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Clinical and Bacteriological Profile of Patients with Recurrent Urinary Tract Infection

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KEYWORDS

Recurrent UTI, ESBL, Antibiotic resistance, Uropathogens.

ABSTRACT:

Background: Recurrent urinary tract infection (RUTI) is a frequently encountered condition in clinical practice and is increasingly complicated by antimicrobial resistance, leading to significant morbidity.

Objective: To analyse the clinical features, causative organisms, and antibiotic sensitivity patterns in patients presenting with recurrent urinary tract infections.

Methods: A prospective observational study was conducted on 240 patients diagnosed with RUTI over a 12-month period. Information regarding demographic characteristics, clinical presentation, associated risk factors, urine microscopy, culture reports, and antibiotic susceptibility patterns was collected and evaluated. Statistical analysis was performed using the chi-square test, with $p < 0.05$ considered significant.

Results: Out of 240 patients, 162 (67.5%) were female and 78 (32.5%) were male, with a mean age of 55.2 ± 12.4 years. The most common predisposing factors included diabetes mellitus (48%), history of catheterization (30%), and postmenopausal status (42%). Escherichia coli was the predominant uropathogen (62%). Extended-spectrum beta-lactamase (ESBL) production was detected in 28% of isolates. Marked resistance to fluoroquinolones was observed and found to be statistically significant ($p < 0.05$).

Conclusion: RUTI is more common in females and elderly with comorbidities. Rising antimicrobial resistance necessitates culture-guided therapy.

Introduction

Urinary tract infections (UTIs) are among the most frequently diagnosed bacterial infections in clinical practice, affecting people across all age groups, though they are more common in females[1]. It is estimated that 50–60% of women will experience at least one episode of UTI during their lifetime, and a proportion of them go on to develop recurrent episodes[1].

Recurrent urinary tract infection (RUTI) is defined as the occurrence of two or more episodes within six months or at least three episodes within one-year[2]. These infections may occur either as relapse or reinfection and are influenced by various host-related factors, including anatomical abnormalities, hormonal changes, and underlying comorbidities[5].

Among the recognized risk factors, diabetes mellitus, postmenopausal status, and prior urinary catheterization are commonly implicated[5]. Diabetes, in particular, increases susceptibility due to reduced immune response and the presence of glycosuria, which supports bacterial proliferation[3].

From a microbiological perspective, *Escherichia coli* remains the leading causative organism, followed by *Klebsiella pneumoniae*, *Enterococcus faecalis*, and *Proteus* species[6]. However, the increasing prevalence of antimicrobial resistance, especially due to ESBL-

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producing strains, has made empirical treatment more challenging[7–10].

Materials and Methods

Study Design and Setting:

This was a prospective observational study carried out in a tertiary care hospital over a period of 12 months.

Study Population:

A total of 240 patients with a confirmed diagnosis of recurrent urinary tract infection were enrolled in the study.

Inclusion Criteria:

Patients with ≥2 episodes of UTI within 6 months or ≥3 episodes within 1 year were included.

Exclusion Criteria:
Pregnant women were excluded from the study.

Data Collection:

A detailed clinical history along with physical examination was recorded for all patients. Midstream urine samples were collected using aseptic precautions and analysed for microscopy, culture, and antimicrobial susceptibility testing.

Laboratory Methods:
• Significant bacteriuria was defined as $\geq 10^5$ CFU/mL
• Culture was performed using CLED and MacConkey agar media
• Antibiotic sensitivity testing was done using the Kirby–Bauer disc diffusion method.

Statistical Analysis:

Data were analysed using SPSS software. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as percentages. The chi-square test was applied for analysis, with $p < 0.05$ considered statistically significant.

Results:

TABLE 1: SOCIO-DEMOGRAPHIC CHARACTERISTICS (N=240)

Characteristic	Category	Frequency (n)	Percentage (%)
Gender	Male	78	32.5
	Female	162	67.5
Age Distribution	20–40 years	40	16.7
	41–60 years	110	45.8
	>60 years	90	37.5
Mean ± SD	—	55.2 ± 12.4 years	—

The socio-demographic characteristics of the study population (N = 240) indicate a clear predominance of female participants, who accounted for 162 individuals (67.5%), whereas males represented 78 participants (32.5%).

