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# Bacteriological Spectrum of UTI and their Antibiograms 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 Enterobacteriacae. 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 *Klebseilla* spp., *Staphlococcus saprophyticus*, *Pseudomonas* spp. *Staphylococcus aureus* (*S. aureus*) and fungal pathogens including *Candida albicans* [5]. The objective of this study is to find out the bacteriological spectrum of UTI and its antibiograms 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

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than 10 WBC/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 h. Twenty or more colonies on CLED Agar were taken as significant. Antibiotic susceptibility was carried out by disc diffusion method against Ampicillin, Amoxicillin/Clavulanate, Trimethoprim/Sulphamethaxazole, Fosfomycin, Amikacin, Gentamicin, Aztreonam, Nitrofurantoin, Ciprofloxacin, Ceftriaxone, Cefotaxime, Pipracillin/Tazobactam, Imipenem, Meropenem as recommended in CLSI-M 100 S 26th 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* were the most frequent urinary pathogen followed by *Klebsiella* spp. and others.

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

| Organisms | Total Numbers | % |
|---|---|---|
| *E. coli* | 112 | 38% |
| *Klebsiella* spp. | 43 | 14.8% |
| *Enterobecter* spp. | 32 | 11% |
| *Enterococus* spp. | 24 | 8.2% |
| *Staphylococcus aureus* | 18 | 6.2% |
| *Citrobacter* spp. | 18 | 6.2% |
| *Pseudomonas aurogenosa* | 15 | 5.1% |
| CONS | 10 | 3.4% |
| *Proteus vulgaris* | 08 | 2.7% |
| *Acinetobacter* spp. | 08 | 2.7% |
| *Serratia* spp. | 03 | 1% |
| Total | 291 | 100 |

*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 Enterobacteriacae whereas Nitrofurantoin, Imipenem and Meropenem were found the most effective as per their susceptibility **(Table 2)**.

**Table 2.** Antimicrobial susceptibility pattern of Enterobacteriacae.

| **Antibiotics** | ***E. coli*=112** | ***Klebsiella* spp.=43** | ***Enterobacter* spp.=32** | ***Proteus* spp.=08** | ***Serratia* spp.=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/ Tazobactum | 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%) |
| Sulphamethaxazole/ | 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%) |

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)**.

**Table 3.** Antimicrobial susceptibility pattern of *Enterococus* spp.

| **Antibiotics** | **Staphylococcus=18** | **CONS=10** | **Enterococcus=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%) |
| Linzolid | 18 (100%) | 10 (100%) | 22 (92%) |
| Vancomycin | 18 (100%) | 10 (100%) | 20 (83%) |

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

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

| **Antibiotics** | ***Pseudomonas* spp.=15** | ***Acinetobacter* spp.=8** |
|---|---|---|
| Tetracycline | - | 4 (50%) |
| Sulphamethaxazole/Trimethoprim | - | 4 (50%) |
| Ciprofloxacin | 6 (40%) | 2 (25%) |
| Ceftazidime | 10 (66%) | 0 (0%) |
| Pipracillin/Tazobactum | 12 (80%) | 2 (25%) |
| Impenem | 11 (73%) | 1 (12%) |
| Amikacin | 12 (80%) | 3 (38%) |
| Gentamycin | 11 (73%) | 3 (38%) |
| Cefotaxime | - | 0 (0%) |
| Cefipime | 10 (66%) | 0 (0%) |
| Colistin | 15 (100%) | 6 (75%) |

## 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]. Hasan et al. [12] have reported a prevalence rate of UTI in females (70.5%) and males (29.5%). 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 pneumonia* (*K. pneumonia*) (14.8%) in our study. Our results are similar to that were reported by Patel et al. [13] in Jamnagar, Gujrat and of Savitha et al. [14], India who had also found *E. coli* and *K. pneumoniae* as the most common uropathogen. 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 [15]. Yadav et al. [16] 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%). The most effective antibiotics in our study are Nitrofurantoin, Imipenem, Meropenem and Amikacin against Enterobacteriaceae. Similar findings have been reported by Niranjan et al. in Puducherry, India [15]. However, Yadav et al. [16] have found Imipenem as the most effective antibiotic against *E. coli* 85.9% and against *Klebsiella* spp. 89.4%.

In a study from Ethiopia out of 1404 urine samples, 319 (22.7%) were culture positive. *Escherichia coli* (63.6%) were 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 [18] and Khameneh and Afshar [19] other Indian studies.

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 ischemic patients beside preoperative and postoperative prophylactic use of these antibiotics in our hospital. Similar findings have been observed by Nozarian and Abdollahi [20] and Keah et al. [21]. Resistance to Ampicilin (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 Enterobacteriacae 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 et al. [13] 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 Farooq et al. [9] Nozarian and Abdollahi et al. [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/Sulphamethoxazole 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. [16] 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. [16] have reported these as 33% and 96%, respectively. All of our Staphylococcal isolates are susceptible to Linezolid, Vancomycin and Nitrofurantoin whereas Yadav et al. [16] have reported these as 95.2%, 100% and 87.4%, respectively [16].

Enterococcus was found in 8% of the isolates whereas Yadav et al. [16] have reported it as 6% in their study. 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 were 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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