

Study Regarding the Bacteriological Profile and Antimicrobial Susceptibility Pattern of Isolates Obtained from Urinary Tract Infections: Analysis of Antibigram from Medicine Department from Secondary Care Hospital North India

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ABSTRACT

Urinary tract infections (UTIs) remain among the most common bacterial infections worldwide, with *Escherichia coli* as the predominant uropathogen. This retrospective study analyzed culture and susceptibility data from 455 samples processed in the Medicine Department of Zonal Hospital Dharamshala between January–December 2024. Urine was the most frequent specimen (58% OPD, 41% IPD, 1% ICU). *E. coli* accounted for the majority of isolates (n=94). High susceptibility was observed to meropenem (91%), piperacillin–tazobactam (89%), gentamicin (86%), fosfomycin (84%), and imipenem (84%), supporting their role in targeted or reserve therapy. Nitrofurantoin (78%) and cefepime (73%) remained moderately effective, whereas ciprofloxacin (30%), ampicillin (21%), and amoxiclav (53%) showed poor efficacy, limiting their empirical use. These findings highlight the value of department-specific antibiograms for guiding rational empirical therapy, preserving carbapenem efficacy, and supporting antimicrobial stewardship initiatives to mitigate resistance in this secondary-care hospital setting.

Keywords: UTI, E.coli, CLSI , Antibigram

INTRODUCTION:

Urinary tract infections (UTIs) represent one of the most common bacterial infections encountered in clinical medicine, particularly in internal medicine and primary care practice. They affect individuals across all age groups but are particularly frequent among women, older adults, and patients with comorbidities such as diabetes and renal disease (1). *Escherichia coli* remains the predominant uropathogen worldwide, responsible for up to 80–90% of community-acquired cases and a significant proportion of hospital-acquired infections (2). *Klebsiella* spp., *Enterobacter* spp., and *Enterococcus* spp. are recognized as significant secondary uropathogens, particularly in hospitalized patients and those with catheters or underlying comorbidities. Studies from North India report *Klebsiella* contributing to 10–20% of UTIs, *Enterobacter* to 3–7%, and *Enterococcus* (often *E. faecalis*) to 5–10%, with higher prevalence in nosocomial and complicated infections. (3) However, the antimicrobial susceptibility profile of uro-pathogens is highly dynamic and varies considerably across regions, institutions, and even within departments of the same hospital. This variability underscores the importance of local surveillance through hospital- and department-level antibiograms. Globally, increasing resistance to frontline antibiotics such as fluoroquinolones and aminopenicillins has limited their empirical utility in UTI management (4). The problem is particularly pressing in India, where irrational use of antibiotics, over-the-counter availability, and lack of stewardship practices have accelerated antimicrobial resistance (AMR) (5). Department-specific antibiogram data, which reflect the patient demographics and antibiotic exposure patterns of that unit, are therefore crucial in guiding rational empirical therapy. Such data not only inform clinicians about the most effective first-line and reserve antibiotics but also help prevent the misuse of broad-spectrum drugs, thereby curbing further resistance. This study analyses the annual antibiogram from the Medicine Department of a secondary-care hospital in north India, focusing on pathogen distribution and susceptibility

trends. By providing evidence-based insights into evolving resistance patterns, the findings aim to strengthen antimicrobial stewardship, optimize empirical therapy for UTIs, and contribute to regional AMR surveillance efforts.

Materials and Methods: This study was designed as a retrospective analysis of culture and sensitivity reports generated in the microbiology laboratory of Zonal Hospital Dharamshala, focusing exclusively on the Medicine Department. The study period spanned January to December 2024. Out of the 982 total clinical samples processed in the hospital during this time, the Medicine Department contributed 455 samples (46%), with urine specimens comprising the majority. Patient demographic analysis revealed that most samples were submitted from the outpatient department (OPD, 58%), followed by the inpatient wards (IPD, 41%), while a small proportion originated from the intensive care unit (ICU, 1%). All participants were advised to collect the midstream urine sample in wide mouth sterile containers after urogenital cleaning with soap and water with sterile gauze. Samples were processed within 1 hour of collection in microbiology laboratory.⁽⁶⁾ Screening tests like wet film preparation and direct gram staining were performed. In Wet film preparation- presence of one pus cell /7 hpf was considered significant pyuria.⁽⁷⁾ Direct Gram staining- detection of one or more morphologically similar bacteria per oil immersion field was treated as significant.⁽⁷⁾ Urine samples were inoculated on blood agar and mac-Conkey agar using a standard loop method (semi-quantitative method).⁽⁸⁾ The plates were read after 24 hours of aerobic incubation at 37 C. They were further incubated for another 24 hours before a negative report is issued. A single organism obtained in counts of >100000 CFU/ml will be considered as significant bacteriuria. Further identification of pathogen was done by standard biochemical techniques.⁽⁹⁾ Kirby Bauer disk diffusion technique was used for antibiotic susceptibility testing of gram negative or gram-positive pathogens. Interpretation of results were done according to CLSI guidelines. ATCC control strains were used.⁽¹⁰⁾ The antibiotic panel tested included carbapenems, beta-lactam/beta-lactamase inhibitor combinations, aminoglycosides, Fosfomycin, nitrofurantoin, cephalosporins, fluoroquinolones, tetracyclines, and aminopenicillins, reflecting the commonly prescribed agents for urinary tract infections and systemic bacterial infections in routine clinical practice.

