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Original Research Article

ANTIMICROBIAL SUSCEPTIBILITY PATTERN OF UROPATHOGENS IN PATIENTS WITH URINARY TRACT INFECTION ATTENDING A TERTIARY CARE HOSPITAL: A PROSPECTIVE CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Rising multidrug resistance (MDR) among uropathogens has complicated empirical therapy for urinary tract infection (UTI), highlighting the need for continuous local antibiogram surveillance. **Materials and Methods:** This prospective cross-sectional study enrolled adult patients (≥18 years) with culture-confirmed UTI at a tertiary care teaching hospital. Isolates were identified by standard biochemical methods, and antimicrobial susceptibility testing was performed by the Kirby–Bauer disk diffusion method per CLSI guidelines. Predictors of MDR UTI were assessed by univariate and multivariable logistic regression. **Results:** Of 320 culture-positive isolates, Gram-negative bacteria predominated (92.2%), led by Escherichia coli (56.6%), Klebsiella pneumoniae (15.3%), and Pseudomonas aeruginosa (7.2%). Overall, 55.6% of isolates were MDR, 25.0% were ESBL producers, and 5.9% were carbapenem-resistant. Susceptibility was highest to imipenem, meropenem, amikacin, fosfomycin, nitrofurantoin, and piperacillin–tazobactam, and lowest to ampicillin, fluoroquinolones, and third-generation cephalosporins. Independent predictors of MDR UTI were previous antibiotic use (AOR 3.48, 95% CI 1.96–6.18), urinary catheterization (AOR 2.86, 1.39–5.89), diabetes mellitus (AOR 2.31, 1.32–4.03), recent hospitalization (AOR 2.17, 1.15–4.08), and previous UTI (AOR 1.89, 1.08–3.31). **Conclusion:** Escherichia coli remains the predominant uropathogen, but MDR burden is substantial. Nitrofurantoin, fosfomycin, aminoglycosides, and carbapenems retain excellent activity and are reasonable empirical options pending culture; regular antibiogram surveillance and stewardship remain essential.

INTRODUCTION

UTI is among the most common bacterial infections in community and hospital practice, disproportionately affecting women, the elderly, diabetics, and catheterized patients.[1] Gram-negative bacilli, particularly E. coli, remain the predominant causative organisms, followed by Klebsiella, Proteus, Pseudomonas, and Enterococcus species.[2] Catheterization and hospitalization further predispose to infection with resistant organisms through disruption of host defenses and biofilm-associated colonization.[3] Because empirical antibiotics are usually started before culture results are available, knowledge of local susceptibility patterns is essential; however, rising resistance to fluoroquinolones, third-generation cephalosporins, and β-lactam/β-lactamase-inhibitor combinations has reduced the reliability of standard empirical regimens.[4,5] This study determined the bacterial profile and antimicrobial susceptibility pattern of uropathogens at a tertiary care hospital and identified factors associated with MDR infection.

MATERIALS AND METHODS

This prospective cross-sectional study was conducted in the Department of General Medicine with the Department of Microbiology at a tertiary care teaching hospital over [study duration], after Institutional Ethics Committee approval (No. [IEC number]). Adult patients (≥18 years) with clinically suspected UTI and culture-confirmed bacterial infection were enrolled after informed consent;

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those with antibiotic exposure in the preceding 48–72 hours, contaminated cultures, or inadequate samples were excluded. Demographic, clinical, and risk-factor data (diabetes, catheterization, prior UTI, hospitalization, prior antibiotic use) were recorded on a case record form. Clean-catch (or catheter-port) urine was cultured on CLED/MacConkey agar; significant bacteriuria was defined as $\geq 10^5$ CFU/mL. Isolates were identified by standard biochemical methods, and susceptibility was determined by the Kirby–Bauer disk diffusion method on Mueller–Hinton agar per the latest CLSI guidelines.4 MDR was defined as non-susceptibility to ≥1 agent in ≥3 antimicrobial classes. Data were analyzed in IBM SPSS using chi-square/Fisher's exact and t-test/Mann–Whitney tests as appropriate; variables with $p<0.10$ on univariate analysis were entered into multivariable logistic regression to identify independent predictors of MDR UTI (two-tailed $p<0.05$ considered significant).

RESULTS

Of 320 culture-positive patients, 178 (55.6%) had MDR UTI. MDR was significantly more frequent among patients aged ≥60 years, inpatients, and those with diabetes, chronic kidney disease, urinary catheterization, prior antibiotic use, prior UTI, recent hospitalization, and flank pain (all $p<0.05$); sex, dysuria, and urinary frequency/urgency showed no significant association.

