

Research Article

Comparison of Anti-Microbial Susceptibility of *Pseudomonas Aeruginosa* Causing Community and Hospital Acquired Urinary Tract Infection at a Tertiary Care Hospital

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Abstract

Introduction: Urinary Tract Infections (UTIs) are a leading cause of morbidity in both community and healthcare settings, with Healthcare-Associated UTIs (HAUTIs) being the most prevalent healthcare-acquired infections. The emergence of multidrug-resistant pathogens, such as *Pseudomonas aeruginosa*, poses significant challenges to effective treatment. **Objectives:** This study investigates the prevalence of *Pseudomonas aeruginosa* in Community-Acquired (CA-UTI) and Hospital-Acquired (HA-UTI) urinary tract infections and evaluates their antimicrobial susceptibility profiles to guide therapeutic strategies.

Materials and Methods: Urine samples were collected from outpatients (classified as CA-UTI) and discharged patients with urinary catheters within five days post-discharge (classified as HA-UTI). Uropathogens were isolated and Antimicrobial Susceptibility Testing (AST) was performed to assess resistance patterns.

Statistical Analysis: Data were analyzed using descriptive statistics, including mean, median, frequency and standard deviation with statistical significance set at $p < 0.05$.

Results: Between April 2023 and March 2024, total of 4,590 urine cultures were analyzed, identifying *Pseudomonas aeruginosa* in 219 cases (163 CA-UTI, 56 HA-UTI). Susceptibility rates for CA-UTI isolates were: Cefepime (42.9%), Ciprofloxacin (31.9%), Imipenem (61.1%), Meropenem (65.6%), Netilmicin (45.3%), Norfloxacin (19.6%), Piperacillin (49.0%), Piperacillin-Tazobactam (65.0%), Ticarcillin (36.1%), Aztreonam (27.6%), Tobramycin (50.9%) and Amikacin (25.1%). HA-UTI isolates exhibited higher resistance, with susceptibility rates of Cefepime (53.5%), Ciprofloxacin (32.1%), Imipenem (61.5%), Meropenem (63.6%), Netilmicin (62.3%), Norfloxacin (28.5%), Piperacillin (48.2%), Piperacillin-Tazobactam (73.2%), Ticarcillin (37.5%), Aztreonam (32.1%), Tobramycin (67.8%) and Amikacin (37.0%).

Conclusion: The study reveals a concerning rise in multidrug resistance among *Pseudomonas aeruginosa* isolates, particularly in CA-UTI, underscoring the need for targeted antimicrobial stewardship and infection control measures to address this growing public health challenge.

Keywords: Community UTI; Hospital UTI; *Pseudomonas*

Introduction

Urinary Tract Infections (UTIs) are the most common outpatient infections, with a lifetime incidence of 50-60% in adult women [1]. UTI recurrence is also common, with about 20-30% of women having a recurrent infection within 6 months of the initial UTI. Urinary Tract Infections (UTIs) are categorized based on the setting in which they are acquired as community-acquired or hospital-acquired (nosocomial) UTI. The Healthcare-associated UTIs (HAUTIs) are the most common form of healthcare-

acquired infection. The common etiology of Community-Acquired Urinary Tract Infections (CA-UTIs) are *Escherichia coli* (*E. coli*): The most common pathogen, responsible for 70-95% of cases. *Staphylococcus saprophyticus*: Especially prevalent in young, sexually active women. *Proteus mirabilis* is also known for its ability to cause kidney stones e.g *Klebsiella species* and *Enterococcus faecalis* [2].

The Hospital Acquired Urinary Tract Infections (HA-UTIs) are the most common type of hospital-acquired infection, accounting for about 30-40% of all nosocomial infections [3]. The use of urinary catheters significantly increases the risk of HA-UTIs. About 75% of HA-UTIs are associated with a urinary catheter. Patients in Intensive Care Units (ICUs), the elderly and those with risk. The common aetiologies include *Escherichia coli*, still common but accounts for a lower percentage compared to CA-UTIs followed by *Klebsiella species*, *Pseudomonas aeruginosa*, *Enterococcus species*, *Pseudomonas aeruginosa*, *Proteus mirabilis*, etc. In addition, the pathogens responsible for UTIs vary according to region thereby, treatment needs to be modified based on the local antibiotic susceptibility data and response to therapy. The burden of UTIs on both individuals and society is multifactorial and is likely to increase in the context of antibiotic resistance. Understanding the etiology and prevalence of CA-UTIs and HA-UTIs helps in implementing appropriate preventive measures and treatment strategies. Here in this study, the authors had tried to characterize the difference in antibiotic susceptibility pattern of uro-pathogenic *Pseudomonas aeruginosa* in Community and Hospital acquired UTI.

