

## Bacteriological Spectrum of UTI and their Antibigrams in a Tertiary Care Cardiac Hospital, Rawalpindi, Pakistan

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### Abstract

**Aim:** Urinary tract infection (UTI) is a term applied to a variety of clinical conditions ranging from asymptomatic presence of bacteria in urine to severe infection of kidney with resultant sepsis. Despite the widespread availability of antibiotics it remains the most common bacterial infection in human beings. The aim of this study was to analyze the bacteriological spectrum of UTI and its antibiogram among patients admitted at Rawalpindi Institute of Cardiology (RIC).

**Material and Methods:** Urine specimens were taken from patients of all age groups admitted in Rawalpindi Institute of Cardiology from January to December 2018. A total of 727 urine specimens were cultured on Cysteine Lactose Electrolyte Deficient Agar. The growth was identified and antibiotic susceptibility was carried out by disc diffusion method as per recommended CLSI guidelines.

**Results:** Out of 727 urine specimens, 291 were culture positive. *Escherichia coli* was the most frequent uropathogen (38%) followed by *Klebsiella pneumonia* (14.8%), *Enterobacter* spp (11%) and *Enterococcus* spp (8.2%).

**Discussion:** Urinary tract infection is common among hospitalized patients. Frequent use of antibiotics has led to antibiotic resistance against common infections including UTI. However, very little information is available about UTIs in patients with ischemic heart disease and other cardiac ailments. Our study has also confirmed UTI being frequent among hospitalized cardiac patients. Nitrofurantoin was the most effective antibiotic followed by Imipenem, Meropenem and Amikacin against *Enterobacteriaceae*. Most isolates showed resistance to Ciprofloxacin and Ampicillin.

**Keywords:** Urinary Tract Infection; *Escherichia coli*; Antibiotics

### Introduction

UTI is associated with significant mortality and morbidity. About 150 million people develop urinary tract infection every year [1]. UTI is more common in women than in men due to the short length of urethra [2].

Common symptoms of upper urinary tract infection include flank pain, fever, chills, nausea and vomiting [3]. Symptoms of lower urinary tract infection include dysuria, frequency, urgency of urine, pelvic pain in women and rectal pain in men [4]. Risk factors of urinary tract infection are older age, kidney stones, weak immune system, pregnancy and anomalies of urinary tract. The most common uropathogen is *Escherichia coli*. Others include *Klebsiella* spp, *Staphylococcus saprophyticus*, *Pseudomonas* spp, *Staphylococcus aureus* (*S. aureus*) and fungal pathogens including *Candida albicans* [5].

**Objectives of the Study**

The objectives of this study is to find out the bacteriological spectrum of UTI and its antibigrams among patients of all age groups both male and female in RIC

**Materials and Methods**

A prospective study was designed to find out the bacteriological spectrum of UTI and its antibiogram among patients of all age groups admitted in RIC, Rawalpindi, Pakistan from January to September 2018. RIC is a tertiary care cardiac hospital in twin city capital of Pakistan.

Catheterized and the patients on antibiotics were excluded. Midstream urine was collected by clean catch technique from admitted patients with UTI symptoms. Urinalysis was carried out by dipstick screening and microscopy. More than 5 WBC/HPF in male and more than 10WBC/HPF in females was considered as pyuria.

All specimens were inoculated on Cysteine Lactose Electrolyte Deficient (CLED) Agar and incubated at 37°C for 24 hours. Twenty or more colonies on CLED Agar was taken as significant. Antibiotic susceptibility was carried out by disc diffusion method against Ampicillin, Amoxicillin/Clavulanate, Trimethoprim/Sulfamethoxazole, Fosfomycin, Amikacin, Gentamicin, Aztreonam, Nitrofurantoin, Ciprofloxacin, Ceftriaxone, Cefotaxime, Piperacillin /Tazobactam, Imipenem, Meropenem as recommended in CLSI-M 100 S 26<sup>th</sup> edition [6].

**Results**

Out of 727 urine samples, 327 (45%) were obtained from females and 400 (55%) from males patients. Among all urine samples 291 (40%) were culture positive whereas 436 (60%) were culture negative. Among all positive cultures 150 (51.5%) were from male patients whereas 141 cases (48.5%) were from females patients.

The frequency of various organisms isolated in urine specimens is shown in table 1. *Escherichia coli* was the most frequent urinary pathogen followed by *Klebsiella* spp and others.

Organism	Total Numbers	%
<i>E. coli</i>	112	38%
<i>Klebsiella</i> spp	43	14.8%
<i>Enterobacter</i> spp	32	11%
<i>Enterococcus</i> spp	24	8.2%
<i>Staphylococcus aureus</i>	18	6.2%
<i>Citrobacter</i> spp	18	6.2%
<i>Pseudomonas aeruginosa</i>	15	5.1%
CONS	10	3.4%
<i>Proteus vulgaris</i>	08	2.7%
<i>Acinetobacter</i> spp	08	2.7%
<i>Serratia</i> spp	03	1%
Total	291	100

**Table 1:** Frequency of organisms (N = 291).

*E. coli* was susceptible to Nitrofurantoin (76%) followed by Imipenem (67%) and Meropenem (62%). It was least susceptible to Ampicillin (4.5%), Ciprofloxacin (22%) and Cefotaxime (30%). Ciprofloxacin was seen least effective against all *Enterobacteriaceae* whereas Nitrofurantoin, Imipenem and Meropenem were found the most effective as per their susceptibility (Table 2).

