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## Etiology and Antibiotic Resistance Pattern of Urinary Tract Infections with Special Reference to Gram Negative Isolates.

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### ABSTRACT

Urinary tract infection (UTI) is the second most common infectious disease in both community and hospitalized patients. In majority of the cases, the patients are treated empirically before the results from the laboratory, which increases the antibiotic resistance in uropathogens due to improper use of drugs. This study was done to find out the etiological agents of UTI, their prevalence, and to evaluate the antibiogram of the bacterial isolates from urine. This study was conducted in tertiary hospital, Chennai from October to December 2013. Midstream Urine samples from 750 patients suspected of UTI were analyzed by conventional semi-quantitative culture technique for significant growth. Antimicrobial susceptibility test was performed for the isolates by Kirby-Bauer disk diffusion method. The overall prevalence of UTI was found to be 23.7%. The most frequent causative organisms isolated were *Escherichia coli* (49.16%), *Klebsiella spp* (22.9%), *Pseudomonas aeruginosa* (8.93%), *Citrobacter freundii* (1.1%), *Enterobacter aerogenes* (0.55%), *Proteus spp* (3.91%), and *Providencia stuartii* (1.1%), *Edwardsiella spp.* (0.55%), *Acinetobacter spp* (1.1%), *Staphylococcus aureus* (0.55%), *Streptococcus spp* (1.1%) and *Enterococcus spp* (0.55%) and *Candida spp* (8.3%). Amikacin, nitrofurantoin and gentamycin were found to be the most effective antibiotics against gram negative isolates. *E. coli* was found to be the most common etiological agent of UTI.

**Keywords:** Urinary tract infections, Gram negative isolates, antibiogram.

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## INTRODUCTION

Urinary tract infection (UTI) is the most common infectious disease worldwide [1] affecting all age groups. It is classified into uncomplicated to complicated UTI. UTI is more common in females than males due to anatomic predisposition and hormonal changes in pregnancy, sexual activity.

Antibiotic susceptibility pattern of urinary tract infections and etiology have been changing in past and recent years, and antibiotic resistance pattern has been the major problem globally.

As empirical treatment is initiated before laboratory results of urine cultures are available, resistance in the uropathogens is increased due to misuse of antibiotic. Specifically the resistance in gram negative isolates has increased due to various resistance mechanisms. Hence the knowledge of etiological agent and resistance pattern in specific geographic locations may aid the clinicians to choose appropriate antibiotics. The aim of the study is to determine the etiological agent of urinary tract infections, their prevalence and evaluate their in vitro susceptibility patterns of gram negative bacteria to commonly used antimicrobial agents.

## MATERIALS AND METHODS

The study period was from October 2013 to December 2013. A total of 750 midstream urine was collected from patients suspected with UTI from various Departments (General, Urology, Nephrology and Gynecology). There were cultured in surface streak procedure in both blood agar and MacConkey agar using calibrated loops for semi-quantitative method and incubated aerobically at 37 °C for 24 hour and were further incubated for 48 hours. Cultures were considered negative and positive. Cultures with no single colony were considered negative. Sample was considered positive for UTI in gram negative isolates, if a single organism was cultured at a concentration of  $\geq 10^5$  cfu/ml. And for Gram Positive isolates, the cultures were considered positive if single organism was cultured at concentration of  $\geq 10^3$  cfu/ml. Bacterial identification was made using Gram staining and colonial morphology, and various standard biochemical tests coagulase, indole, citrate, urease, triple sugar iron agar, H<sub>2</sub>O production, oxidase, catalase, bile esculin. Antimicrobial susceptibility of isolates was tested for bacterial uropathogens by the modified Kirby Bauer disk diffusion technique according to Clinical and Laboratory Standards Institute (CLSI) guidelines. The reference strains used as control were *E. coli* (ATCC 25922), and *P. aeruginosa* (ATCC 27853), and *Staphylococcus aureus* (ATCC 25932).

## RESULTS

In the present study, 756 urine samples were analysed. The distribution of the urinary isolates is reported in **Table 1**. Overall, 179(23.7%) out of 756 patients showed positive urine cultures. In which 110(61.5%) isolates were from female patients and 69(38.5%) isolates were isolated from male patients. More than 164(83.2%) isolates belong to Enterobacteriaceae. In which, *E. coli* was the predominant microorganism from all age

groups and both sexes. *Candida* spp was isolated from 15 cases, out of which 11 were from females between the age group of 50- 70.

**Table1: Incidence and distribution of urinary isolates**

S No	ISOLATES	NO OF ISOLATES	PERCENTAGE (%)
1	<i>E. coli</i>	88	49.16
2	<i>Klebsiella</i> spp	41	22.9
3	<i>Pseudomonas</i> spp	16	8.93
4	<i>Proteus</i>	7	3.91
5	<i>Citrobacter</i>	2	1.1
6	<i>Acinetobacter</i>	2	1.1
7	<i>Providencia</i>	2	1.1
8	<i>Edwardsiella</i>	1	0.55
9	<i>Enterobacter</i>	1	0.55
10	<i>S. aureus</i>	1	0.55
11	<i>Streptococcus</i>	2	1.1
12	<i>Candida</i>	15	8.3
	Total	179	100

The resistance pattern of the gram negative isolates is reported in Table 2. 50-80% of *E. coli*, *Klebsiella* spp, *Pseudomonas* spp and *Proteus* spp isolates were resistance to most of the cephalosporin. Most of the isolates were sensitive to Amikacin, nitrofurantoin, gentamycin.