Material and Method

The study was a retrospective observational study. The details of all the urine culture testing done during the period of 12 months (1st April 2023 -31st March 2024) had been retrieved from electronic and manual registers. The urine cultures were performed by semi quantitative technique on cysteine lactose electrolyte deficient media and AST was done by disc diffusion technique by Kirby Breuer's technique and interpreted according to the CLSI guidelines 2023 [4]. The Out-patients department had been considered as Community Acquired Urinary Tract Infections whereas the ward samples and if urine samples submitted within 5 days of discharge, then it is considered as Hospital Acquired Urinary Tract Infections. The details of isolated uropathogens and AST had been analyzed. The statistical analysis was done using statistical parameters like mean, median, frequency, standard deviation and p value <0.05 was considered as significant. The ethical clearance for the study was taken from the institute ethical board.

Result

A total of 4590 urine non-repetitive samples were cultured of which 1782 urine were culture positive for significant bacteriuria for any of the known uropathogen. *Pseudomonas aeruginosa* was identified in 219 (n=219;12%) urine culture. Out of which 163 isolated from community acquired UTI and 56 from Hospital acquired UTI (Fig. 1).

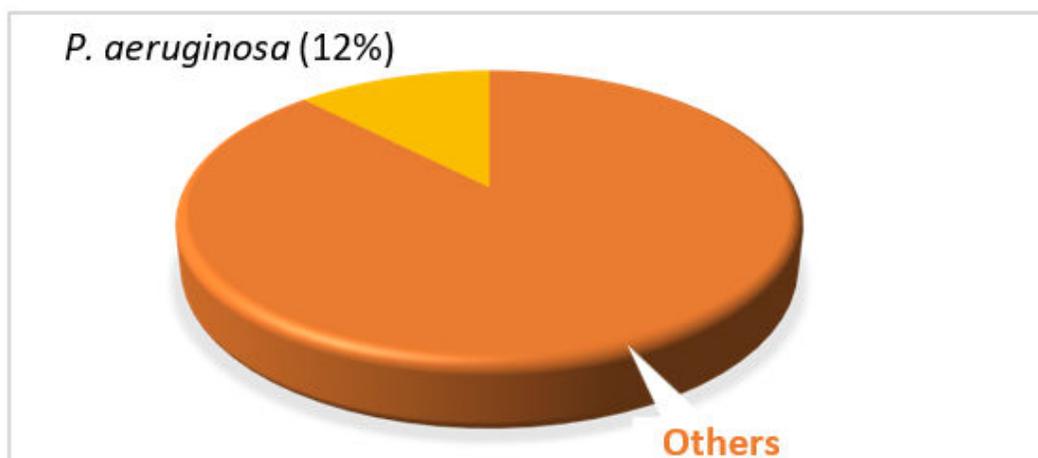


Figure 1: The pie chart depicts the proportion of *Pseudomonas aeruginosa* isolated from total urine culture positive.

Analyzing the AST of 163 CA-UTI, *Pseudomonas aeruginosa* isolates it was found that highest susceptibility was seen for Piperacillin+Tazobactam, Imipenem and Meropenem i.e 66%, 65% and 61% respectively. The details of susceptibility pattern had been showed Fig. 2. On the other hand, the AST pattern of 56 HA-UTI, *Pseudomonas aeruginosa* isolates, showed highest

susceptibility to Piperacillin+Tazobactam, Meropenem and Tobramycin approximately 73%, 70% and 67% respectively as shown Fig. 2.

These susceptibility pattern of *Pseudomonas aeruginosa* isolates from the authors healthcare setting is further compared with the national data of susceptibility pattern of the microorganism. The detail of the comparison had been given in Table 1.

A statistically significant ($p < 0.05$) difference in susceptibility pattern of the isolate for the antibiotics Tobramycin and Netilmicin between Community and Hospital acquired UTI was observed.

