

**ANTIBIOGRAM ASSAY OF E.COLI ISOLATES IN PATIENTS WITH URINARY TRACT INFECTION**

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**Abstract:** Screening of prevalent bacterial pathogens for antibiotic susceptibility profiles in different regions is necessary. *E. coli* and other pathogens are so common in our environment that it is essential to monitor trends in antibiotic susceptibility regularly.

**Objective:** The aim of the study was to find out the antibiotic susceptibility pattern of *E.coli* isolates in patients with urinary tract infection.

**Methods:** This study was conducted at the Saidu Group of Teaching Hospital Swat after taking permission from the ethical committee of the institute. We collected a total of 900 urine samples from males and females of all ages for culture and sensitivity. The Kirby-Bauer disc diffusion method was used to assess the antibiogram on Mueller-Hinton agar. The plates were kept in incubator at 37°C for the 48 hours, and the inhibition zone was measured. The antibiogram was performed by Kirby-Bauer disc diffusion method applying various antibiotics. The bacterial strains were classified in to three majors groups on the basis of antibiotic susceptibility pattern resistant (R) sensitive (S), and intermediate (I). Data was statistically analyzed presented in the tables and figures. **Results:** For culture and sensitivity testing, a total of 900 urine samples from patients with suspected UTIs were obtained from the several departments' inpatient and outpatient to the microbiological lab. Substantial bacteriuria was noted in 250 (27.7%). The most prevalent bacteria isolated was *E.coli* (55%) and its antibiogram was carried out. Ampicillin had the highest proportion of resistance (96.1%), followed by Ceftriaxone (91%), Moxifloxacin (87.1%), and Ceftazidime (75.5%). Whereas it was sensitive to Fosfomycin (94.2%), followed by Sulzone (84.3%), Imepinem (84.3%) and Amikacin (78%).

**Conclusion:** It was concluded from the current study that the most prevalent bacteria causing urinary tract infection was *E.coli*, and this bacteria showed remarkable resistance against Ampicillin, Ceftriaxone, Moxifloxacin, and Ceftazidime. The most used bacterium antibiotics for therapy were Fosfomycin, Imepinem and Amikacin. Therefore, antibiotic susceptibility should be considered before therapy.

**Keywords:** Antibiotic Resistance, Escherichia coli, Susceptibility, Drug, Urinary Tract Infections, Urine Microbiology.

## Introduction

The term "urinary tract infections" refers to various disorders with varying degrees of morbidity, such as cystitis and pyelonephritis, defined by the presence of bacteria in the urinary system. It is one of the most prevalent infectious diseases worldwide. (1) *Escherichia coli* is a bacterium belonging to the Enterobacteriaceae family. It is a facultative anaerobic gram-negative rod-shaped bacterium. It is the causative agent of nosocomial and community-acquired infections in humans. As a result, this organism is clinically vital and is isolated from a range of clinical specimens. It is one of the pathogens most routinely isolated from blood and urine. (2) Apart from urinary tract infections, this bacteria is the most common pathogen that causes intra-abdominal infections. (3) Knowing the current state of antimicrobial resistance is crucial, particularly in light of the persistent, uncontrollable resistance exhibited by gram-negative isolates to many current antimicrobial agents. (4) *E. coli* is an extra-intestinal pathogen most known for its ability to cause bacteremia, newborn bacterial meningitis, and urinary tract infections. The unique strains of this bacterium that cause the majority of UTI, sepsis, and

meningitis are a small group of virulent clones that are identified by particular O.K.H serotypes and primarily arise from *E. coli* phylogenetic group B2, which is determined by multilocus enzyme electrophoresis, and to a lesser extent from group D. (5) Antibiotic susceptibility of bacterial isolates is dynamic, changing with the passage of time and environmental factors. (6) Regular screening of prevalent bacterial pathogens for antibiotic susceptibility profiles in different regions is necessary. (7) Because drug-resistant *E. coli* and other pathogens are so common in our environment, it is essential to monitor trends in antibiotic susceptibility regularly. These trends serve as the foundation for developing sensible prescription programs, formulating policy, and evaluating the efficacy of both. (8) The excessive use and misuse of antibiotics in Pakistan contributes to the issue of antibiotic resistance. (9) Identifying microorganisms responsible for urinary tract infections and their resistance to routinely given antibiotics in clinical settings are crucial factors that enhance the effectiveness of empirical treatment. (10) Therefore, the current study was conducted to determine the antibiogram



assay of E.coli isolates in patients with urinary tract infections.

