

# Bacterial Profile and Antibiotic Susceptibility Pattern of Urinary Tract Infections in Older Adults in Bhopal

Vikas Gour<sup>1</sup>, Dr. Malika Pal<sup>2</sup>, Ms. Anjali Kumari<sup>3</sup>

<sup>1</sup>Student, Department of Microbiology, Faculty of Science, SAM Global University, Raisen, Madhya Pradesh, India

<sup>2</sup>Professor, Department of Microbiology, Faculty of Science, SAM Global University, Raisen, Madhya Pradesh, India

<sup>3</sup>Assistant Professor, Department of Microbiology, Faculty of Science, SAM Global University, Raisen, Madhya Pradesh, India

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## ABSTRACT

Urinary tract infections (UTIs) are among the most common bacterial infections affecting older adults and contribute significantly to morbidity, healthcare utilization, and antimicrobial consumption. The present study aimed to identify bacterial pathogens associated with UTIs in elderly patients and evaluate their antibiotic susceptibility patterns in Bhopal. A total of 100 urine samples were collected from patients aged 60 years and above with symptoms suggestive of UTI. Samples were processed using standard microbiological methods including culture, bacterial identification, and antimicrobial susceptibility testing according to CLSI guidelines. Significant bacterial growth was observed in 72% of samples. *Escherichia coli* was the predominant uropathogen (52.8%), followed by *Klebsiella pneumoniae* (19.4%) and *Enterococcus faecalis* (11.1%). Gram-negative bacteria accounted for 86.1% of all isolates. Antibiotic susceptibility testing revealed high sensitivity to Meropenem (88.9%), Nitrofurantoin (86.1%), and Amikacin (84.7%), whereas Ampicillin, Ceftriaxone, and Ciprofloxacin showed lower effectiveness. Multidrug-resistant organisms constituted 29.2% of isolates. The findings emphasize the need for routine culture-based diagnosis and rational antibiotic use to combat antimicrobial resistance among elderly UTI patients.

**Keywords:** Urinary Tract Infection, Older Adults, Uropathogens, Antibiotic Susceptibility, Antimicrobial Resistance, *Escherichia coli*

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## INTRODUCTION

Urinary tract infections (UTIs) are among the most frequently encountered bacterial infections worldwide and represent a significant healthcare burden. Elderly individuals are particularly vulnerable due to age-related physiological changes, impaired immune responses, urinary retention, diabetes mellitus, catheterization, and frequent healthcare exposure. The increasing prevalence of antimicrobial resistance among uropathogens has further complicated the management of UTIs in this population.

Older adults often present with atypical clinical manifestations, including confusion, lethargy, anorexia, and generalized weakness, making diagnosis challenging. Delayed recognition and inappropriate antibiotic therapy can lead to severe complications such as pyelonephritis, bacteremia, and urosepsis. Therefore, identification of causative pathogens and determination of their antimicrobial susceptibility patterns are essential for effective treatment.

Although several studies have investigated UTI pathogens in India, region-specific data focusing on elderly populations remain limited, particularly in central India. The present study was undertaken to determine the bacterial profile of UTIs among older adults in Bhopal and evaluate antibiotic susceptibility patterns to support evidence-based therapeutic decisions and antimicrobial stewardship initiatives.

## MATERIALS AND METHODS

The present study was conducted as a hospital-based cross-sectional observational study in a tertiary care teaching hospital in Bhopal, Madhya Pradesh. The study duration was six months, from December 2025 to May 2026. A total of 100 urine samples were collected from elderly patients aged 60 years and above presenting with symptoms suggestive of urinary tract infection.

Midstream urine samples were collected aseptically and processed immediately in the microbiology laboratory. Samples were cultured on standard bacteriological media, and significant bacteriuria was determined according to established microbiological criteria. Bacterial isolates were identified based on colony morphology, Gram staining characteristics, and biochemical tests.

Antimicrobial susceptibility testing was performed using the Kirby–Bauer disc diffusion method on Mueller–Hinton Agar according to Clinical and Laboratory Standards Institute (CLSI) guidelines. Antibiotics tested included Ampicillin, Ceftriaxone, Ciprofloxacin, Gentamicin, Amikacin, Nitrofurantoin, Piperacillin-Tazobactam, and Meropenem. Results were interpreted as sensitive or resistant according to CLSI criteria.

Data were compiled and analyzed using descriptive statistics. Results were expressed as frequencies and percentages.

## RESULTS AND DISCUSSION

### 3.1 Age Distribution of Study Participants

A total of 100 elderly patients with suspected urinary tract infection were included in the study. The majority of patients belonged to the 60–69 years age group (46%), followed by 70–79 years (34%) and ≥80 years (20%). The findings indicate that urinary tract infections are common across all elderly age groups, with a higher occurrence among younger elderly individuals.

**Table 1. Age Distribution of Study Participants**

| Age Group (Years) | Number | Percentage (%) |
|-------------------|--------|----------------|
| 60–69             | 46     | 46.0           |
| 70–79             | 34     | 34.0           |
| ≥80               | 20     | 20.0           |
| Total             | 100    | 100            |

### 3.2 Gender Distribution

Among the study participants, females constituted 58% of cases whereas males accounted for 42%. The higher prevalence among females may be attributed to anatomical and physiological factors that increase susceptibility to urinary tract infections.