Antibiotic	<i>E. coli</i> = 112	<i>Klebsiella spp</i> = 43	<i>Enterobacter spp</i> = 32	<i>Proteus spp</i> = 08	<i>Serratia spp</i> = 03
Ampicillin	4 (4.5%)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
Ciprofloxacin	25 (22%)	12 (28%)	10 (31%)	2 (25%)	1 (33%)
Nitrofurantoin	86 (76%)	33 (76%)	30 (94%)	6 (75%)	3 (100%)
Amikacin	65 (58%)	26 (63%)	24 (75%)	6 (75%)	2 (66%)
Piperacillin/ Tazobactam	50 (45%)	15 (35%)	15 (46%)	5 (63%)	1 (33%)
Gentamicin	51 (45%)	24 (56%)	18 (56%)	4 (50%)	3 (100%)
Fosfomycin	50 (45%)	18 (42%)	15 (46%)	4 (50%)	2 (66%)
Imipenem	76 (67%)	30 (70%)	23 (72%)	6 (75%)	1 (33%)
Ceftriaxone	35 (31%)	18 (42%)	21 (66%)	3 (38%)	1 (33%)
Sulfamethoxazole	45 (40%)	21 (49%)	13 (40%)	2 (25%)	3 (100%)
Cefotaxime	30 (27%)	28 (65%)	20 (63%)	3 (38%)	0 (0%)
Meropenem	70 (62%)	16 (37%)	20 (63%)	6 (75%)	0 (0%)
Ceftazidime				3 (38%)	0 (0%)

**Table 2:** Antimicrobial susceptibility pattern of *Enterobacteriaceae*.

Cefoxitin screen was used to detect Methicillin resistant *Staphylococcus aureus* (MRSA). All Staphylococcal isolates were susceptible to Linezolid, Vancomycin and Nitrofurantoin. Enterococci were least susceptible to Ampicillin and most of isolates had high level resistance to Gentamycin (Table 3).

Antibiotic	<i>Staphylococcus</i> = 18	CONS = 10	<i>Enterococcus</i> = 24
Ampicillin	0 (0%)	02 (20%)	6 (25%)
Cefoxitin screen	2 (11%)	1 (10%)	-
Ciprofloxacin	10 (55%)	4 (40%)	8 (33%)
Gentamicin	11 (61%)	6 (60%)	18 (75%)
Nitrofurantoin	18 (100%)	10 (100%)	20 (83%)
Fosfomycin	12 (67%)	10 (100%)	14 (58%)
Linezolid	18 (100%)	10 (100%)	22 (92%)
Vancomycin	18 (100%)	10 (100%)	20 (83%)

**Table 3:** Antimicrobial susceptibility pattern of *Enterococcus spp.*

*Pseudomonas spp.* were best susceptible to Colistin followed by Piperacillin/Tazobactam, Amikacin and Imipenem. *Acinetobacter* was the most resistant urinary pathogen. It was most susceptible to Colistin. (Table 4).

Antibiotic	<i>Pseudomonas spp</i> = 15	<i>Acinetobacter sp</i> = 8
Tetracycline	-	4 (50%)
Sulfamethoxazole/Trimethoprim	-	4 (50%)
Ciprofloxacin	6 (40%)	2 (25%)
Ceftazidime	10 (66%)	0 (0%)
Piperacillin/Tazobactam	12 (80%)	2 (25%)
Imipenem	11 (73%)	1 (12%)
Amikacin	12 (80%)	3 (38%)
Gentamycin	11 (73%)	3 (38%)
Cefotaxime	-	0 (0%)
Cefepime	10 (66%)	0 (0%)
Colistin	15 (100%)	6 (75%)

**Table 4:** Antimicrobial susceptibility pattern of *Pseudomonas aeruginosa*.

### Discussion

Effective management of UTI depends upon the identification of microorganism and its susceptibility. It often requires close cooperation between clinician and microbiologist [7].

UTI is the most common bacterial infection and second common cause of morbidity and mortality in all age groups. In a study from Pakistan Institute of Medical Science, out of 1363 urine samples 289 were found positive for UTI [8]. Similar findings were observed in a study from Agha Khan University Hospital, Pakistan, where out of 9892 urine samples 37% were culture positive [9]. In that study, the frequency of UTI in females and males was 60.5% and 39.5% respectively. However, in our study the gender distribution is 51.5% in males and 48.5% in females out of total 291 culture positive cases. The frequency of uropathogens isolated in our study is different from other studies where UTI was more frequent in females than in males. The clinical factors including anatomic differences, hormonal effects and behavioral patterns contribute to frequent UTI [10,11]. Azra S., *et al.* have reported a prevalence rate of UTI in females (70.5%) and males (29.5%) [12]. However, in our study being carried out in a cardiac hospital, UTI is more frequent in males than in females since myocardial ischemia is more common in male population than females.