RESULTS:

A total of 455 clinical samples were received from the Medicine Department during the study period. The majority were obtained from the outpatient department (58%), followed by inpatient wards (41%), with only a small proportion originating from the intensive care unit (1%). Urine was the predominant specimen type, consistent with the department's clinical burden of urinary tract infections. Microbiological analysis revealed that *Escherichia coli* (79.7%) was the leading pathogen, followed by *Klebsiella pneumoniae* (16.1%) and *Pseudomonas aeruginosa* (1.7%) as depicted in Figure:1 . As the *Escherichia coli* was the predominant pathogen susceptibility pattern is demonstrated for it as high sensitivity to carbapenems and certain first-line agents, with Meropenem (91%), Piperacillin–Tazobactam (89%), Gentamicin (86%), Fosfomycin (84%), and Imipenem (84%) showing the greatest effectiveness. Moderate susceptibility was observed for Nitrofurantoin (78%), Cefepime (73%), and Amikacin (73%), indicating their continued utility in selected cases. However, resistance was notable against several commonly prescribed antibiotics. Lower sensitivity rates were seen with Ceftazidime (62%), Norfloxacin (57%), Amoxicillin/Clavulanic acid (53%), and Tetracycline (52%). Results are depicted in table :1. Alarming, very poor susceptibility was documented for Ciprofloxacin (30%), Ampicillin (21%), underscoring the limited role of these agents in empirical therapy within this population.

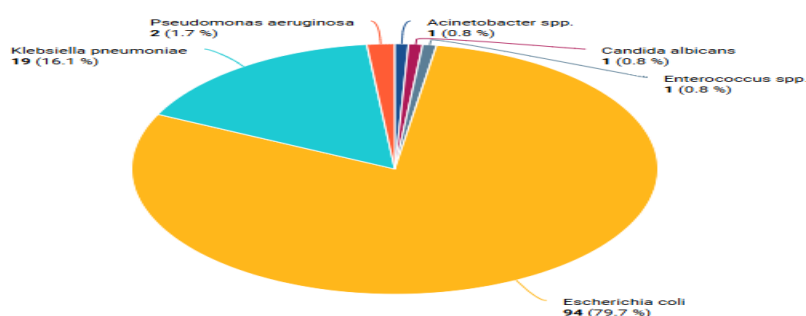


Figure:1 Isolates obtained from Urine samples.

Table1: Antibiotic Susceptibility Pattern of E. coli Isolates (n = 94)

Category	Antibiotic	Susceptibility (%)
High Susceptibility (>80%)	Meropenem	91%
	Piperacillin–Tazobactam	89%
	Gentamicin	86%
	Fosfomycin	84%
	Imipenem	84%
Moderate Susceptibility (60–80%)	Nitrofurantoin	78%
	Cefepime	73%
	Amikacin	73%
	Ceftazidime	62%
Low Susceptibility (<60%)	Norfloxacin	57%
	Amoxicillin/Clavulanic acid	53%
	Tetracycline	52%
	Ciprofloxacin	30%
	Ampicillin	21%

DISCUSSION:

This departmental antibiogram highlights a clear stratification of antibiotic efficacy for *Escherichia coli* urinary tract infections (UTIs) managed in the Medicine Department. Carbapenems such as meropenem (91%) and imipenem (84%), along with β -lactam/ β -lactamase inhibitor combinations like piperacillin–tazobactam (89%), demonstrated high effectiveness (>85%), reaffirming their role as reserve drugs in complicated infections. Among oral agents, fosfomycin (84%) and nitrofurantoin (78%) remain reliable first-line options for outpatient management of uncomplicated UTIs. These results are consistent with Rizvi et.al, and Bhargava et.al where nitrofurantoin susceptibility rates for *E. coli* ranged from 78–92% , and fosfomycin maintained >80% sensitivity, making them preferred oral empirical choices.^(11,12) Conversely, fluoroquinolones showed alarmingly high resistance, with ciprofloxacin demonstrating only 30% sensitivity and norfloxacin 57%, paralleling ahirwar et .al and national Idata where fluoroquinolone resistance often exceeds 60–70%.^(13,14) Similarly, ampicillin was largely ineffective (21%), mirroring findings from kaur H et.al that report ampicillin resistance >75% in community and hospital isolates.⁽¹⁵⁾ Cephalosporins displayed moderate susceptibility, with cefepime (73%) and ceftazidime (62%) showing limited reliability -a trend also reported from tertiary centres in Delhi, Chandigarh, and Uttar Pradesh, where third-generation cephalosporin susceptibility for *E. coli* rarely exceeds 65–70% due to high ESBL prevalence.^(12,13) These findings emphasize the need for susceptibility-guided use of cephalosporins to prevent treatment failures. Overall, these results mirror broader Indian AMR surveillance trends, including those reported in the ICMR-AMRSN network, which consistently highlight escalating fluoroquinolone and aminopenicillin resistance in *E. coli*, stable nitrofurantoin efficacy, and high retained activity of carbapenems.^(14,16) Our findings therefore reinforce the necessity of: Regular, department-wise antibiogram updates (at least annually) ,Integration with hospital antimicrobial stewardship programs (AMSPs) ,Judicious carbapenem use to preserve their activity for multidrug-resistant infections .Such efforts

are crucial to optimizing empirical therapy, improving clinical outcomes, and curbing the acceleration of antimicrobial resistance in the region.

CONCLUSION:

The Medicine Department contributed the largest sample load in 2024, with *E. coli* emerging as the predominant isolate. The organism retained high susceptibility to carbapenems, piperacillin–tazobactam, and fosfomycin, but showed poor response to fluoroquinolones and ampicillin. Department-specific antibiograms thus remain invaluable for guiding empirical therapy and should be routinely disseminated to treating physicians to optimize antibiotic selection. For uncomplicated UTIs, oral agents such as fosfomycin and nitrofurantoin should be prioritized, while carbapenems must be preserved for resistant or severe infections to prevent the acceleration of antimicrobial resistance.

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