**Table 2. Gender Distribution of Study Participants**

| Gender | Number | Percentage (%) |
|--------|--------|----------------|
| Male   | 42     | 42.0           |
| Female | 58     | 58.0           |
| Total  | 100    | 100            |

### 3.3 Culture Positivity Rate

Urine culture analysis revealed significant bacterial growth in 72 samples, resulting in a culture positivity rate of 72%. Twenty-eight samples showed no significant growth and were excluded from further microbiological analysis.

**Table 3. Culture Positivity Rate**

| Culture Result | Number | Percentage (%) |
|----------------|--------|----------------|
| Positive       | 72     | 72.0           |
| Negative       | 28     | 28.0           |
| Total          | 100    | 100            |

The high culture positivity rate observed in the present study highlights the substantial burden of urinary tract infections among elderly patients.

### 3.4 Distribution of Uropathogens

A total of 72 bacterial isolates were recovered from culture-positive urine samples. *Escherichia coli* was the most common pathogen (52.8%), followed by *Klebsiella pneumoniae* (19.4%) and *Enterococcus faecalis* (11.1%). These findings are consistent with previous reports identifying *E. coli* as the predominant uropathogen among elderly patients.

**Table 4. Distribution of Uropathogens**

| Organism               | Number | Percentage (%) |
|------------------------|--------|----------------|
| Escherichia coli       | 38     | 52.8           |
| Klebsiella pneumoniae  | 14     | 19.4           |
| Enterococcus faecalis  | 8      | 11.1           |
| Proteus mirabilis      | 6      | 8.3            |
| Pseudomonas aeruginosa | 4      | 5.6            |
| Staphylococcus aureus  | 2      | 2.8            |
| Total                  | 72     | 100            |

Escherichia coli remained the predominant uropathogen, consistent with global reports describing its role as the principal cause of urinary tract infections.

### 3.5 Gram Reaction of Isolates

Gram-negative bacteria predominated among the isolates and accounted for 86.1% of all recovered organisms, whereas Gram-positive bacteria represented only 13.9%.

**Table 5. Gram Reaction of Isolates**

| Group         | Number | Percentage (%) |
|---------------|--------|----------------|
| Gram-negative | 62     | 86.1           |
| Gram-positive | 10     | 13.9           |
| Total         | 72     | 100            |

The predominance of Gram-negative organisms observed in this study is consistent with the established epidemiology of urinary tract infections.

### 3.6 Antibiotic Susceptibility Pattern

Antimicrobial susceptibility testing demonstrated that Meropenem exhibited the highest sensitivity (88.9%), followed by Nitrofurantoin (86.1%), Amikacin (84.7%), and Piperacillin–Tazobactam (80.6%). Lower sensitivity rates were observed for Ampicillin (27.8%), Ceftriaxone (41.7%), and Ciprofloxacin (48.6%), indicating increasing resistance against commonly prescribed antibiotics.

**Table 6. Antibiotic Susceptibility Pattern of Uropathogens**

| Antibiotic              | Sensitive Isolates (%) |
|-------------------------|------------------------|
| Meropenem               | 88.9                   |
| Nitrofurantoin          | 86.1                   |
| Amikacin                | 84.7                   |
| Piperacillin–Tazobactam | 80.6                   |
| Gentamicin              | 77.8                   |
| Ciprofloxacin           | 48.6                   |
| Ceftriaxone             | 41.7                   |
| Ampicillin              | 27.8                   |

The findings indicate that carbapenems, aminoglycosides, and Nitrofurantoin remain highly effective against urinary pathogens isolated from elderly patients.

### 3.7 Prevalence of Multidrug-Resistant Isolates

Multidrug resistance was detected in 21 isolates (29.2%), whereas 51 isolates (70.8%) were classified as non-MDR.

**Table 7. Distribution of MDR Isolates**

| Category         | Number | Percentage (%) |
|------------------|--------|----------------|
| MDR Isolates     | 21     | 29.2           |
| Non-MDR Isolates | 51     | 70.8           |
| Total            | 72     | 100            |

The detection of multidrug-resistant organisms among nearly one-third of isolates reflects the growing challenge of antimicrobial resistance among urinary pathogens. MDR organisms were predominantly Gram-negative bacteria, particularly *Escherichia coli* and *Klebsiella pneumoniae*.

The findings of the present study emphasize the importance of routine urine culture, antimicrobial susceptibility testing, rational antibiotic prescribing, and antimicrobial stewardship programs for effective management of urinary tract infections among elderly patients. Continuous surveillance of antimicrobial resistance patterns is essential to guide empirical therapy and improve clinical outcomes in this vulnerable population.

### CONCLUSION

The present study demonstrated a high prevalence of culture-confirmed urinary tract infections among elderly patients in Bhopal, with a culture positivity rate of 72%. Female patients were more frequently affected than males, and the majority of cases occurred in the 60–69 years age group. *Escherichia coli* emerged as the predominant uropathogen, followed by *Klebsiella pneumoniae* and *Enterococcus faecalis*. Gram-negative bacteria accounted for the vast majority of isolates.

Antibiotic susceptibility testing revealed excellent activity of Meropenem, Nitrofurantoin, Amikacin, and Piperacillin-Tazobactam, whereas substantial resistance was observed against Ampicillin, Ceftriaxone, and Ciprofloxacin. Nearly one-third of bacterial isolates were multidrug resistant, emphasizing the growing threat of antimicrobial resistance among uropathogens.

Routine urine culture, antimicrobial susceptibility testing, rational antibiotic prescribing, infection control measures, and antimicrobial stewardship programs are essential for effective management of UTIs in elderly patients. These findings provide valuable regional data that can support empirical treatment strategies and improve patient outcomes in central India.

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