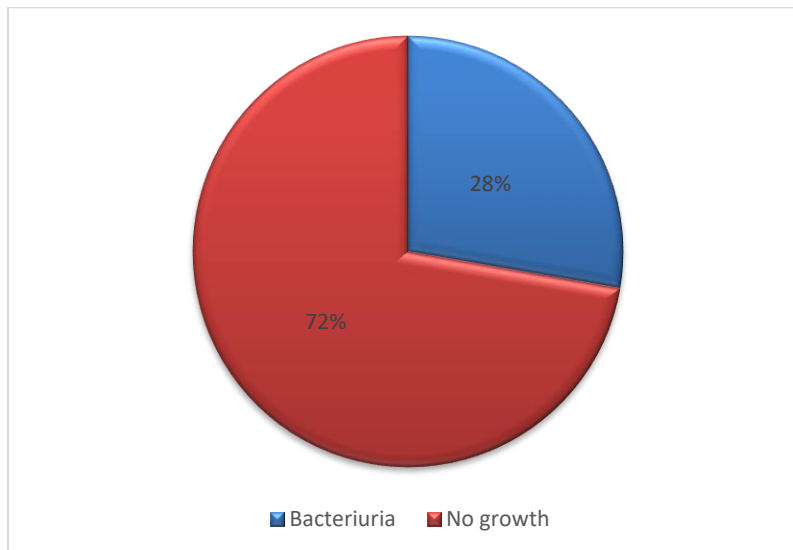
**Methodology**

This study was conducted at the Saidu Group of Teaching Hospital Swat after obtaining permission from the institute's ethical committee. We collected 900 urine samples from males and females of all ages for culture and sensitivity. Each participant provided a clean midstream urine specimen collected into a sterile screw-capped container. These samples were immediately processed in a bacteriology lab. Each specimen was cultured using the semi-quantitative standard loop technique after being received by the lab. This method uses a 4mm internal diameter loop to collect 0.01 ml of urine sample inoculated on Hichrome UTI agar and MacConkey agar. Overnight, the plates were incubated at 37°C in an aerobic environment. Based on the Kass criterion, a colony count of 10<sup>5</sup> or more colony-forming units (CFU)/mL of urine was considered significant for bacterial cells. (11) The isolated bacteria from the urine culture were further identified through Gram staining, biochemical tests, and the colony's size, shape, and colour on MacConkey agar. The Kirby-Bauer disc diffusion method assessed the antibiogram on Mueller-Hinton agar. The plates were kept in an incubator at 37°C for 48 hours, and the inhibition zone was measured by the 2019 Clinical and Laboratory Standards Institute guidelines. (12) The antibiogram was performed by applying various antibiotics Tazocin (TZP), Ceftazidime (CAZ), Ceftriaxone (CRO), Fosfomycin (FOS), Moxifloxacin (MXF), Cefexime (CFM), Ciprofloxacin (CIP), Amikacin (AKN), Sulzone(SCF) Ampicillin (AMP), Nitrofurantoin (F) and Imipenem (IPM). By measuring the inhibitory zone diameter, the bacterial strains were classified into three

major groups based on antibiotic susceptibility: resistant (R), sensitive (S) and intermediate (I). Data was statistically analysed and presented in the tables and figures.

**Results**

For culture and sensitivity testing, a total of 900 urine samples from patients with suspected UTIs were obtained from several departments' inpatient and outpatient to the microbiological lab. Substantial bacteriuria was noted in 250 (27.7%) patients, whereas 650 (72.2%) of the urine samples showed no growth, as shown in Figure 1. The most predominant gender was females, with 60 %, while Males constituted 40%. Most samples were collected from OPD (50%), followed by hospital wards (40%), as demonstrated in Table 1. The most prevalent bacteria isolated in both sexes was E.coli (55%), followed by Enterococcus spp. (20%), Klebsiella spp. (10%), Coliform spp. (5%), Acinetobacter spp.(6%) and S.aureus (4%), respectively, as shown in Table 2. The most prevalent bacteria isolated in both sexes was E.coli (55%), followed by Enterococcus spp. (20%), Klebsiella species (10%), Coliform species. (5%), Acinetobacter species (6%) and S.aureus (4%), respectively, as shown in Table 2. E. coli was the most prevalent bacteria isolated. Females had the most considerable prevalence (68%) compared to men (38%). E. coli was mostly isolated from OPD patients (65%). The prevalence of E.coli causing UTIS isolated from different hospital areas is shown in Table 3. The antibiogram of E.coli was done. Ampicillin had the highest proportion of resistance (96.1%), followed by Ceftriaxone (91%), Moxifloxacin (87.1%), Ceftazidime (75.5%), whereas Fosfomycin was the most sensitive antibiotic (94.2%), followed by Sulzone( 84.3%), Imepinem (84.3%) and Amikacin (78%) as described in table 4.