*Escherichia coli* is the predominant urinary pathogen (38%) followed by *Klebsiella pneumoniae* (*K. pneumoniae*) (14.8%) in our study. Our results are similar to that were reported by Patel., *et al.* in Jamnagar, Gujrat and of Savitha., *et al.* India who had also found *E. coli* and *K. pneumoniae* as the most common uropathogen [13,14]. They found *E. coli* causing UTI in 53.38% and 48.04% and *Klebsiella spp* in 18.98% and 8.82% of the isolates respectively. Yadav., *et al.* have reported *E. coli* (61%), followed by *S. aureus* (12%), CONS (7%), *Enterococcus* (5%), *K. pneumoniae* (5%), *Candida spp.* (3%), *Proteus spp.* (2%) and others (6%) [14]. The most effective antibiotics in our study are Nitrofurantoin, Imipenem, Meropenem and Amikacin against *Enterobacteriaceae*. Similar findings have been reported by Niranjana., *et al.* in Puducherry, India [15]. However, Monika and Yadav have found Imipenem as the most effective antibiotic against *E. coli* 85.9% and against *Klebsiella spp* 89.4% [16].

In a study from Ethiopia out of 1404 urine samples, 319 (22.7%) were culture positive. *Escherichia coli* (63.6%) was the predominant uropathogen. Resistance to Erythromycin, Amoxicillin and Tetracycline was quite high in that study [17].

Nitrofurantoin is found as the most effective to treat UTI in our study. Similar findings were observed in surveillance studies by Sasirekha and Khameneh and other Indian studies [18,19].

Most of the organisms showed resistance to Ampicillin and Ciprofloxacin in our study. It could be attributed to empirical use of these antibiotics to treat common infections including pneumonias in ischaemic patients beside preoperative and postoperative prophylactic use of these antibiotics in our hospital. Similar findings have been observed by Nozarian S., *et al.* and Keah SH., *et al* [20,21]. Resistance to Ampicillin (50.1%) and Cotrimoxazole (22.1%) was observed in patients with complicated UTI and acute pyelonephritis in a study from United States [22].

In our study *E. coli* is susceptible to Nitrofurantoin (76%) followed by Imipenem (67%) and Meropenem (62%). It is least susceptible to Ampicillin (4.5%), Ciprofloxacin (22%) and Cefotaxime (30%). Ciprofloxacin is seen the least effective against all *Enterobacteriaceae* whereas Nitrofurantoin, Imipenem and Meropenem are found the most effective as per their susceptibility (Table 2).

*Klebsiella* spp is the second most frequently isolated uropathogen (14.8%). It is most susceptible to Nitrofurantoin (76%), Imipenem (70%) and Meropenem (65%). Amikacin is more effective than Gentamycin being 63% and 56% respectively. Similar findings have been reported by Patel<sup>13</sup> and Agha Khan University Hospital [9].

We have found *Enterobacter* spp 11% in our culture isolates whereas it was reported 5% from Agha Khan University hospital, Karachi Pakistan and 8% by Zohreh Nozarian., *et al* [9,20]. The later had reported sensitivity of *Enterobacter* spp 82.3% and 86.7% to Nitrofurantoin and Amikacin respectively, whereas it is 94% and 75% respectively in our study. Susceptibility towards Imipenem is 72% and Meropenem is 63%. The least susceptibility is observed against Ampicillin, Ciprofloxacin and Cephalosporins in that order. All isolates of *Serratia* spp are susceptible to Gentamycin, Trimethoprim/Sulfamethoxazole and Nitrofurantoin (100%).

The frequency of *S. aureus* and CONS in our study is 6.2% and 3.4% respectively (Table 2), whereas Yadav., *et al.* have reported these as 12% and 7% respectively. MRSA and Methicillin-resistant Coagulase Negative *Staphylococcus* (MR CONS) are 11% and 10% respectively in our study. While, Yadav., *et al.* have reported these as 33% and 96% respectively [16]. All of our Staphylococcal isolates are susceptible to Linezolid, Vancomycin and Nitrofurantoin whereas Yadav M., *et al.* have reported these as 95.2%, 100% and 87.4% respectively [16].

*Enterococcus* was found in 8% of the isolates whereas Yadav., *et al.* have reported it as 6% in their study [16]. We have found it 93% susceptible against Linezolid and 83% against Vancomycin and Nitrofurantoin each.

## Conclusion

UTI is the most common disease among hospitalized patients around the world. Our study has also confirmed that UTI is also common in patients admitted in a cardiac hospital. UTI is more frequent in males than in female patients admitted in our cardiac hospital. *Escherichia coli* was the most frequent uropathogen. Most of the isolates were susceptible to Nitrofurantoin, Imipenem, Meropenem and Amikacin but resistant to Amoxicillin, Ciprofloxacin and Ceftriaxone.

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