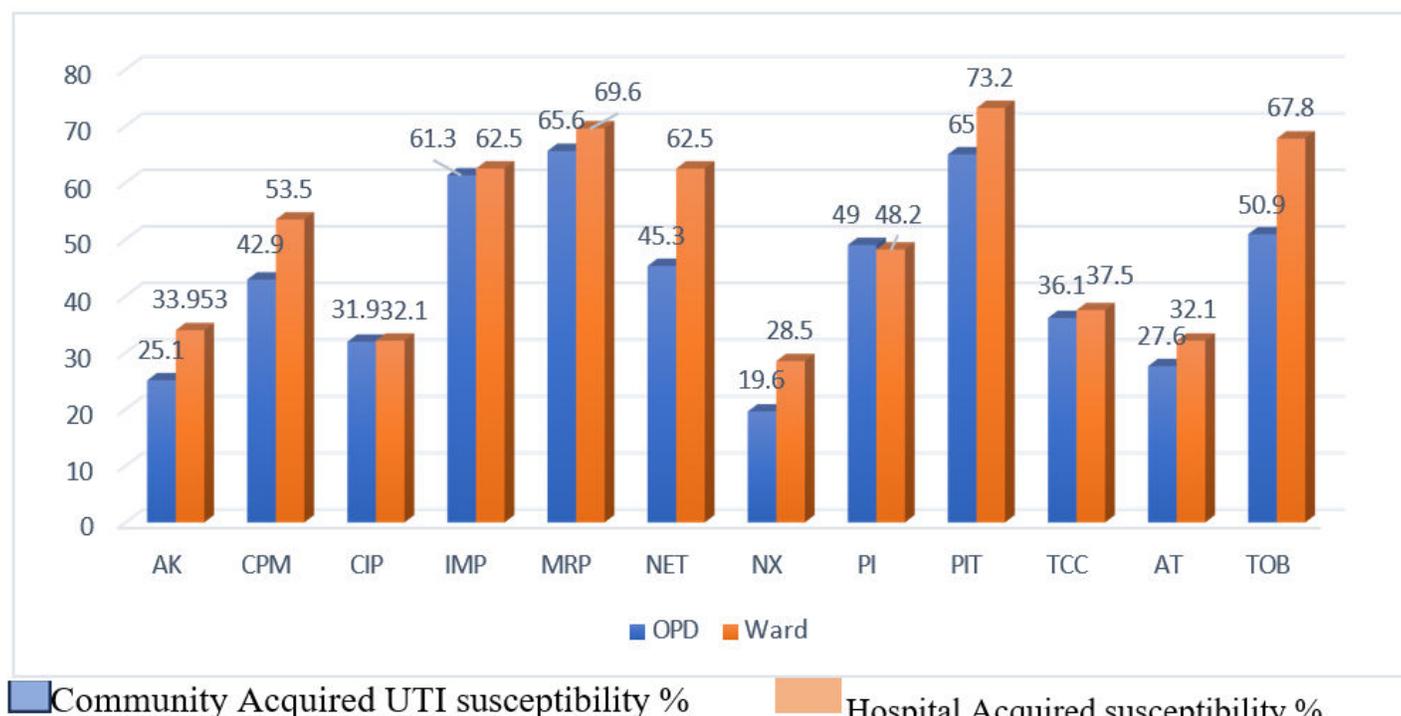


Figure 2: The percentage susceptibility of *Pseudomonas aeruginosa* in Community and Hospital acquired UTI. Note: AK: Amikacin; CPM: Cefipime; CIP: Ciprofloxacin; IMP: Impenem; MRP: Meropenem; NET: Netilmicin; NX: Norfloxacin; PI: Piperacillin; Piperacillin+Tazobactam; TCC: Ticarcillin; AT: Aztreonam; TOB: Tobramycin.

	Community-UTI n,(%)			Hospital-UTI n,(%)		
	Study n(%)	ICMR report n(%)	P value	Study n (%)	ICMR report n(%)	P value
AK	41 (25.1)	-60.7	<0.005	19 (33.9)	47.9	0.04
CPM	70 (42.9)	59.1	0.03	30 (53.5)	41.6	0.025
CIP	52 (31.9)	43.2	1	18 (32.1)	33.5	0.89
IMP	52 (61.3)	60.2	<0.005	35 (62.5)	49.6	<0.005
MRP	107 (65.6)	63.1	0.55	39 (69.6)	52.5	<0.005
NX	32 (19.6)	37.1	0.75	16 (28.5)	33.2	0.82
PIT	106 (65)	66.8	0.88	41 (73.2)	54.8	1
TOB	83 (50.9)	60.5	<0.005	38 (67.8)	48	<0.005

Table 1: Percentage of Antimicrobial susceptibility of *Pseudomonas aeruginosa* isolates observed in the study and compared with AST pattern of the organism across India as surveyed and published in Anti Microbial Resistance Surveillance Network; Annual Report; 2022.pdf. Note: AK: Amikacin; CPM: Cefipime; CIP: Ciprofloxacin; IMP: Impenem; MRP: Meropenem; NET: Netilmicin; NX: Norfloxacin; PI: Piperacillin; Piperacillin+Tazobactam; TCC: Ticarcillin; AT: Aztreonam; TOB: Tobramycin.

