI at some time during their lives. Manifestations of UTI's may vary from mild symptomatic cystitis to pyelonephritis and septicemia <sup>[1]</sup> Significant morbidity and mortality may arise from improperly treated UTI. [4) UTI affects all age-groups with variable incidence. The highest incidence mostly occurs in healthy young women who present with symptoms of acute uncomplicated bacterial cystitis or pyelonephritis. Infection rate also increases with age.<sup>[5]</sup>

The resistance of urinary tract pathogens to commonly prescribed antibiotics has increased worldwide<sup>. [6],[7]</sup> There are also reports of change in the resistance pattern over the last serious decade leading to therapeutic challenges<sup>. [4],[8]</sup> Since the distribution of these pathogens their susceptibility and to antibiotics varies regionally, <sup>[9]</sup> and treatment for UTI is usually empirical, there must be an knowledge adequate regarding the characteristics epidemiological of the pathogens involved and their antibiotic resistance patterns. This will help to achieve good therapeutic outcomes and prevent the drug-resistant emergence of bacterial strains(9).

The present study is aimed to identify the bacterial uropathogens and their antibiotic resistance pattern isolated from both outpatients as well as hospitalized patients.

## Materials and Methods

The study was done at the Department of Microbiology, Kurnool Medical College. Kurnool. A total of 1287 urine samples were obtained from January 2019 to June 2019. Out of these, 350 samples are collected from patients attending the outpatient department presented with symptoms of UTI, and 937 samples were obtained from hospitalized patients with symptoms of UTI after 48 hrs of admission into the hospital. Clean catched midstream urine samples were collected in a wide-mouthed leak-proof sterile container and transported to the laboratory. In the case of catheterized patients specimen is obtained by sterile aspiration of urine from the catheter with needle and syringe.

The specimens were processed bv conventional method i.e.semiquantitative culture using Calibrated loop method and incubated aerobically at 37 <sup>o</sup>C for 24 hrs. Pure growth of the isolate in colony count of  $>10^{5}$ CFU/ml of urine was considered as significant bacteriuria. Culture isolates were further identified by biochemical tests. Antibiotic susceptibility testing was done by the Kirby Bauer Disc Diffusion Method using the commercial media provided by Himedia, Mumbai, India following CLSI guidelines. Antibiotic discs were procured from Himedia. Antibiotic disc used are Amikacin (30µg), Gentamycin (30µg), Ceftazidime/Clavulanic  $(30/10\mu g),$ Imipenem acid  $(10 \mu g),$ Piperacillin/ Tazobactum  $(100/10\mu g)$ , Nitrofurantoin (300µg), Ceftriaxone (30µg), Colistin(50µg), Polymyxin В (300µg), Levofloxacin (5µg), Cefpodoxime (10µg), Vancomycin(30µg).

# **Results and Discussion**

Out of 350 outpatient samples 112(32%), and of 937 inpatient samples 447(47.7%) showed significant bacteriuria. Among the outpatient samples, the common organisms isolated were *E.coli*-41(36.6%), Klebsiella species-38(33.92%), Pseudomonas species-18 species-1(0.89%), (16.07%),Proteus S.aureus-12(10.7%), CONS-2(1.78%) and most of them were isolated from females-88(78.57%) within the age of 21-40 years-67(59.7%).Of the Inpatient samples the predominant organisms isolated were E.coli-177(39.59%), Klebsiella species-173(38.7%), Pseudomonas-40(8.94%) S.aureus-35 (7.83%), Citrobacter species-3 (0.67%)%), Proteus species-5(1.12%) CONS-5(1.125%), Enterococcus species-9(2.01%), and most of the isolates were obtained from females-303(67.78%) and most of the patients are within the age of 21-40 yrs-346(77.4%). When compared to outpatients, isolates from Inpatients were considerably more resistant to

multiple drugs including imipenem (12.1%vs 25.8% for *E.coli* and *klebsiella* 13.1%Vs 32.94% respectively) and piperacillin/ Tazobactum (14.6% Vs 69.5% for *E.coli* and 39.4% Vs 79.2% for *Klebsiella* respectively).The antibiotic resistance pattern is shown in Tables 1&2.

Urinary tract infection is a common health problem worldwide; the epidemiology and antimicrobial resistance pattern of associated bacteria vary from region to region and may differ depending on whether it occurs in the community or the hospital.

Surveillance of bacterial spectrum and resistance pattern of uropathogens is thus very important both globally and at the local level<sup>-</sup>[11]

In the present study, the culture-positive rate was 43.43%, and a similar culture-positive rate was observed in other studies <sup>(12,13).</sup>

Incidence of UTI was more common in females than in males in our study which was 69.94% which was similar to Piatti *et al.*, also reported a higher prevalence of UTI in female (77%). The reasons for the high prevalence of the UTIs in females can be due to the anatomical structure of the urogenital tract having short urethra, presence of normal flora in the vagina, and other factors. The female to male ratio was 2.32:1(14,15,16,17). In the present study, most of the patients are within the age of 21-40 yrs-346(77.4%), which correlates with other studies. <sup>(18)</sup>

The antimicrobial susceptibility patterns have changed over time, but the spectrum of agents causing UTI has remained relatively constant, with *E. coli* being the most common isolate. In our study, *E. coli* was the most common isolate (38.9%-218 out of 559), both in the OPD and in the IPD which is similar to studies from other tertiary care centers<sup>(19).</sup> However, studies from some other parts of the country have shown higher isolation rates (65% to more than 90%)<sup>(13,14)</sup>.Other isolates are Klebsiellaspecies(37.8%),Pseudomonasspecie s(10%), S.aureus(8.4%),Enterococcus species(1.6%) ,CONS(1.25%),Proteus species(1.07%), Citrobacter species(0.5%).

