

**Original Article****Microbiological profile of urinary tract infection in a tertiary care hospital**

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DOI: 10.5455/jrmds.2016436

**ABSTRACT**

**Background:** Urinary tract infections are amongst the most common infections encountered in clinical practice. Area specific monitoring studies aimed to gain knowledge about the type of pathogens responsible for UTIs and their resistance patterns may help the clinician to choose the correct empirical treatment.

**Objective:** We aimed to study the antibiotic resistance pattern of the urinary pathogens isolated from patients in our tertiary care hospital.

**Methods:** This observational study was conducted at N.H.L. Medical College and V.S. Hospital, Ahmedabad Gujarat, India from January to June 2016. The study included all the patients who were admitted or visited the outpatient department in the hospital with symptoms of UTI and had UTI confirmed by positive urine culture reports. Culture and antibiotic susceptibility was carried out as per standard microbiological procedures.

**Results:** Significant bacteriuria was present in 24.26% of the samples, 64.58% were sterile and 11.16% showed insignificant bacteriuria. The most common pathogens isolated were *Escherichia coli* (61.42%), *Klebsiella* spp (14.22%) and *Pseudomonas aeruginosa* (8.02%). For enterobacteriaceae isolates the mean resistance was low for cefoperazone sulbactam (34.4%), amikacin (29.4%), nitrofurantoin (27.6%) and carbapenems (30%). Isolates of *Pseudomonas aeruginosa* and *Acinetobacter baumannii* were highly resistant to multiple antimicrobial agents.

**Conclusion:** A high isolation rate of pathogens from urine samples of clinically suspected UTI shows a good correlation between clinical findings and microbiological methods. The antibiotics commonly used in UTIs are less effective. Regular monitoring is required to establish reliable information about resistance pattern of urinary pathogens for optimal empirical therapy of patients with UTIs.

**Key Words:** Urinary Tract Infection, Antibiotic Resistance, Antibiogram.

**INTRODUCTION**

Among the most common infectious diseases, urinary tract infections (UTIs) are a commonly encountered diseases by clinicians in developing countries with an estimated annual global incidence of at least 250 million [1,2]. Many times, physicians resort to prescribing broad spectrum antibiotics over specific antibiotics in the view of resistance of the causative organism to the antibiotic. Poor patient compliance and incomplete course of antibiotic therapy have resulted in the evolution of resistance to many of these antibiotics. In last decade bacteria emerged with new forms of virulence and new patterns of resistance to antimicrobial agents. The emergence of resistance to such drugs is a natural biological phenomenon.[3] Resistance rates to the most common prescribed drugs used in the treatment of UTIs vary considerably in different areas worldwide. The estimation of local etiology and susceptibility profile could support the most

effective empirical treatment [4]. Thus, the aim of this study was to determine bacterial etiologic agent of uropathogen and evaluate their in vitro susceptibility pattern to commonly used antimicrobial agents.

**MATERIALS AND METHODS****Study area and design**

The study was done at N.H.L. Medical College and V.S. Hospital, Ahmedabad Gujarat, India from January to June 2016. The study included all the patients who were admitted or visited the outpatient department in the hospital with symptoms of UTI during the study period and had UTI confirmed by positive urine culture reports. Only one sample from each subject was considered.

**Sample collection**

A clean catch midstream specimen or suprapubic aspirate, in subjects who were unable to give the

former, was collected in a sterile wide mouthleak-proof container to hold about 50 ml specimen.

### Isolation & Identification of Organisms

Using a calibrated loop method of a loop diameter of 4 mm, 10 $\mu$ l of the un-centrifuged specimen was transferred onto the agar plate and streak using the modified Mayo's technique without flaming the loop for isolation and incubated at 35–37°C for 24 h. A specimen was considered Significant bacteriuria for UTI if a single organism was cultured at a concentration of >10<sup>5</sup> colony forming units/ml and Insignificant bacteriuria if between 10<sup>4</sup> -10<sup>5</sup> colony forming unit and sterile if <10<sup>4</sup> colony forming unit. The gram-positive and gram-negative organisms were culture isolates which were further identified by using various biochemical reactions up to genus/species levels wherever applicable. In the presence of any potential growth, Antibiotic susceptibility testing was done using modified Kirby–Bauer disc diffusion method on Mueller-Hinton agar according to latest CLSI guideline [5]. Drugs used routinely in hospital were included for testing.