**Table 2: Resistance pattern of Gram negative isolates from urine**

S. No	Isolates	AK%	AT%	Gm%	CX%	FU%	CR%	FR%	CI%	NF%	NA%	FX%	CZ%	OF%	CN%
1	<i>E. coli</i>	4.5	72.7	54.5	76.7	3.4	81.8	76.1	73.8	72.7	85.2	77.2	71.5	70.4	79.5
2	<i>Klebsiella</i> spp	7.3	7.3	46.3	31.7	31.7	73.1	58.7	63.4	60.9	65.85	65.8	63.4	56.9	70.7
3	<i>Pseudomonas</i> spp	6.25	43.75	18.75	68.75	81.25	81.25	25	25	31.25	87.5	93.75	31.25	25	81.25
4	<i>Proteus</i> spp	28.57	57.14	57.14	85.7	57.14	71.4	71.4	57.14	57.14	85.7	85.7	57.14	71.4	71.4
5	<i>Citrobacter</i> spp	0	0	0	0	50	50	0	0	0	0	50	0	0	50
6	<i>Enterobacter</i> spp	0	100	0	100	0	100	100	100	100	100	100	100	100	100
7	<i>Providencia</i> spp	0	50	0	50	50	100	50	50	50	50	100	50	50	100
8	<i>Edwardsiella</i> spp	0	100	0	100	100	100	100	0	0	100	100	100	0	100
9	<i>Acinetobacter</i> spp	50	100	100	100	50	100	100	100	100	100	100	100	100	100

AK- Amikacin, AT- Aztreonam, GM- Gentamycin, Cx-Cefotaxime, CZ- Ceftazidime, FU- Nitrofurantoin, CR – Cefuroxime, NA-Nalidixic acid, CR-Cefuroxime, Fx- Cefixime, CN-cefdinir, FR – Ceftriaxone, CI- Ciprofloxacin, Of – ofloxacin

## DISCUSSION

UTI is predominantly an infectious disease of females due to short urethra and close to anal opening and also due to hormonal changes during pregnancy. In our study, out of 179 isolates, 110 were isolated from female patients. Similar findings were done by other studies [2, 3]. Bacteria are the major causative organism and are responsible for more than 94.4% of UTI cases. This is in concordance with other study [4].

According to our study Enterobacteriaceae was major cause of UTI. *E. coli* was predominant bacterial pathogen followed by *Klebsiella* species, *Pseudomonas* species and other non-lactose fermenters, which is in concordance to a study [5].

*Escherichia coli* is the most frequent infecting organism in acute infections [6,7]. Area-specific monitoring studies aimed to understanding the types of pathogens responsible for UTIs and their resistance patterns may help clinicians to select proper empirical treatment [8].

In our study, overall 95% of *E. coli* was sensitive amikacin, nitrofurantoin, gentamycin. 50-70% *Klebsiella* spp in addition to this was sensitive to Ciprofloxacin, ofloxacin, cefotaxime, cefuroxime, aztreonam.

In contrast to this 70- 80% of *Pseudomonas* spp are resistant to nitrofurantoin and cephalosporins. However, isolates were sensitive to ciprofloxacin, Ofloxacin, amikacin, and gentamycin. Overall, 50-80% of *Proteus* strains are resistant to all the 14 drugs.

*Acinetobacter* spp was resistant to almost all the commonly used antibiotic routinely and necessitating its susceptibility test for new drug [9]. But in general, 50-90% of the gram negative organisms were resistance to most cephalosporins. Nitrofurantoin is a urinary antibiotic, hence not used for other infections outside UTI. This may be the reason that resistance to this agent has not occurred much. As *Pseudomonas* spp. and *Acinetobacter* spp., have intrinsic resistance to this drug, which is clearly seen from our results. Hence nitrofurantoin can be used for treating uropathogens (*E. coli*, *Klebsiella* spp., *S. aureus*), which has a good effect [10].

Resistance to ceftriaxone and ceftazidime was more than 60% in almost all the gram negative isolates tested indicating ESBL producers [10], especially in *E. coli*, although resistance among *E. coli*, *Klebsiella*, and *Pseudomonas* spp was very low (4-7%). But toxicity of aminoglycoside must be kept in mind; however it can be used for the second line therapy for UTI.

## CONCLUSION

In the present study, we conclude that *E. coli* and *Klebsiella* are the major urinary tract pathogens. The study reveals the high level of resistance to commonly available antimicrobials among the gram negative bacteria, and the necessity of starting the treatment after the susceptibility pattern is reported from microbiology laboratory. Taking into account the resistance pattern nitrofurantoin can be drug of choice for *E. coli* and



Klebsiella. Ciprofloxacin, Ofloxacin, amikacin can be the drug for Pseudomonas spp. depending on the susceptibility pattern.

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