

BACTERIOLOGICAL SPECTRUM AND ANTIMICROBIAL RESISTANCE PATTERN OF URINARY TRACT INFECTIONS: A HOSPITAL RECORD BASED STUDY FROM A TERTIARY CARE CENTRE OF TRIPURA

Clinical Microbiology

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ABSTRACT

Background: Urinary tract infection (UTI) is one of the most common bacterial infections encountered by clinicians particularly in developing countries. Current knowledge on antimicrobial resistance pattern is essential for appropriate therapy. The aim of the study was to identify the organisms causing UTI and to determine their antimicrobial susceptibility pattern. **Method:** The clinical data of 2400 urine culture were collected for the study. The data were from samples collected between April 2025 to March 2026. The aetiology of urinary tract infection and their antimicrobial susceptibility pattern were analysed. Out of the 2400 urine samples, 1140 samples were either sterile or showed insignificant growth, 1260 (52.5%) samples showed significant growth. The overall most common isolates were: *Escherichia coli* followed by *Klebsiella* spp, *Acinetobacter* spp and *Staphylococcus aureus*. Females were more affected than males with a ratio of 2:1, and majority of the infections were in the age group of 21-40 years. **Conclusion:** *Escherichia coli*, *Klebsiella pneumoniae*, *Acinetobacter* spp, *Staphylococcus aureus* and *Enterococcus* spp were the common pathogens causing UTIs in our region. The bacterial species and antimicrobial resistance patterns seen in uropathogens varied across different patient populations that visited the tertiary care hospital. Strengthening and improving the monitoring and surveillance of bacterial resistance is very essential to minimize the spread and evolution of multi-drug-resistant organisms. The study will help improve resistance surveillance and antibiotic policies, ultimately enhancing patient outcomes.

KEYWORDS

UTI, Uropathogens, Significant Bacteriuria, Antimicrobial Susceptibility.

INTRODUCTION:

Urinary tract infections (UTIs) are one of the most common and prevalent healthcare challenges affecting millions of individuals annually and imposing a substantial burden.¹ Despite advancements in medical science, the incidence of UTIs remains alarmingly high, particularly due to the emergence of multidrug-resistant pathogens. *Escherichia coli* (*E. coli*) is the predominant causative agent of UTIs accounting for approximately 70-95% of community-acquired and 50% of hospital-acquired cases.²

A urinary tract infection is defined as an inflammatory condition caused by pathogenic microorganisms invading the urinary system, including the kidneys, ureters, bladder, and urethra. Clinical diagnosis of UTI accompanied by symptoms with Positive urine culture results with a bacterial colony count of $\geq 10^5$ CFU/ml is considered significant.² The widespread and indiscriminate use of antibiotics has led to the development of resistance mechanisms. Understanding the microbial profile of UTIs and the resistance patterns of predominant pathogens is crucial for guiding empirical antibiotic therapy and improving patient outcomes. Aim and Objective: The aim and objective of the study was to determine the spectrum of UTI in patients attending a tertiary care hospital of Tripura and to determine their antibiotic susceptibility pattern.

Materials and Methods:

This retrospective investigation was carried out in the Department of Microbiology at the Integrated Laboratory Services of IGM Hospital, Agartala, for a period of 1 year from April 2025 to March 2026. 2400 Midstream clean catch urine samples were collected from patients suspected of having a urinary tract infection in a sterile screw-capped container. Samples were inoculated on Cysteine Lactose Electrolyte Deficient (CLED) agar plates using the semi-quantitative streaking method. The plates were incubated aerobically at 37°C for 18 to 24 hours. After overnight incubation, colony morphology and characteristics were identified using conventional microbiological identification methods. Antimicrobial susceptibility testing (AST) was done using the Kirby-Bauer disk diffusion method on Muller-Hinton agar as recommended by Clinical Laboratory Standard Institute (CLSI) guidelines. The following antibiotics were tested: Nitrofurantoin (NIT), Doxycycline (DO), Trimethoprim-sulfamethoxazole (TMP-SMZ), Amikacin (AK), Ciprofloxacin (CIP), Ceftriaxone (CTR), Cefuroxime (CXM), Amoxycillin/Clavulanic acid (AMC), Piperacillin/tazobactam (PIT), Meropenem (MRP), Vancomycin (VA), Linezolid (LZ) and interpretation was made accordingly. The details of the culture-positive samples were collected retrospectively and entered into a Microsoft Excel sheet. Later, the antibiogram was prepared manually and the antimicrobial

susceptibility pattern was analyzed to know about the current status of all antimicrobials tested in the laboratory.

RESULTS:

Out of 2400 samples, 1260 (52.5%) showed significant growth. *Escherichia coli* was the commonest pathogen isolated (40%), followed by *Klebsiella* spp and *Acinetobacter* spp (17.14%). *Staphylococcus aureus* was isolated in 10.47% cases followed by *Enterococcus* spp (9.52%) and *Pseudomonas* spp. (4.76%), *Proteus* spp. (0.95%). Females were more affected than males (2:1), with majority of infections occurring in the age group of 21-40 years. Figure no 1. Shows Organism-wise distribution of culture-positive urine isolates.

