



# URINARY TRACT INFECTIONS; ETIOLOGICAL PROFILE AND ANTIMICROBIAL SUSCEPTIBILITY PAT- TERNS OF UROPATHOGENS

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**ABSTRACT... Background:** Urinary tract infections (UTIs) constitute important bacterial disease which contributes to significant morbidity world-wide. Empirical treatment in patients suffering from UTI depends upon the local knowledge of common microorganisms responsible for UTI in that geographical area as well as their antimicrobial susceptibility patterns. **Objectives:** To determine the frequency and antimicrobial susceptibility of uropathogens which are responsible for urinary tract infections. **Study Design:** Experimental study. **Setting:** Department of Pathology, Frontier Medical & Dental College and Mohi Ud Din Islamic Medical College. **Period:** January 2015 to June 2015. **Material & methods:** Total of 113 patients were included in the study. Urine samples were cultured on MacConkey's agar and Cysteine Lactose Electrolyte Deficient (CLED) agar. Micro-organisms were identified using standard tests and antimicrobial susceptibility was checked using modified Kirby Bauer method following Clinical and Laboratory Standards Institute (CLSI) guidelines. **Results:** The average age of patients was  $32.19 \pm 16.47$  years. Gram negative organisms accounted for majority of cases, about 89 (78.76%) cases. Escherichia coli was the most common micro-organism which was found in 50 (44.24%) cases followed by Staphylococcus aureus in 24 (21.24%), Enterobacter spp. in 19 (16.81%), Klebsiella spp. in 11 (9.73%) and Proteus spp. in 9 (7.96%) cases. E. coli was sensitive to imipenem and ciprofloxacin and was resistant to amoxicillin/clavulanic acid and gentamicin. **Conclusion:** Gram negative organisms are largely responsible for UTIs and E. coli being the most common etiological agent. E. coli is sensitive to commonly prescribed drugs for UTI like ciprofloxacin.

**Key words:** Urinary tract infection, antimicrobial sensitivity, E. coli.

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## INTRODUCTION

Urinary tract infections (UTIs) constitute important bacterial disease which contributes to significant morbidity in both out-patient and in-patients.<sup>1,2</sup> UTIs lead to significant healthcare expenditure which amounts to 1.6 billion dollars each year in United States of America.<sup>3</sup> UTI affects both sexes but is more common in women. The increased incidence of UTI in females is attributed to many factors like short urethra, proximity of urethra to anal area and hence, increased risk of infection by fecal flora.<sup>4</sup> UTI can affect any part of urinary system and usually presents with painful micturition, foul smelling urine, loin pain and urgency.<sup>4</sup> Urine microscopy and culture are of paramount importance in the diagnosis of UTIs.<sup>5</sup>

UTIs are caused by different pathogens but most

common among them are bacteria, which are responsible for about 95% of cases.<sup>6</sup> Among bacterial pathogens, Enterobacteriaceae family is an important cause of UTI with Escherichia coli accounting for 70-80% of cases.<sup>2,6</sup> Other bacterial pathogens responsible for UTI include Klebsiella pneumoniae, Pseudomonas aeruginosa, Proteus spp. and Enterococcus spp.<sup>2,4,7</sup> Uropathogens are developing resistance to many commonly prescribed antibiotics at an alarming rate.<sup>8</sup> Routine diagnostic and culture facilities are not available in many parts of developing countries and it results in incorrect diagnosis or self-medication which contribute significantly to the development of antimicrobial resistance among uropathogens.<sup>1,9</sup> Therefore, it is of vital importance to know the etiological profile and antibiotic susceptibility patterns of uropathogens in a geographical

location to guide treatment decisions for patients suffering from UTIs.

The aim of our study was to determine the common etiological organisms in patients suffering from UTI and their antimicrobial susceptibility patterns in Abbottabad, Pakistan.

## MATERIALS & METHODS

This study was conducted in the Department of Pathology, Frontier Medical & Dental College and Mohi Ud Din Islamic Medical College, from January 2015 to June 2015. It was an experimental study and there was a non-probability consecutive sampling. All patients of both genders who were more than 20 years of age and suspected of having UTI were included in this study. The patients having recurrent UTIs, with urological abnormalities, those on antibiotics and pregnant women were excluded from the study. Based on inclusion and exclusion criteria, 113 samples were collected.

The clean catch mid-stream urine (MSU) sample was collected in a sterile wide mouthed container and processed immediately. A drop of urine sample was placed on a clean slide for microscopy and observed for the presence of white blood cells (WBC). Presence of  $\geq 10$  WBCs per high per field was considered significant.<sup>10</sup> The urine samples were inoculated on MacConkey's agar (Oxoid, UK), Cysteine Lactose Electrolyte Deficient (CLED) agar (Oxoid, UK) and Blood agar (Oxoid, UK) at 37°C for 24-48 hours. A bacterial growth of  $\geq 10^5$  cfu/ml was considered significant. Organisms were identified on the basis of colony morphology, gram staining and biochemical characteristics.