In terms of age distribution, the highest proportion of subjects was observed in the 41–60 years age group (n = 110; 45.8%). Participants aged above 60 years constituted 90 cases (37.5%), while the 20–40 years age group formed the smallest segment with 40 individuals (16.7%).

The overall mean age of the participants was 55.2 years with a standard deviation of 12.4 years, reflecting a study population largely composed of middle-aged and elderly individuals.

TABLE 2: CLINICAL PRESENTATION (N=240)

Symptom	Frequency (n)	Percentage (%)
Dysuria	204	85.0
Increased frequency	187	77.9
Urgency	156	65.0
Fever	96	40.0
Abdominal pain	132	55.0
Hematuria	38	15.8
Pyuria/cloudy urine	29	12.1

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The clinical profile of the study population (N = 240) was dominated by lower urinary tract symptoms. Dysuria was the most frequently reported complaint (85.0%), followed by increased urinary frequency (77.9%) and urgency (65.0%). Abdominal pain was present in over half of the participants (55.0%), while fever was noted in 40.0% of cases. Less common findings included hematuria (15.8%) and pyuria or cloudy urine (12.1%).

Overall, the findings highlight dysuria and other irritative urinary symptoms as the predominant clinical features, with systemic manifestations such as fever occurring in a smaller proportion of patients.

TABLE 3: RISK FACTORS (N=240)

Risk Factor	Frequency (n)	Percentage (%)
Diabetes mellitus	115	47.9
Postmenopausal status	102	42.5
Catheterization history	72	30.0
Chronic kidney disease	29	12.1
Renal stones	24	10.0

Among the study population (N = 240), diabetes mellitus emerged as the most common risk factor, present in 115 patients (47.9%). Postmenopausal status was identified in 102 participants (42.5%), while a history of catheterization was reported in 72 cases (30.0%). Less frequent risk factors included chronic kidney disease (12.1%) and renal stones (10.0%).

Overall, metabolic and hormonal factors, along with prior urinary instrumentation, constituted the major predisposing conditions in this cohort.

TABLE 4: BACTERIOLOGICAL PROFILE (N=240)

Organism	Frequency (n)	Percentage (%)
Escherichia coli	149	62.1
Klebsiella pneumoniae	43	17.9
Enterococcus spp.	24	10.0
Proteus mirabilis	12	5.0
Pseudomonas aeruginosa	8	3.3
Others	4	1.7

The analysis of urine culture isolates revealed that *Escherichia coli* was the predominant organism, identified in 149 cases (62.1%). This was followed by *Klebsiella pneumoniae*, which accounted for 43 isolates (17.9%). *Enterococcus* species were detected in 24 patients (10%), while *Proteus mirabilis* was isolated in 12 cases (5%). *Pseudomonas aeruginosa* was found in 8 samples (3.3%). The remaining isolates, categorized as other organisms, comprised 4 cases (1.7%).

TABLE 5: ANTIBIOTIC SENSITIVITY PATTERN (OVERALL ISOLATES, N=240)

Antibiotic	Sensitive (%)	Resistant (%)	Interpretation
Nitrofurantoin	58.3	41.7	High sensitivity
Carbapenems	82.5	17.5	Highest sensitivity
Piperacillin/Tazobactam	71.2	28.8	Good sensitivity
Cephalosporins (3rd gen)	52.4	47.6	Moderate sensitivity
Ciprofloxacin	43.1	56.9	High resistance
Ampicillin	38.0	62.0	High resistance
Amikacin	66.7	33.3	Moderate–good

The antibiotic susceptibility pattern of isolates (N = 240) demonstrated the highest sensitivity to

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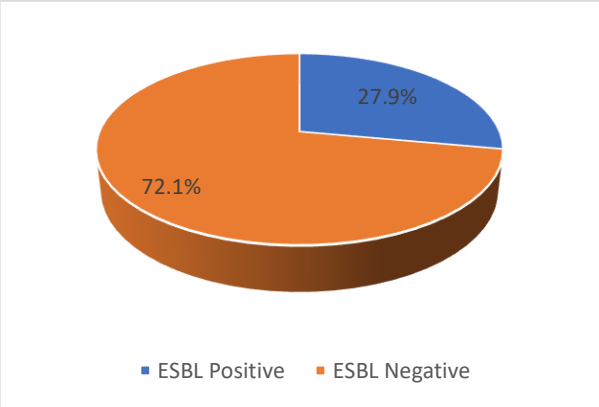
carbapenems (82.5%), followed by piperacillin/tazobactam (71.2%) and amikacin (66.7%). Nitrofurantoin showed moderate effectiveness with 58.3% sensitivity, while third-generation cephalosporins exhibited near-equal sensitivity and resistance rates (52.4% vs. 47.6%).