**Fig.1 Distribution of urine sample for negative upbeat culture**

**Table 1: Percentage-wise distribution of urine samples collected from various hospital areas.**

| Samples areas       | Percentage |
|---------------------|------------|
| Intensive care unit | 10%        |
| Outpatient door     | 50 %       |
| Wards               | 40%        |

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**Table 2. Prevalence of bacteria isolated from urine samples**

| Bacteria              | Frequency |
|-----------------------|-----------|
| E.coli                | 55%       |
| Enterococcus species  | 20%       |
| Klebsiella species    | 10%       |
| Coliform group        | 5%        |
| Acinetobacter species | 6%        |
| S.aureus              | 4%        |

**Table 3: Frequency of UTI caused by E. coli in outpatients and patients**

| Site                | (%) |
|---------------------|-----|
| Intensive care unit | 15  |
| Outpatient door     | 65  |
| Wards               | 20  |

**Table 4 Antibiogram of E.coli**

| Antibiotics    | Codes | Antibiogram |              |           |
|----------------|-------|-------------|--------------|-----------|
|                |       | Sensitive   | Intermediate | Resistant |
| Ampicilin      | AMP   | 3.9 %       | -            | 96.1%     |
| Ceftriaxone    | CRO   | 9%          | -            | 91%       |
| Cefixime       | CFM   | 14%         | -            | 86%       |
| Ceftazidime    | CAZ   | 14.5%       | -            | 75.5%     |
| Cefotaxime     | CTX   | 18%         | -            | 88%       |
| Moxifloxacin   | MXF   | 18.9%       | -            | 87.1%     |
| Fosfomycin     | FOS   | 94.2%       | -            | 5.8%      |
| Sulzone        | SCF   | 84.3%       | 8.1%         | 7.6%      |
| Imipenem       | IPM   | 79.4%       | 7%           | 13.6%     |
| Amikacin       | AKN   | 78%         | 4%           | 18%       |
| Tazocin        | TZP   | 76.5%       | 21.1         | 2.4%      |
| Meropenem      | MRP   | 64.9%       | -            | 35.1%     |
| Nitrofurantion | F     | 60%         | -            | 40%       |
| Ciprofloxacin  | CIP   | 38.2%       | 3%           | 58.8      |

## Discussion

In the current study, we evaluated the antibiotic susceptibility pattern of E.coli isolates in individuals with urinary tract infections. A total of 900 urine samples from patients with suspected UTIs were obtained for culture and sensitivity testing, out of which 250 (27.7%) were culture-positive. This study has similarities to previous research done by Santhosh et al. (13). E. coli was the most common isolate in the current investigation, accounting for 55% of all isolates, followed by Enterococcus (20%). This aligns with most research, such as those conducted by Shivani Gupta et al. (14). Regarding the gender distribution in our study, women had a higher prevalence of E. coli (60%) than males. This is comparable to the study by Malik et al. (15). The fact that E. coli found in UTIs is becoming increasingly resistant to antibiotics is an essential issue for the public. It's critical to identify antibiotic resistance patterns in E. coli isolates to make appropriate medical opinions. Even though this bacteria is susceptible to many antibiotics, the number of medications that work against it continues to decrease due to empirical usage. Antimicrobial drug resistance has increased over time. The intensity of resistance varies throughout nations (16). Our results show that E. coli has a significant level of antibiotic resistance, with ampicillin having the highest level of resistance (96.1%), followed by Ceftriaxone (91%), Moxifloxacin (87.1%), Ceftazidime (75.5%), This study has similarities to all previous studies carried out by Malik et al. (15) and Niranjana et al. (17) This

demonstrates that urinary tract infections should only be treated cautiously with these drugs. Antibiotic usage is quite prevalent, which makes many of them ineffective for treating UTIs. Our results suggest that cephalosporin and penicillin should not be used for treating UTIs as they are often ineffective against UTI infections in developing countries like Pakistan. Despite the lack of efficacy in this study, penicillin and cephalosporin are still widely used to treat UTIs caused by Escherichia coli worldwide. Some recent studies found that a more significant proportion of E. coli from European countries was sensitive to cephalosporin or penicillin. (16) E. coli has a very high antibiotic resistance to cephalosporins and penicillins, according to previous studies conducted in Pakistan (18), which support our study. Quinolones have been utilised recently to treat E. coli infections, particularly ciprofloxacin. However, the current assessment found that E. coli had a 58.8% ciprofloxacin resistance, which is in line with the findings of Mavroidi et al. (19). From our results, it was evaluated that E.coli was most sensitive to Fosfomycin antibiotic (94.2%), followed by Sulzone( 84.3%), Imepinem(84.3%) and Amikacin (78%).The results are similar to the previous studies conducted by Mangaiark (20) and Sharma (21)

## Conclusion

It was concluded from the current study that the most prevalent bacteria causing urinary tract infection was E.coli,

and this bacteria showed remarkable resistance against Ampicillin, Ceftriaxone, Moxifloxacin, and Ceftazidime. The most effective antibiotics for therapy were Fosfomycin, Imepinem and Amikacin. Therefore, antibiotic susceptibility should be done before treatment.

### Declarations

#### Data Availability statement

All data generated or analysed during the study are included in the manuscript.

#### Ethics approval and consent to participate.

It is approved by the department concerned. (IRBEC-1311/TCH-22)

#### Consent for publication

Approved

#### Funding

Not applicable

### Conflict of interest

The authors declared an absence of conflict of interest.

### Authors Contribution

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Concept & Design of Study

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Final Approval of version

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