**Ethical clearance:** Not required as it is observational study.

## RESULTS

**Table1 – Frequency of uropathogens**

Organisms	No. of isolates	& (n=661)
<b>Escherichia coli</b>	406	61.42%
<b>Klebsiella pneumoniae ss. pneumoniae</b>	94	14.22%
<b>Pseudomonas aeruginosa</b>	53	8.02%
<b>Proteus sp.</b>	14	2.12%
<b>Providencia sp.</b>	3	0.45%
<b>Morganella sp.</b>	3	0.45%
<b>Citrobacter koseri (diversus)</b>	5	0.76%
<b>Acinetobacter baumannii</b>	7	1.06%
<b>Staphylococcus aureus ss. aureus</b>	11	1.66%
<b>Staphylococcus, coagulase negative</b>	6	0.91%
<b>Enterococcus sp.</b>	4	0.61%
<b>Candida albicans</b>	18	2.72%
<b>Candida spp.</b>	37	5.60%

Out of 2725 cultured urine specimens, Significant bacteriuria was present in 661(24.26%) of the samples, 1760(64.58%) were sterile and 303(11.16%) showed insignificant bacteriuria. E. coli (61.42%) and K. pneumoniae (14.22%) were the most prevalent microorganisms in UTI patients, while other gram negatives were found in small in

number. On the other hand the isolated Gram positive bacteria were S. aureus, S. saprophyticus and enterococcus spp. proportion of 11(1.66 %), 6 (0.91%) and 4(0.61%), respectively. Candida albicans and other Candidanon albicans spp. were also isolated proportion of 18(2.72 %) and 37(5.60%) respectively (Table 1).

The antimicrobial potency and spectrum for selected antimicrobial agents of different classes against the UTI pathogens recorded in the study are summarized in figure 1, 2, 3 and 4. Bacterial uropathogen isolates from patients with UTIs revealed the presence of high levels of single and multiple antimicrobial resistances against commonly prescribed drugs.

Enterobacteriaceae which is the predominant cause of UTI, showed high percentage of resistance to ceftriaxone and cefepime (82.7% & 69.9% respectively), and low resistance to Cefoperazone/sulbactam (34.4%). Carbapenems (30%), amikacin (29.4%) and nitrofurantoin (27.6%) had the least resistance. A high rate of resistance was recorded against levofloxacin (79.3%). [Fig-1].

Pseudomonas aeruginosa and Acinetobacter baumannii were responsible for about 8.02% and 1.06% of UTIs cases respectively. Isolates of these both organisms were highly resistant to multiple antimicrobial agents. Among the isolates of pseudomonas aeruginosa 52.8% were carbapenems and piperacillin-tazobactam resistant. Whereas in Isolates of Acinetobacter baumannii 57.1% were carbapenems resistant followed by 42.9% of isolates were cefoperazone-sulbactam resistant. [Fig-2 & Fig-3].

In this study, staphylococcus spp. were responsible for about 2.57% of UTIs cases; Among these, 42.9% strains of staphylococcal spp. were methicillin resistant staphylococcus. Staphylococcus spp. was most sensitive to vancomycin (100%), linezolid (100%) and clindamycin (100%). [Fig-4].

## DISCUSSION

Bacterial infection of the urinary tract is one of the common causes for seeking medical attention in the community, [6]. Effective management of patients suffering from bacterial UTIs commonly relies on the identification of the type of organisms that caused the disease and the selection of an effective antibiotic agent to the organism in question [7].

