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Prevalence of Multidrug-Resistant Urinary Tract Infections and Their Antibiotic Susceptibility Patterns in Tertiary Care Hospitals

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ABSTRACT

UTIs are some of the most frequent cases of bacterial infections that are experienced in the community and in hospitals. The rising occurrence of multidrug-resistant (MDR) pathogens makes the process of treatment more complicated and contributes to morbidity. To establish the prevalence, bacterial profile and antimicrobial resistance patterns of the pathogens responsible of urinary tract infection in the tertiary care hospitals. The study was a cross-sectional one conducted during six months (January to June 2024) and on 500 patients diagnosed with UTIs clinically. Middle urines were collected and cultured. Standard biochemical tests were used to identify bacterial isolates and antibiotic susceptibility testing was done using KirbyBauer disk diffusion method according to CLSI 2024 guidelines. Among 500 samples, 310 (62) of them had a significant bacteria growth. The most common isolate was *Escherichia coli* (48), then *Klebsiella pneumoniae* (22), *Enterococcus spp.* (15), *Pseudomonas aeruginosa* (8) and *Proteus mirabilis* (7). Forty six percent of the isolates were detected with MDR, mostly Gram-negative bacteria. The resistance was high against the Ceftriaxone (72%), Ciprofloxacin (64%), and Ampicillin (80%), but Nitrofurantoin (88%), and Imipenem (90%) were effective. The analysis demonstrates that MDR urinary pathogens are present at a very elevated rate, and the regular monitoring of antimicrobials usage and the reasonable use of antibiotics are necessary to avoid the further development of resistance.

Keywords: UTI, antimicrobial resistance, MDR bacteria, antimicrobial susceptibility, tertiary care hospital.

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1. Introduction

UTIs are one of the most frequently encountered bacterial infections in the whole world, and they afflict people of all ages. They cause some 40% of all nosocomial infections occurring in hospital environments, which are usually linked to either indwelling urinary catheters or immunocompromised states.

The emergence of antimicrobial resistance (AMR) in the global context, particularly in the presence of extended-spectrum β -lactamase

(ESBL), and carbapenemase-producing Enterobacterales has made a large range of widely used antibiotics ineffective. Local resistance patterns need to be understood to lead to an empirical therapy, as well as to formulate policies in the area of antibiotic stewardship. The research focuses on the patterns of prevalence and antibiotic susceptibility of uropathogens isolated in tertiary care hospitals to help in evidence-based treatment and infection control.

Materials and Methods

2.1 Study Design and Population

This is a cross-sectional study, which was carried out in the Department of Microbiology of two tertiary care hospitals in India between January and June 2024.

The sample of 500 patients (inpatients and outpatients) with clinical symptoms of UTI was included.

2.2 Inclusion and Exclusion Criteria

Inclusion: This patient needs clinical signs of UTI (burning micturition, dysuria, pain in the flank, fever) and positive urine culture (>10⁵ CFU/mL).

Contraindications: Exclusion: Patients on antibiotics in the last 72 hours or mixed growth of contaminants.

The samples were collected and cultured following the procedure outlined below:

The collection of Midstream clean-catch urine samples was made in sterile containers inoculated in CLED agar and incubated at 37C during 24-48 hours. The further identification of significant growths was performed with the help of Gram staining and conventional biochemical tests (indole, citrate, urease, TSI, oxidase).

Antimicrobial susceptibility testing (AST) involves the use of a culture to determine the susceptibility of microorganisms to various

antibiotics. Antimicrobial Susceptibility Testing in microbiology is the act of assessing the sensitivity of microorganisms to different antibiotics utilizing a culture. KirbyBauer disk diffusion technique was conducted on MuellerHinton agar and the outcome was interpreted based on CLSI 2024.

Tests of antibiotics included:

- β-lactams: Ampicillin, Ceftriaxone, Piperacillin -Tazobactam.
- Aminoglycosides: Amikacin, Gentamicin.
- Carbapenems: Imipenem, Meropenem.
- Fluoroquinolones Ciprofloxacin, Levofloxacin
- Nitrofurantoin, Colistin (Grand-negative isolates)

2.5 Data Analysis

The analysis of the data was done with the help of SPSS v28.0. The prevalence, resistance rates and MDR distribution were determined using descriptive statistics.

Results

3.1 Prevalence of UTIs

Of 500 samples of urine, 310 (62) samples had significant bacterial growth. Females were more likely to get infected (68% compared to males (32%).

