



# Isolation of Human Pathogenic bacteria causing Urinary tract infection and their Antimicrobial susceptibility pattern in a Tertiary care Hospital, Jaipur, India

Kumar Rakesh\*, Dahiya S.S., Hemwani Kirti and Srivastava Preeti

Department of Microbiology, NIMS Medical College, NIMS University, Jaipur, Rajasthan, INDIA

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## Abstract

*This study was performed in a tertiary care hospital at Jaipur, Rajasthan between March 2013 to February 2014 to confirm the changing pattern of antibiotic sensitivity among pathogens causing urinary tract infections (UTI). The culture positivity in urine samples was found to be 24.30%. The most common organisms isolated were Escherichia coli, Staphylococcus aureus, Coagulase negative Staphylococcus aureus, Klebsiella spp. and Pseudomonas spp. (These represented 34.42%, 22.95%, 18.03%, 14.75% and 9.83% of isolates respectively). More than 70% of the isolates were sensitive to Imipenem and Ciprofloxacin. Very low rate of sensitivity was seen against Cefuroxime and Amikacin. Prior to advising the antimicrobial therapy, a detailed knowledge of the susceptibility patterns of the uropathogens is necessary to avoid incompatible and irrational antimicrobial usage and to control the further development of drug resistance.*

**Keywords:** UTI, uropathogens, antimicrobial susceptibility pattern, human pathogenic bacteria.

## Introduction

Urinary tract infections (UTIs) are the most frequent infections, which cause pain, fever, discomfort and extra intestinal infections in all age groups of people<sup>1</sup>. Every year approximately 150 million people are suffering with UTI all over the world<sup>2</sup>. It has been expected that about six million patients visit outpatient departments and about 300,000 are treated in the wards every year for UTI worldwide. About 10% of human population gets UTI at some stage during their lives<sup>3</sup>. Most common causative bacteria is E. coli and more prone to play a role in causing 80-90% of lower UTI, whereas in about 95% of patients suffering from acute pyelonephritis, normally the infecting organisms are Gram negative isolates, Proteus mirabilis and Klebsiella pneumoniae<sup>4</sup> and some Gram positive organisms found are Streptococcus agalacticus and Coagulase negative Staphylococci<sup>5</sup>. Now a days, drug resistance is a huge growing problem in treating infectious diseases like malaria, tuberculosis (TB), diarrheal diseases, urinary tract infections (UTIs) etc. As recommended by Goldman and Huskins<sup>6</sup>, the inappropriate and uncontrolled use of many antibiotics resulted in rate of antimicrobial resistance which became a major health problem globally. In this study, we analyzed the antimicrobial susceptibility patterns of the commonly isolated Gram negative and Gram positive bacteria from urine specimens examined at a tertiary care Hospital.

## Material and Methods

**Collection and transportation of urine sample:** A total of 251 urine samples were collected each in 30 ml sterile plastic container from the patients located in NIMS hospital with

aseptic precautions. The samples were properly labeled indicating the source, date/time of collection, sex and age of patients.

Every sample was inoculated on both blood agar and MacConkey agar plates and incubated at 37°C for 24-48 hours. Significant growth was identified biochemically in a systematic way according to standard methods as per CLSI guidelines<sup>7</sup>. Antimicrobial sensitivity testing of all isolates was performed on Mueller Hilton Agar plates by the Kirby Bauer method<sup>8</sup>.

For Gram negative and *Pseudomonas aeruginosa* isolates following antimicrobials were used: Ampicillin (10µg), Amikacin (30 µg), Gentamicin (10 µg), Aztreonam (30 µg), Imipenem (10µg), Ciprofloxacin (5µg), Ceftazidime (30µg), Cefepime (30µg), Cefuroxime (30µg), Co-trimoxazole (1.25/23.75µg).

For Gram positive aerobic isolates, following antimicrobials were used: Ampicillin (10µg), Amikacin (30µg), Piperacillin/tazobactam (100/10µg), Ciprofloxacin (5µg), Gentamycin (10µg), Linezolid (30µg), Vancomycin (30µg), Nitrofurantoin (300µg) and Norfloxacin (10µg).

Zones of inhibition were measured and interpreted using Himedia charts.

## Results and Discussion

Out of total 251 urine samples, only 61(24.30%) showed a significant growth ( $>10^5$  cfu/ml) and considered positive for

UTI. We found 25(40.98%) Gram positive and 36(59.01%) Gram negative bacteria from 61(24.30%) culture positive samples of urine shown in table 1.

The rates of sensitivity to ten selected antimicrobial agents against Gram negative bacilli and Gram positive cocci are shown in table 4 and 5.