Fig. 1 – Resistance pattern of *Enterobacteriaceae* to various antibiotics

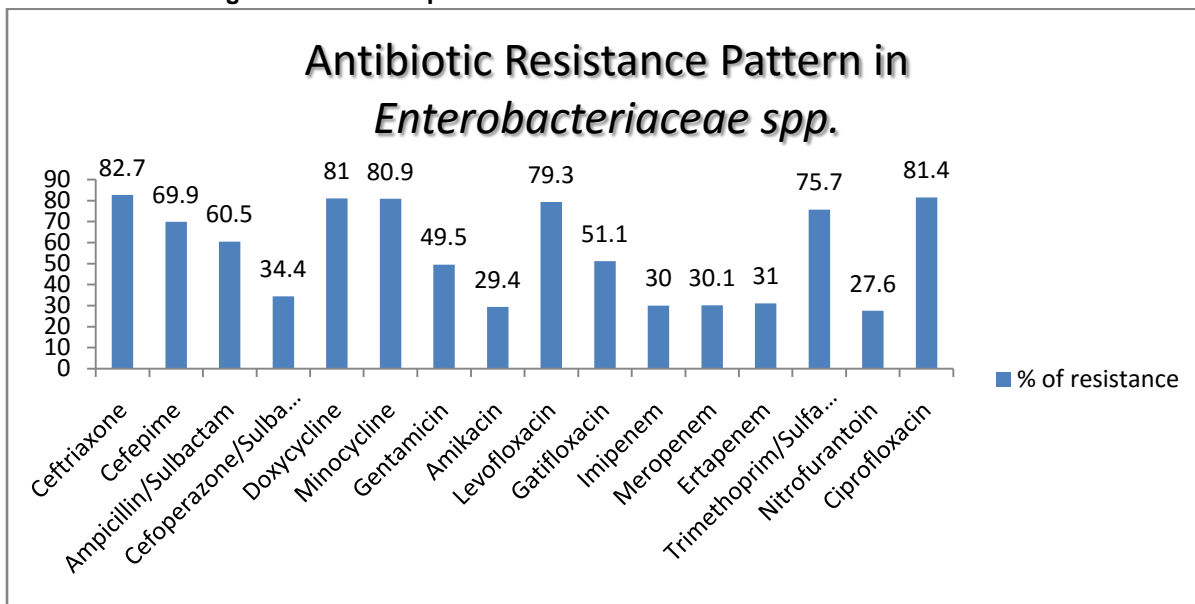
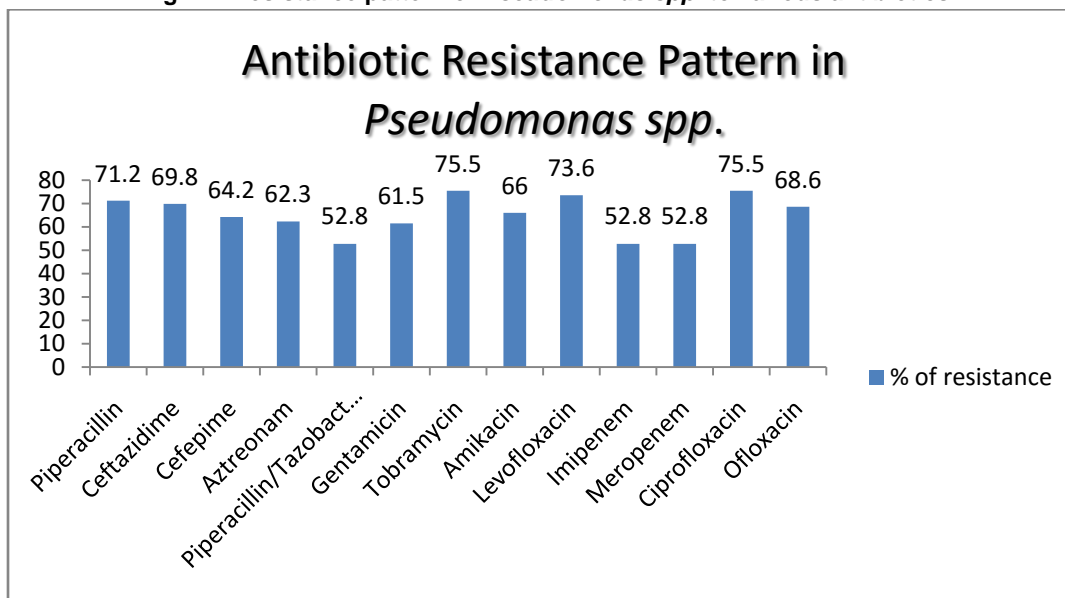