Table 1: Distribution of Bacterial Isolates (n = 310)

| Organism | Number of Isolates | Percentage (%) |
|-------------------------------|--------------------|----------------|
| <i>Escherichia coli</i> | 149 | 48 |
| <i>Klebsiella pneumoniae</i> | 68 | 22 |
| <i>Enterococcus spp.</i> | 46 | 15 |
| <i>Pseudomonas aeruginosa</i> | 25 | 8 |
| <i>Proteus mirabilis</i> | 22 | 7 |

3.2 Antimicrobial Resistance Patterns

Table 2: Resistance (%) of Common Isolates to Tested Antibiotics

| Antibiotic | <i>E. coli</i> | <i>K. pneumoniae</i> | <i>P. aeruginosa</i> | <i>Enterococcus spp.</i> |
|-------------|----------------|----------------------|----------------------|--------------------------|
| Ampicillin | 80 | 85 | 72 | 68 |
| Ceftriaxone | 72 | 76 | 70 | - |

| Antibiotic | <i>E. coli</i> | <i>K. pneumoniae</i> | <i>P. aeruginosa</i> | <i>Enterococcus spp.</i> |
|------------|----------------|----------------------|----------------------|--------------------------|
|------------|----------------|----------------------|----------------------|--------------------------|

| | | | | |
|----------------|----|----|----|----|
| Ciprofloxacin | 64 | 69 | 66 | 55 |
| Amikacin | 35 | 40 | 45 | 30 |
| Imipenem | 10 | 12 | 18 | 15 |
| Nitrofurantoin | 12 | 15 | 25 | 10 |
| Colistin | 5 | 8 | 12 | - |

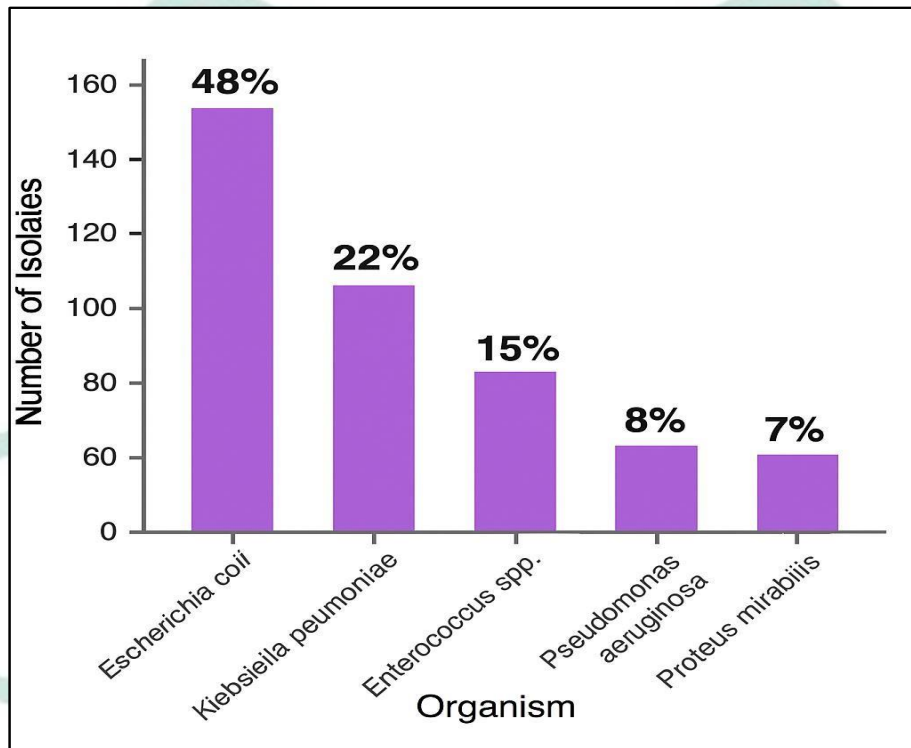


Figure 1: Prevalence of Uropathogens

(Bar chart showing distribution of bacterial isolates; E. coli predominates at 48%)

Figure 2: Antibiotic Resistance Patterns

(Graph showing high resistance to β -lactams and fluoroquinolones, but low resistance to carbapenems and nitrofurantoin.)

4. Discussion

The paper shows that the culture-confirmed UTIs prevail at 62 percent, which is similar to the literature in tertiary care hospitals (55-65%). E. coli was the most common isolate, which showed its great uropathogenic adaptation and virulence

Conclusion

The further spread of MDR uropathogens, especially E. coli and Klebsiella pneumoniae is a significant risk to patient safety in tertiary hospitals. Periodic introspection of the antibiotic sensitivity, restricted anti-bacterial medication

factors. The resistance to β -lactams and fluoroquinolones is also high and alarming, probably because of the practice of empirical antibiotic misuse and self-medication. It is interesting to note that carbapenems (Imipenem) and Nitrofurantoin can still be employed particularly in MDR cases. The same has been described by Kaur et al. (2023) and Singh et al. (2022), and MDR Enterobacterales can be observed to be rising around the globe. Continuous monitoring and tight infection control is also emphasized by the presence of resistant Enterococcus spp. (15%).

applications, and a control of the infection are also critical to reduce additional resistance. Local antibiogram data should be used to lead the empirical therapy.

6. References

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