A total of 251 urine samples from patients (136 male and 115 female) were examined in this study. Out of 251 samples, 61 (24.30%) showed significant bacteriuria of which 40 (65.57%) were females 21 (34.42%) were males as shown in table 2. The frequency of *E. coli* in total isolated strains and their relation to sex distribution is shown in table 3.

The average antibiotic susceptibility pattern against *E. coli*, *Klebsiella*, and *Pseudomonas* spp. showed good susceptibility to Imipenem (91.40%), and Ciprofloxacin (71.47%) and lower susceptibility to Cefuroxime (30.72%) and Ampicillin (31.93%).

**Table-1**  
**Prevalence of urinary bacterial isolates in community and hospital infections**

Bacteria	Total isolates	Inpatients	Outpatients
<i>Escherichia coli</i> .	21 (34.42%)	12 (30.7%)	9(40.90%)
<i>Klebsiella</i> spp.	9 (14.75%)	5 (12.8%)	4(18.18%)
<i>Pseudomonas</i> spp.	6 (9.83%)	5 (7.93%)	1(4.54%)
<i>Staphylococcus aureus</i>	14 (22.95%)	9(23.07%)	5(22.72%)
<i>Coagulase negative Staph. aureus</i>	11 (18.03%)	8(20.51%)	3(13.63%)
Total	61	39(63.93%)	22(36.06%)

**Table-2**  
**Prevalence of UTIs in relation to sex of patients**

Sex	Examined	Positive	Percentage
Male	115	21	29.41%
Female	136	40	18.26%
Total	251	61	24.11%

**Table-3**  
**The frequency of *E. coli* in total isolated strains and their relations to sex**

Prevalence of <i>E. Coli</i> among IPD and OPD patients								
Sex	Age group (years)					% of occurrence	Total % of occurrence	
	0-10	11-20	21-30	31-40	41-50	Above 50		
Male	1/15	1/9	0/5	0/6	0/5	0/9	2/69 (2.89%)	21
Female	1/8	6/24	9/55	1/27	0/9	2/10	19/182 (10.43%)	

**Table-4**  
**Antibiotic susceptibility pattern in Gram negative isolates**

Organisms	Ampicillin	Amikacin	Gentamicin	Aztreonam	Imipenem	Ciprofloxacin	Ceftazidime	Cefepime	Cefuroxime	Cotrimexole
<i>E. coli</i> (%)	39.1%	83.6%	54.5%	68.6%	98.3%	53.4%	68.3%	71.1%	41.6%	42.5%
<i>klebsiella</i> spp.(%)	49.7%	71.6%	46.7%	68.6%	93.5%	88.5%	66.8%	72.5%	43.5%	60.9%
<i>Pseudomonas</i> spp. (%)	7%	56.1%	26.5%	34.5%	82.4%	72.5%	50.0%	65.4%	7.05%	13.5%
Mean	31.93%	70.43%	42.57%	57.23%	91.40%	71.47%	61.70%	69.67%	30.72%	38.97%

**Table-5**  
**Antibiotic susceptibility pattern in Gram positive isolates**

Organisms	Linezolid	Vancomycin	Piperacillin/ Tazobactam	Norflox	Ampicillin	Gentamicin	Ciprofloxacin	Amikacin	Nitrofurantoin	Mean
<i>S. aureus</i>	100%	100%	70%	78%	80%	80%	80%	96%	83%	85%

**Discussion:** The varying trend in the aetiopathogenesis of UTIs and the rising resistance to the antimicrobial agents are a matter of worldwide alarm. Even with the sufficient precautions, preventive measures and the advances in treatment, UTIs still remain the commonest infections, both in the hospitalized patients and in the community. This may probably be due to the advancing ages, increase in the immunocompromised status, prolonged hospitalizations, insufficient personal and environmental sanitation, increased instrumentation (catheters), comorbidities and functional or anatomical abnormalities<sup>9</sup>. The indiscriminate, inadequate and irrational usage of antimicrobials has additionally contributed to the appearance of resistant strains, which may turn out to be a chief cause for the morbidity and mortality in the developing countries.

The present study provided a view on the frequency and the antibiogram of the uropathogens which were isolated from NIMS Medical College Jaipur. *E. coli* (34.42%) was the chief organism which was isolated, followed by *S. aureus* (22.95%) *Coagulase negative Staphylococcus aureus* (CONS) (18.03%), *Klebsiella* (14.75%), *Pseudomonas* (9.83%). *Escherichia coli* (34.42%) was found to be the most prevalent Gram negative bacteria in the culture positive urine samples of UTI. This result is consistent with reports from other studies by Supriya et al.<sup>10</sup>, Pallavi Khanna et al.<sup>11</sup> and Oladeinde B H et al. (2011)<sup>12</sup>. *Staphylococcus* species was second most prevalent isolate in our study. Similar reports were revealed by other authors Tessema et al.<sup>13</sup>, Zahera et al.<sup>14</sup> and Ferede et al.<sup>15</sup>.