Fig. 2 – Resistance pattern of *Pseudomonas* spp. to various antibiotics



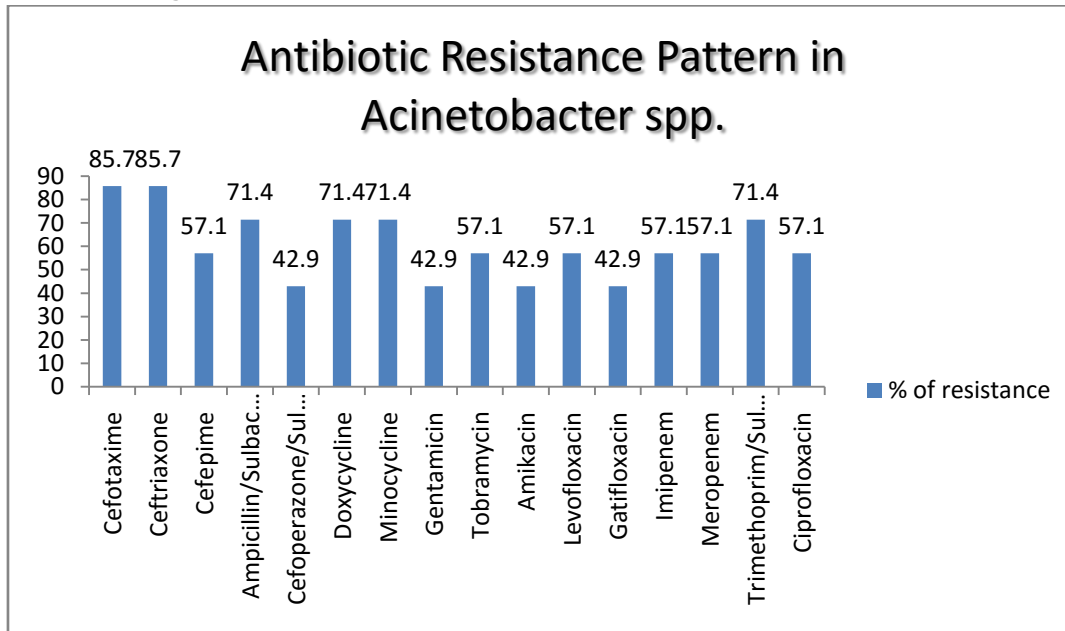
Significant bacteriuria was present in 24.26 percent of the samples, 64.58 percent were sterile, 11.16 percent showed insignificant bacteriuria which is comparatively similar to reports within the country. [8,9] A high isolation rate of pathogens from urine samples of clinically suspected UTI shows a good correlation between clinical findings and microbiological methods. *E. coli* and *Klebsiella pneumoniae* were the most common organisms isolated in our study. These findings agree with other recent Indian reports which have indicated that gram negative bacteria, mostly *E. coli* and *Klebsiella*

*pneumoniae*, are the most common pathogens isolated in patients with UTI [10]. The most effective antibiotic for *E. coli* in this study observed was Cefoperazone- sulbactam followed by amikacin and Nitrofurantoin. This is similar to recent studies in India (5). The antimicrobial susceptibility pattern of *E. coli* varies widely by region.

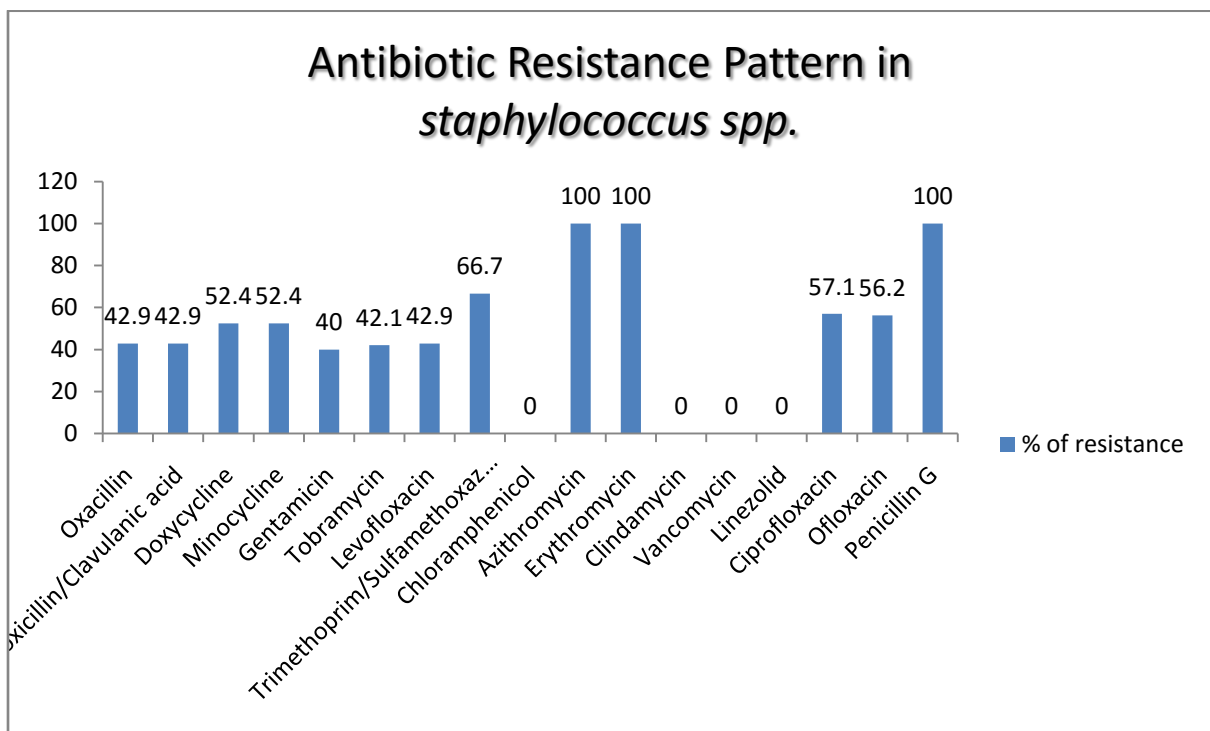
Related to many other studies in the isolates of *Pseudomonas aeruginosa* and *Acinetobacter baumannii* much higher resistance pattern was observed. [11-13] The above difference may be due