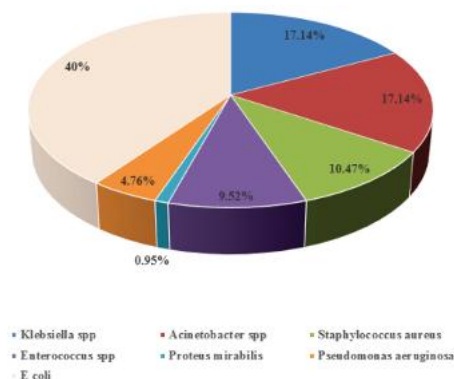


Figure no 1. Organism-wise distribution of culture-positive urine isolates.

Most of the Gram negative isolates were sensitive to Piperacillin-tazobactam and Meropenem (90.47%), followed by Nitrofurantoin (81.81%), Ciprofloxacin and Amikacin (73.61% each). Cotrimoxazole (16.66%) was the least sensitive antibiotic for Gram negative isolates. Among the Gram positive isolates, most of the isolates were sensitive to Vancomycin and Linezolid (100%), followed by Doxycycline (80%), Ciprofloxacin (70%), Nitrofurantoin and 3rd generation cephalosporin (40%). Below depicted table shows the antibiotic susceptibility of various isolated from UTI.

Most common pathogens isolated from UTI	Antibiotic susceptibility
<i>Escherichia coli</i>	AK(73.81%), CXM(61.9%), CTR (61.9%), CIP(73.61%), DO(73.81%), PIT(90.47%), MRP(90.47%), TMP-SMZ(26.19%), NIT(64.28%)

<i>Acinetobacter spp</i>	AK (66.66%), CXM (55.55%), CTR (55.55%), CIP(72.22%), DO (61.11%), PIT(88.88%), MRP(72.22%), TMP-SMZ(16.66%), NIT(55.55%)
<i>Enterococcus spp</i>	CXM (40%), CTR(40%), CIP(70%), DO (80%), VA(100%), LZ(100%), TMP-SMZ(30%), NIT (40%)
<i>Klebsiella pneumoniae</i>	AK (72.22%), CXM (50%), CTR (50%), CIP (77.77%), DO (50%), PIT (77.77%), MRP (73.2%), TMP-SMZ(50%), NIT(27.77%)
<i>Staphylococcus aureus</i>	AK (90.9%), CXM (63.63%), CTR (63.63%), CIP (81.81%), DO (80%), VA(100%), LZ(100%), TMP-SMZ(27.22%), NIT (81.81%)
<i>Pseudomonas aeruginosa</i>	AK (100%), CXM (40%), CTR (40%), CIP(100%), DO (20%), PIT(80%), MRP(90%), TMP-SMZ(60%), NIT (64.28%)
<i>Proteus mirabilis</i>	AK (73.81%), CXM (61.9%), CTR (61.9%), CIP(73.61%), DO (73.81%), PIT(90.47%), MRP(90.47%), TMP-SMZ(26.19%), NIT (64.28%)

DISCUSSION:

E. coli remains the predominant pathogen associated with urinary tract infections (UTIs), as evidenced by the analysis of urine samples collected from patients.

In this study, the most common urinary pathogen was found to be *Escherichia coli* which is consistent with other studies conducted in various other regions.^{1,2,3} Females were predominantly infected more than males, with predominance of infection in reproductive age group which is also consistent with the study conducted by Debnath J et al.³ High isolation rate among 21-40 years age group may be justified due to that females being more susceptible to develop UTI than males due to certain anatomical and physiological factors such as absence of prostatic secretions, easy contamination of the urinary tract with faecal normal flora and short urethra and it has also been consistent with some studies conducted in 2015 by Saha A et al.⁵

E. coli and *Klebsiella spp* showed higher resistance towards Trimethoprim+Sulfamethoxazole compared to other classes of antibiotics, whereas a study conducted by Jangra S et al revealed that *E. coli* and *Klebsiella* showed higher resistance towards Amikacin.⁴

CONCLUSION:

The common etiology of UTIs was *Escherichia coli* followed by *Klebsiella* and *Acinetobacter spp*. And females were mostly affected than males. High incidence of UTIs among females in 21-40 years age group is a great concern as in the reproductive age treating the infections with various drug resistant bacteria is very challenging. A strong decision has to be established regarding the antibiotic policies for UTI and stringent measures have to be taken to ensure the effectiveness of the same. Strengthening and improving the monitoring and surveillance of bacterial resistance is very essential to minimize the spread and evolution of multi-drug-resistant organisms. The study will help improve resistance surveillance and antibiotic policies, ultimately enhancing patient outcomes.

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