Sexual activity has been reported to influence higher occurrence of UTI in females. Considering the fact that most of infecting organisms are commensals of perianal and vaginal regions, emphasis on personal hygiene especially in females may be important in reducing the incidence of UTI. In our study, culture positivity was higher in females 40 (65.57%) than males 21 (34.2%) shown in table 1, which is in concordance with the findings of similar studies which were done by Khadri et al.<sup>16</sup>, Oladeinde B H et al.<sup>12</sup>, Manjunath et al.<sup>17</sup> and Barate D L et al.<sup>18</sup>.

In the year 2012, Rupinder Kaur et al.<sup>19</sup> also reported *E. coli* (71.7%) was most common in UTI followed by *K. pneumonia* (15.3%), *S. aureus* (4.3%) and *P. aeruginosa* (4.3%) in her study. In the study of Foxman et al.<sup>20</sup> *E. coli* was the predominant pathogen in UTI and showed high chance of recurrent infection by *E. coli* within first 6 months.

In the context of antibiotic sensitivity in our study, Imipenem (98.3%) was found to be highly active against Gram negative isolates of *E. coli* followed by *Klebsiella* spp. (93.5%) and *Pseudomonas* spp. (82.4%). Similar findings were also reported by several authors in different time periods. Our results are comparable with a study by Mohammad M T et al. (2010)<sup>21</sup>, which revealed that Imipenem (94.20%) was most effective drug against urinary *E. coli* followed by Amikacin (93.11%). We found that Imipenem (98.3%) was most effective antibacterial agent against urinary *E. coli*. During the last few years, Co-Trimoxole has shown high level of therapeutic failure due to which quinolones are now being preferred<sup>22</sup>.

There are local dissimilarities in the antimicrobial susceptibility among urinary pathogens in different hospitals. In a previous study, other authors reported their knowledge of antimicrobial susceptibility activity to Ampicillin for *E. coli* 25% by Dhakal et al.<sup>23</sup> and 24.8% by Ahmad et al. (2012)<sup>24</sup>. Similar finding was found to be in our study 39.1%.

In the present study, the activity of antimicrobial agents against *E. coli* such as: Ampicillin, Cefuroxime, Co-trimoxazole and Gentamicin was found to be 39.1%, 41.6%, 42.5% and 54.5% respectively. Similar findings were reported from India and other countries such as Rahem Khoshbakht et al.<sup>25</sup>, Hamayun et al.<sup>26</sup> and Prakash et al.<sup>27</sup>.

In our study, 53.4% of *E. coli* were sensitive to Ciprofloxacin. These findings are comparable to those reported by Shalini et al.<sup>28</sup> who gave sensitivity to Ciprofloxacin as 69% in 2011. *E. coli* was reported to be 53.4% sensitive to Ciprofloxacin, while emphasizing that fluoroquinolones are among the most efficient drugs in treating UTI as per Kurutepe et al.<sup>29</sup>. Various studies have bared increasing resistance to fluoroquinolones. Kurutepe

et al.<sup>29</sup> found increase in resistance from 2.9% in 2000 to 11.3% in 2002.

Hamayun et al.<sup>26</sup> reported from India that certain virulent factors like hemolysin production and presence of fimbriae in *E. coli* may be related with uropathogenicity. The variation in sensitivity pattern of the isolates might be due to the irrational prophylactic usage easy availability and the over the counter sale of antimicrobials without a proper prescription and an inappropriate dosing schedule.

*Klebsiella* spp. showed a higher sensitivity to Imipenem and Ciprofloxacin and a lower sensitivity to Cefuroxime and Gentamicin as compared to *E. coli*.

*Pseudomonas aeruginosa* showed a greater sensitivity towards the Imipenem and Ciprofloxacin but a lower sensitivity towards the Ampicillin, Cefuroxime and Co-trimoxazole. We found to be Imipenem and Ciprofloxacin the most effective drugs for the therapy of UTIs, as shown in table-4 and 5.

## Conclusion

The increase in drug resistance among the uropathogens is a cause a global threat. The wide availability and the common usage of Penicillin and Co-trimoxazole has led to the development of resistant strains. Before recommendation of an empirical anti microbial therapy, an indepth knowledge of the etiology, the predisposing factors, the cultural positivity is essential to avoid irrational drug usage and to establish the optimum prophylactic therapy.

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