to the geographic variations that were observed in the different strains of nonfermentors.

**Fig. 3 – Resistance pattern of *Acinetobacter spp* to various antibiotics**



**Fig. 4 – Resistance pattern of *staphylococcus spp.* to various antibiotics**



Also, the Carbapenem resistant organisms raise a concern over the available options to treat complicated and drug resistant cases. Until recently, carbapenems were almost uniformly active against

resistant Gram negative organisms, but some strains have now developed very effective ways to deal with the carbapenems. There are various mechanisms by which these organisms achieve such feat, by

producing beta lactamases which destroy the antibiotics, by blocking the entry of these antibiotics, or by efflux pumps which actively pump out these antibiotics.[14] Furthermore, some of these mechanisms are not antibiotic or class specific, and can also be easily transferred from one organism to another. The situation is worsening everyday as no new antibiotics against these multidrug resistant organisms are in advanced stages of clinical development. With limited options and all the above mentioned growing concerns, it would not be late where we will find ourselves in epidemics with multidrug resistant organisms. Such feat on a larger scale could help in establishing standardized empiric therapy. But care should be taken to include the prevalent organism and antibiotic susceptibility pattern of the region as it varies over larger geographic areas due to various reasons.

Resistance to oxacillin as a representative of beta lactamase resistant penicillins has developed in UTIs with Gram-positive cocci isolated, where resistance rates to oxacillin were 42.9% for *Staphylococcus*. *S.aureus* is an important uropathogen and was responsible for 1.66% of UTI cases in our study. It has been emphasized that any amount of this bacterium should be subjected to antibiogram test. [15]

Over the last decade there has been a substantial increase in resistance of uropathogens to antibiotics. Resistance rates among *S. aureus* strains are increasing, and a major part of this species has become resistant to beta lactamase resistant penicillins. [16, 17] For such resistant species, vancomycin is the effective choice of drug. Resistance to vancomycin is reported among enterococci, [18, 19] but this resistance has also begun to develop among staphylococci. [20] In this study we concentrated on resistance to vancomycin and fortunately resistant strains to vancomycin were not observed.

The regional variations of resistance to antibiotics may be explained in part by different local antibiotic practices. [21, 22] The influence of excessive and/or inappropriate antibiotic use on the development of antibiotic-resistant strains, particularly broad-spectrum agents prescribed empirically, has been demonstrated. Reducing the number of prescriptions of a particular antibiotic can lead to a decrease in resistance rates. [23, 24]

## CONCLUSION

The result of present study shows higher rate of resistance in a tertiary care hospital, though not that different from the rest of the world, is ever increasing due to uncontrolled abuse of the available antibiotics. A strong decision has to be established regarding the antibiotic policies for UTI and stringent measures have to be taken to ensure the effectiveness of the same. This reflects the need for accurate and updated population surveillance data, particularly in light of concerns regarding variable regional antimicrobial susceptibility patterns. This information will directly affect selection of empiric therapy for UTI. Regular monitoring is required to establish reliable information about susceptibility pattern of urinary pathogens for optimal empirical therapy of patients with UTIs. We suggest that empirical antibiotic selection should be based on the knowledge of local prevalence of bacterial organisms and antibiotic sensitivities rather than on universal guidelines.

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Date of Submission: 10/08/2016  
Date of Acceptance: 30/08/2016

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