Table 1: Distribution of uropathogens (N = 320)

Organism	n	%
Escherichia coli	181	56.6
Klebsiella pneumoniae	49	15.3
Pseudomonas aeruginosa	23	7.2
Proteus mirabilis	16	5.0
Acinetobacter baumannii	11	3.4
Citrobacter freundii	8	2.5
Enterobacter cloacae	7	2.2
Gram-negative subtotal	295	92.2
Enterococcus faecalis	15	4.7
Staphylococcus saprophyticus	7	2.2
Staphylococcus aureus	3	0.9
Gram-positive subtotal	25	7.8

Table 2: Susceptibility (%) of major Gram-negative isolates to key agents

Antibiotic	E. coli	K. pneumoniae	P. aeruginosa	P. mirabilis	A. baumannii
Piperacillin–Tazobactam	85.1	79.6	73.9	87.5	63.6
Amikacin	93.4	89.8	87.0	93.8	72.7
Ciprofloxacin	33.7	28.6	39.1	31.3	18.2
Nitrofurantoin	89.5	61.2	NA	31.3	NA
Fosfomycin	94.5	83.7	NA	56.3	NA
Imipenem	97.2	93.9	87.0	100.0	72.7
Meropenem	96.7	91.8	82.6	93.8	63.6

Among Gram-positive isolates, all remained fully susceptible to linezolid, vancomycin, teicoplanin, and nitrofurantoin, with lower susceptibility to penicillin (28.6–33.3%) and ciprofloxacin (33.3–57.1%).

Table 3: MDR, ESBL, and carbapenem resistance by organism

Organism	Isolates	MDR %	ESBL %†	Carbapenem-R %‡
E. coli	181	52.5	29.8	2.8
K. pneumoniae	49	65.3	38.8	8.2
P. aeruginosa	23	69.6	NA	17.4
P. mirabilis	16	43.8	18.8	6.3
A. baumannii	11	90.9	NA	36.4
Enterobacter cloacae	7	71.4	28.6	14.3
Overall (all isolates)	320	55.6	25.0	5.9

†Among Enterobacterales; ‡all isolates.

Table 4: Independent predictors of MDR UTI (multivariable logistic regression)

Variable	AOR	95% CI	p-value
Previous antibiotic use	3.48	1.96–6.18	<0.0001
Urinary catheterization	2.86	1.39–5.89	0.0041
Diabetes mellitus	2.31	1.32–4.03	0.0032
Recent hospitalization	2.17	1.15–4.08	0.0164
Previous history of UTI	1.89	1.08–3.31	0.0261
Age ≥60 years	1.58	0.92–2.71	0.0974
Inpatient status	1.63	0.94–2.82	0.0813
Chronic kidney disease	1.54	0.68–3.47	0.2957
Male sex	1.11	0.65–1.90	0.6943

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DISCUSSION

Gram-negative predominance and the leading role of E. coli, seen in 56.6% of isolates here, mirror findings from other tertiary care series, where E. coli accounted for 31.7–42.5% of isolates followed by Klebsiella and Pseudomonas or Enterococcus.[6,7,8] The excellent activity of carbapenems, amikacin, fosfomycin, and nitrofurantoin against Gram-negative isolates, and of glycopeptides/linezolid against Gram-positive isolates, is consistent with prior reports,[6-8] supporting their continued empirical use while fluoroquinolones and third-generation cephalosporins should be de-prioritized given poor susceptibility (28–41%).

The MDR prevalence of 55.6% falls within the range reported from other hospitals (55–78%), with the highest organism-specific rates again seen in Acinetobacter, Pseudomonas, and Klebsiella.[9-11] Previous antibiotic exposure, catheterization, diabetes, previous UTI, and recent hospitalization were independent predictors of MDR infection, consistent with the biological plausibility of selective pressure from repeated antimicrobial exposure and with similar associations reported elsewhere.[9,11,12] These findings support early identification of high-risk patients to guide culture-directed rather than blanket empirical therapy.

Limitations include the single-center design and absence of molecular characterization of resistance mechanisms (ESBL/carbapenemase genotyping), which may limit generalizability.

CONCLUSION

E. coli remains the predominant uropathogen, with a substantial MDR burden, particularly among Acinetobacter baumannii, Klebsiella pneumoniae, and Pseudomonas aeruginosa. Nitrofurantoin, fosfomycin, amikacin, piperacillin–tazobactam, and carbapenems retain good activity and are reasonable empirical choices pending culture. Previous antibiotic exposure, catheterization, diabetes, previous UTI, and recent hospitalization independently predict MDR infection. Institution-specific antibiograms, routine culture-guided therapy, and antimicrobial stewardship remain essential; multicenter studies with molecular resistance profiling are recommended.

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