The antibiotic susceptibility of bacterial isolates was tested using modified Kirby Bauer disc diffusion method following Clinical and Laboratory Standards Institute (CLSI) guidelines. Zones of inhibitions were measured. The commercially available antibiotic susceptibility discs (Oxoid, UK) were used. They included; Amoxicillin/clavulanic acid (20/10 $\mu$ g), Cefotaxime (5 $\mu$ g), Ciprofloxacin (5 $\mu$ g), Trimethoprim/sulfamethoxazole

(1.25/23.75 $\mu$ g), Gentamicin (30  $\mu$ g), Ceftriaxone (30 $\mu$ g), Amikacin (30  $\mu$ g) and Imipenem (10 $\mu$ g).

Statistical Package for Social Sciences (SPSS, version 17) was used for statistical analysis. Mean, standard deviation was calculated for descriptive variables like age and percentages for antimicrobial susceptibility.

## RESULTS

There were 113 patients with 64 males and 49 females with male to female ratio of 1.31:1, as shown in Figure-1. The average age of patients was  $32.19 \pm 16.47$  years.



Figure-1. Gender-wise distribution of study sample

The number of gram negative micro-organisms responsible for UTI was quite higher than gram positive organisms as shown in Table-I.

Pathogens	No of cases,(Percentage)
Gram Negative Organisms	89, (78.76%)
Gram Positive Organisms	24, (21.24%)
Total	113, (100%)

Table-I. Distribution of microorganisms according to gram staining, (n=113)

Frequency of different microorganisms causing UTI was shown in Table-II. E. coli was the most common microorganism isolated. It was isolated from 50 (44.24 %) cases followed by S. aureus which was found in 24 (21.24%) while Klebsiella spp. and Proteus spp. were the least common, being isolated in 11 (9.73%) and 9 (7.96%) patients respectively.

Sensitivity of different microorganisms (in

percentages) to different antibiotics is shown in Table-III. *E. coli* showed higher sensitivity to imipenem and ciprofloxacin and was resistant to amoxicillin/clavulanic acid, *S. aureus* was sensitive to ciprofloxacin and resistant to cefotaxime, *Enterobacter* spp. were sensitive to amoxicillin/clavulanic acid, ciprofloxacin and ceftriaxone while highly resistant to cefotaxime, *Klebsiella* spp. were sensitive to gentamicin and trimethoprim/sulfamethoxazole while resistant to cefotaxime and amikacin and *Proteus* spp. were sensitive to amikacin, ciprofloxacin and

amoxicillin/clavulanic acid while resistant to cefotaxime and imipenem.

Microorganism	No of cases
<i>Escherichia coli</i>	50, (44.24%)
<i>Staphylococcus aureus</i>	24, (21.24%)
<i>Enterobacter</i> spp.	19, (16.81 %)
<i>Klebsiella</i> spp.	11, (9.73%)
<i>Proteus</i> spp.	09, (7.96%)
Total	113, (100%)

**Table-II. Distribution of microorganisms responsible for UTI, (n=113)**

Microorganism	Amoxicillin/ clavulanic acid	Cefotaxime	Ciprofloxacin	Trimethoprim/ sulfamethoxazole	Gentamicin	Ceftriaxone	Amikacin	Imipenem
<i>E. coli</i>	28%	56%	66%	40%	44%	52%	64%	76%
<i>S. aureus</i>	54.16%	20.83%	79.17%	54.17%	75%	54.17%	54.17%	41.67%
<i>Enterobacter</i> spp.	94.74%	0%	84.76%	73.68%	57.90%	84.21%	57.89%	57.89%
<i>Klebsiella</i> spp.	27.27%	18.18%	54.54%	72.11%	81.81%	54.54%	18.18%	63.63%
<i>Proteus</i> spp.	88.89%	0%	100.00%	77.78%	77.78%	66.67%	88.87%	0.00%

**Table-III. Antibiotic susceptibility profile of microorganisms isolated in the study**

## DISCUSSION

UTIs are one of the main causes of seeking medical attention.<sup>2</sup> Empirical therapy in these patients depends upon the knowledge of microorganisms prevalent in that area as well as their antimicrobial sensitivity patterns.<sup>11</sup> This study was conducted to determine the frequency of different uropathogens which are responsible for UTIs and their antimicrobial sensitivity patterns. Our study has shown that there was higher predilection for male gender. This is in contrast to findings of other studies done on the same subject.<sup>12,13</sup> It could be due to highly conservative nature of population in our area where female patients either don't seek medical care or they prefer to visit female doctors. The average age of patients was  $32.19 \pm 16.47$  years. This finding was comparable to other studies.