Discussion

Generally, in the susceptibility pattern of Community acquired and Hospital-acquired UTI, the later exhibit higher resistance rates due to multiple drugs uses and subsequently its emergence of resistance [3]. The present study showed a statistically significant ($p < 0.05$) difference in susceptibility pattern of the isolates for the antibiotics Tobramycin and Netilmicin between Community and Hospital acquired UTI. Similar kind of pattern is also seen in national wide antibiotic surveillance report [5]. It can be due to non/less availability over the counter, of these drugs as well as these drugs are less prescribed for UTI due to their side effects.

The antibiotic susceptibility pattern of *Pseudomonas aeruginosa* causing community acquired UTI, showed difference from the nationwide antibiotic resistance report. These differences were statistically significant for antibiotics like amikacin, gentamycin, imipenem and tobramycin. For amikacin, Community-UTI susceptibility (25.1%) is significantly lower than the nationwide resistance report (60.7%). This relatively lower susceptibility in the study population, can be attributed to catchment population of a referral health center, where patient usually lands up after multiple use of antibiotics from subcenters.

For the antibiotic imipenem, high susceptibility in both present study and as well as nationwide report suggest less emergence of resistance for this antibiotic in community UTI patients. This pattern is comparable to the susceptibility seen in the study of Farhan et al, since this antibiotic is costly and available in injectable form, hence its susceptibility pattern still remains high [6]. Comparing the susceptibility pattern of the antibiotic tobramycin, it is seen in Community-UTI, susceptibility was also significant (50.9%) but slightly lower than the nation-wide surveillance report (60.5%) [5]. Another study by Nkont Cho F, et al., show high susceptibility to tobramycin (90%) in community acquired UTI whereas in a study done in India showed about 60% resistance to Tobramycin [2,7]. This can be due to local use of the antibiotic tobramycin more.

In hospital acquired UTI, the antibiotic found to be significantly more susceptible were amikacin, cefepime, imipenem, meropenem and tobramycin. All these antibiotics in the present study showed susceptibility similar to the findings done at nearby geographical areas [2,8]. Before analyzing these, the authors wants to clarify the *Pseudomonas aeruginosa* isolates from Hospital acquired UTI were less in number. This is due to the study population which were not inpatients rather the patients discharged with foleys catheter and submitted their samples within five days of discharge.

Conclusion

The AST pattern of *Pseudomonas aeruginosa* in both type of UTI indicates the community acquired strains are trending towards multi resistant bugs. This can be clear indication of increasing irrational, over counter availability and overuse of antibiotics. The increasing multi resistance of community acquired isolates demands surveillance and screening at secondary and primary health care also.

Conflict of Interest

The authors have declared no conflict of interest.

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References

1. Pardeshi P. Prevalence of urinary tract infections and current scenario of antibiotic susceptibility pattern of bacteria causing UTI. Indian J Microbiol Res. 2018;5(3):334-8.
2. Mohapatra S, Panigrahy R, Tak V, JV S, KC S, Chaudhuri S, et al. Prevalence and resistance pattern of uropathogens from community settings of different regions: An experience from India. Access Microbiology. 2022;4(2):000321.
3. Mathur P, Malpiedi P, Walia K, Srikantiah P, Gupta S, Lohiya A, et al. Health-care-associated bloodstream and urinary tract infections in a network of hospitals in India: a multicentre, hospital-based, prospective surveillance study. The Lancet Global Health. 2022;10(9):e1317-25.
4. CLSI supplement M100 (ISBN 978-1-68440-170-3); ISBN 978-1-68440-171-0. Clinical and Laboratory Standards Institute, USA, 2023.

5. Annual report-antimicrobial resistance research and surveillance network: 2022; division of epidemiology and communicable diseases: Indian Council of Medical Research. 2022.
6. Farhan SM, Raafat M, Abourehab MAS, Abd El-Baky RM, Abdalla S, EL-Gendy AO, et al. Effect of imipenem and amikacin combination against multi-drug resistant *Pseudomonas aeruginosa*. *Antibiotics (Basel)* 2021;10(11):1429.
7. Nkont Cho F, Sainte-Rose V, Abboud P, Portecop P, Pujo JM, Cook F, et al. Antimicrobial susceptibility of community-acquired urine bacterial isolates in French Amazonia. *Am J Trop Med Hyg.* 2023.
8. Saxena RS. Distribution and antimicrobial susceptibility pattern of bacterial pathogens causing urinary tract infection in urban community of Meerut City, India. *ISRN Microbiol.* 2013;2013:e749629.

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