*E. coli* has shown highest resistance against Ceftriaxone (96.6% vs 80.4%) and Ciprofloxacin(88% vs 53.6%), Piperacillin /Tazobactum (69.5% vs14.6%), Cetazidime and Clavulanic acid(62.7% vs43.9%) Gentamycin(52% vs 31.7%),Imipenem(25.8% vs 12.1%) for Ip and Op samples respectively.

*K. pneumonia* has shown highest resistance to Ciprofloxacin(83.3% vs 73.6%),ceftriaxone (52% vs 36.8%), imipenem (32.9% vs 13.1%), pipericillin/tazobactum (79.7% vs 39.4%), gentamycin (56.6% vs50 %) for Ip and Op samples respectively.

Pathogens isolated from in-patients generally showed higher resistance rate compared to those isolated from out-patients to tested antibiotics.

Among all the Gram-negative isolates highest resistance was shown to Ceftriaxone followed by Ciprofloxacin, Piperacillin/Tazobactum, Gentamycin, Amikacin. There is an increasing resistance pattern to Imipenem, which is different from other studies where Gramnegative uropathogens were less resistant to amikacin, piperacillin-tazobactam, and imipenem.

Furthermore, Meier *et al.*, in 2011, reported higher resistance (84.8%) to ciprofloxacin and higher resistance (15%) to nitrofurantoin in comparison to this study results<sup>(20).</sup> Auer *et al.*, in 2010, showed a resistance rate (11.12%) to nitrofurantoin,(27.38%) to gentamicin and (72.23%) to ciprofloxacin<sup>(21)</sup>

Organism	NO.of isolates	AK (R%)	GEN (R%)	CIP (R%)	CAC (R%)	IPM (R%)	PIT (R%)	NIT (R%)	CTR (R%)	CPM (R%)	PB (R%)	CL (R%)
Escherichia coli												
IP	177	27.7	51.97	88	62.7	25.8	69.5	26.5	96.6	-	-	-
OP	41	31.7	31.7	53.6	43.9	12.1	14.6	44	80.4	-	-	-
Klebsiella species												
IP	173	49.7	56.6	83.8	86.7	32.94	79.2	53.7	92.4	-	-	-
OP	38	50	50	73.6	52.6	13.1	39.4	50	73.6	-	-	-
<i>Pseudomonas</i> species Ip Op	40 18	57.5 33.33	40 27	25 33.33	-	60 5.5	20 5.5	42.5 50	37.5 5.5	65 22.22	5 -	25 -
Citrobacter species												
Ip	3	-	33.33	-	33.33	33.3	66.6	-	33.33	-	-	-
Ōp	-	-	-	-	-	-	-	-	-	-	-	-
Proteus species												
Ip	5	20	20	-	20	20	20	20	20	-	-	-
Ор	1	-	-	-	-	-	100	-	-	-	-	-

Table.1 Distribution of Antibiotic resistance pattern among the gram-negative isolates

Table.2 Table showing the resistance pattern of gram positive organisms

Organism	No of isolates	AK (R%)	GEN (R%)	E (R%)	CD (R%)	AMC (R%)	VA (R%)	LZ (R%)	CX (R%)	DO (R%)	CIP (R%)
S.aureus		()	()	()	()	()	()	()	()	()	()
Ір	35	14	11.4	37.5	25.7	74	11.4	8.6	14.2	2.8	2.8
Ōp	12	25	33.3	33.3	33.3	66.6	16.6	16.6	-	-	-
CONS											
IP	5	-	-	80	80	80	20	-	60	20	20
OP	2	-	-	50	50	50	-	-	-	-	50
Enterococcus											
species											
Ір	9	11.1	44.4	55.5	44.4	-	11.1	11.1	11.1	11.1	-
Ор	-	-	-	-	-	-	-	-	-	-	-

Fig.1 Line diagram showing the significant bacteriuria





Fig.2 Bar diagram showing the gender-wise distribution of significant bacteriuria

Fig. 3 Bar diagram showing the isolates in both outpatient and Inpatient samples



In another study by Rajan and Prabavathy in 2012, the urinary ESBL-producing *E. coli* were almost resistant (98%). Ullah *et al.*, in 2009 reported much higher bacterial resistance rates of (80.3%) and (66.7%) to ciprofloxacin and gentamicin, respectively<sup>(22).</sup>

Piperacillin-tazobactam and imipenem are kept as reserve drug options because the increasing resistance to imipenem calls for a check on the indiscriminate use of imipenem for the treatment of UTI. This pattern of antibiotic resistance among uropathogens has severe implications on developing countries such as ours due to increased healthcare cost resulting from the increased duration of hospital stay and the search for more 'highpowered' expensive antimicrobials. The resistance profile of the bacteria isolated may be attributed to the irrational use of antibiotics, practices of self-medication, antibiotics misuse, and abuse<sup>(10).</sup>

The changing antibiotic sensitivity of uropathogens with time and the emergence of multidrug resistance in them is a matter of concern as it has an impact on the empiric selection of antimicrobials.

India, In there are clear-cut no recommendations on how frequently antimicrobial surveillance should be done. Periodic studies depicting the local resistance pattern of uropathogens should be done to assist the policymakers in formulating and policies prescribing assessing for the antibiotics in India.

So, there is a need for developing specific guidelines to prescribe antibiotics in treating UTI and directing the attention of the authorities to the development of increasing antibiotic resistance of uropathogens to take corrective measures.

Knowledge regarding the uropathogens and their resistance patterns to various antibiotics is essential to formulate the guidelines for the early institution of empirical therapy as well as for definitive therapy. We suggest that empirical antibiotic selection should be based on the knowledge of the local prevalence of bacterial organisms and their resistance pattern rather than on universal guidelines.

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