In contrast, a high level of resistance was observed with commonly used antibiotics such as ciprofloxacin (56.9%) and ampicillin (62.0%). Overall, these findings indicate better efficacy of higher-end antibiotics, with significant resistance to routinely prescribed agents.

TABLE 6: ESBL PRODUCTION



Parameter	Frequency	Percentage
ESBL Positive	67	27.9%
ESBL Negative	173	72.1%

Extended-spectrum beta-lactamase (ESBL) production was identified in 67 isolates (27.9%), while the majority, 173 isolates (72.1%), were ESBL negative.

TABLE 7: MULTI-DRUG RESISTANCE (MDR)

Category	Frequency (n)	Percentage (%)
MDR isolates	112	46.7
Non-MDR isolates	128	53.3

Regarding multidrug resistance, 112 isolates (46.7%) were classified as MDR, whereas 128 isolates (53.3%) were non-MDR.

Overall, a considerable proportion of isolates exhibited ESBL production and multidrug resistance, indicating a significant burden of antimicrobial resistance within the study population.

DISCUSSION

Recurrent urinary tract infection (RUTI) represents an important and growing clinical concern because of its frequent recurrence, higher occurrence in females, and increasing antimicrobial resistance. In the present study, females accounted for 67.5% of cases, indicating a clear female predominance. This observation is in agreement with Foxman et al., who reported that 50–60% of women experience at least one UTI episode during their lifetime, with recurrence being common due to anatomical and hormonal influences[1].

Most patients in this study were above 40 years of age, with a mean age of 55.2 ± 12.4 years. A similar age pattern was described by Gupta et al., who noted that postmenopausal women are more prone to recurrent infections due to reduced estrogen levels, leading to altered vaginal flora and weakened urogenital defense[2].

Diabetes mellitus (47.9%) emerged as the most frequent risk factor in our study. Comparable findings were reported by Geerlings et al., who explained that diabetic individuals are at higher risk of RUTI due to impaired neutrophil activity, glycosuria, and reduced immune defense mechanisms[3]. In addition, postmenopausal status (42.5%) and history of catheterization (30%) were also important contributing factors, similar to findings reported by Raz et al.[4].

From a microbiological perspective, *Escherichia coli* (62.1%) was the leading pathogen, followed by *Klebsiella pneumoniae* (17.9%). This aligns with global evidence where *E. coli* accounts for 60–80% of UTI cases due to virulence factors such as adhesins, pili, and biofilm-forming ability. Similar conclusions were drawn by Flores-Mireles et al.[6]

In the present study, ESBL-producing organisms were detected in 27.9% of isolates, indicating a concerning rise in resistant strains. This finding is comparable to Paterson et al., who reported a global increase in ESBL-producing Enterobacteriaceae[7].

Antibiotic sensitivity patterns showed high resistance to ciprofloxacin (56.9%) and ampicillin (62%). A similar trend was reported by Tamma et al., who highlighted increasing fluoroquinolone resistance due to widespread antibiotic use[8]. On the other hand, carbapenems

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demonstrated the highest sensitivity (82.5%), consistent with IDSA recommendations[9].

The occurrence of multidrug-resistant (MDR) organisms in this study was 46.7%, which closely matches global trends reported by Magiorakos et al.[10]

CONCLUSION

Recurrent urinary tract infection is a clinically important condition predominantly affecting females and older individuals, especially those with comorbidities such as diabetes mellitus. *Escherichia coli* continues to be the most common causative organism, followed by *Klebsiella pneumoniae*.

The present study highlights a significant burden of antimicrobial resistance, particularly against fluoroquinolones and beta-lactam antibiotics, along with a notable proportion of ESBL-producing and multidrug-resistant organisms.

These findings emphasize the importance of routine urine culture and sensitivity testing prior to initiating treatment, along with strict implementation of antibiotic stewardship programs to curb further development of resistance.

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