A study done in Palestine by Zakariya el Astal reported mean age to be  $31.6 \pm 10.3$  years.<sup>14</sup> Similarly, a study done in Pakistan by Khan et al and another done in Iran by Kashef et al reported it to be 48 years and 48.5 years respectively.<sup>2,10</sup>

The incidence of gram negative uropathogens

was higher in our study. It was 78.76 %. This is similar to other studies done in our region. Baral et al, in their study conducted in Nepal, and Farajnia et al, in their study which was conducted in Iran, also reported the prevalence of gram negative organisms to be 95.4% and 85.6% respectively.<sup>1,6</sup>

*E. coli* (44.24%) was found to be the most common microorganism causing UTI in our study. Our findings corroborated with other studies. Khan et al and Shahzad et al documented the incidence of *E. coli* to be 61.3% & 68.1% respectively in Pakistan, Das et al documented it to be 59.4% in Nepal, Al-haddad documented it to be 41.5% in Yemen and Kashef et al reported it to be 68.8 % in Iran.<sup>2,4,5,10,15</sup> The incidence of *Klebsiella* spp. was 9.73% and that of *Proteus* spp. to be 7.96% in our study. Kashef et al, in their study conducted in Iran, reported their incidence to be 9.6% and 12.4% while Das et al, in their study conducted in Nepal, reported it to be 15.7% and 7.4 % respectively.<sup>10,12</sup> Our study has shown that the frequency of *S. aureus* was 21.24%. This is in contrast to other studies. Shahzad et al reported the incidence of *S. aureus* to be 11.5% while Das et al to be 3.4% respectively.<sup>4,12</sup> This difference

may be due to differing patterns of incidence of uropathogens in different geographical locations.

Our study has shown that among gram negative urinary isolates, *E. coli* was sensitive to imipenem, amikacin and ciprofloxacin. It was considerably resistant to amoxicillin/clavulanic acid. *Klebsiella* spp. were sensitive to imipenem and gentamicin while resistant to cefotaxime and amikacin. *Proteus* spp. were sensitive to ciprofloxacin, amoxicillin/clavulanic acid and amikacin while resistant to cefotaxime and imipenem. Both *Klebsiella* spp. and *Proteus* spp. were sensitive to trimethoprim/sulfamethoxazole. This is quite in common with the findings of other studies. A study from India by Niranjana and Malini reported higher resistance of *E. coli* to amoxicillin/clavulanic acid in their study.<sup>16</sup> Khan et al also reported the same finding in their study where *E. coli* was sensitive to amikacin and imipenem and resistant to amoxicillin/clavulanic acid while *Klebsiella* spp. were sensitive to imipenem.<sup>2</sup> Das et al, in their study from Nepal, documented the same finding where *Proteus* spp. were sensitive to amikacin and ciprofloxacin.<sup>5</sup>

Regarding gram positive organisms, our study has shown that *S. aureus* was sensitive to ciprofloxacin and gentamicin while resistant to cefotaxime and imipenem. *Enterobacter* spp. were sensitive to amoxicillin/clavulanic acid, ciprofloxacin and ceftriaxone while resistant to cefotaxime. Shahzad et al have also showed the same results where *S. aureus* was sensitive to ciprofloxacin.<sup>4</sup> We have reported an interesting finding that both gram positive organisms in our study were resistant to cefotaxime, which was commonly used as parenteral treatment of UTI. This may be due to injudicious use of these antibiotics which lead to increased resistance among uropathogens.

In conclusion, our study has shown that gram negative organisms are responsible for more cases of UTI and *E. coli* is the main causative agent. *E. coli* is sensitive to commonly prescribed drugs, like ciprofloxacin, amikacin and imipenem.

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### PREVIOUS RELATED STUDY

Ghulam Hussain Baloch, Mukhtiar Hussain Jaffery, Chandra Madhudass, Bikha Ram Devrajani, Syed Zulfiqar Ali Shah. URINARY TRACT INFECTION; FREQUENCY AND PATTERN IN PATIENTS WITH DIABETES MELLITUS (Original) Prof Med Jour 18(3) 466-469 Jul, Aug, Sep 2011.

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“The happiest people don't have best of everything, they make best of everything.”

Unknown



### AUTHORSHIP AND CONTRIBUTION DECLARATION

Sr. #	Author-s Full Name	Contribution to the paper	Author=s Signature
1	Dr. M. Usman Anjum	Written manuscript & performed study	
2	Dr. M. Safdar Khan	Performed study / co-author	
3	Dr. Abdul Razzaq Shahid	Performed study / co-author	
4	Dr. Syed Humayun Shah	Conceived the idea, supervised and proof-read the manuscript	