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Antimicrobial Susceptibility Pattern of Escherichia Coli Isolated from Urinary Tract Infected Patients

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Abstract

The most common kind of infection acquired in hospitals is a bacterial urinary tract infection. Additionally, they are to blame for the highest number of patient deaths, hospital stays, and total medical care expenses. Several studies have reported varying degrees of prevalence for Escherichia coli. This study was designed to check the antimicrobial susceptibility pattern of Escherichia coli (E. coli) isolated from urinary tract infected patient. Urine samples were collected and cultured on CLED media to isolate E. coli. Antibiotic susceptibility testing was performed using the Kirby-Bauer disk diffusion method. A total 276 patients were included in this study. E. coli was the most prevalent isolate in both sexes that constitute 116 (42.02%) of total patients. The antimicrobial susceptibility pattern of E. coli against various antibiotics was observed as Fosfomycin showed the highest sensitivity (78.2%), followed by Amikacin (72.6%) and Imipenem (69.1%). In contrast, high resistance was observed with Ampicillin (94.4%), Ceftriaxone (93.5%), and Gentamycin (91.8%). In conclusion, this study offers crucial information about the patterns of antibiotic susceptibility of E. coli isolates from patients with urinary tract infections (UTIs). E. coli strains show resistance to widely used antibiotics, such as beta-lactams, quinolones, cephalosporins and aminoglycosides.

Keywords: Susceptibility pattern, E. coli, Urinary tract infection

Introduction

Urinary tract infections (UTIs) affect the kidneys, bladder, ureters, and urethra ooccurring both in the community and hospital settings. Bacteria are the main cause of UTIs, and E. coli is the most frequent offender. Women are the predominant group of patients with UTIs [1]. There are two types of UTIs: hospital acquired urinary tract infections (HAUTIs) and community acquired urinary tract infections (CAUTIs). In addition, the incidence of UTIs caused by multidrug resistance (MDR) is increasing, resulting in a significant increase in the spread of antibiotic resistance and the economic burden of these infection [2]. The most prevalent kinds of UTIs are lower ones such as urethritis (urethra infection) and cystitis (urinary bladder infection). More

dangerous upper urinary tract infections (UTIs) include pyelonephritis (kidney infection), which can manifest as fever, back pain, and nausea [3]. Globally, E. coli is the leading cause of urinary tract infections (UTIs), accounting for approximately 80-90% of community acquired cases [4]. The prevalence of E. coli as the primary UTI pathogen is consistent across different regions, with significant variations in antimicrobial resistance patterns [5]. In Pakistan, E. coli is the causative agent of urinary tract infections (UTIs), accounting for 44.24% to 47.7% of UTI cases [6]. Main routes of transmission of E. coli are faecal oral route, sexual activity, catheterization [7], inadequate hygiene and urinary tract abnormalities [8]. E. coli induced UTI is a dynamic and complex process that includes bacterial persistence, invasion, adherence, and immune evasion inside the urinary tract [9]. Diagnosing UTIs is based on assessing the patient's urinary symptoms and detecting pyuria and bacteriuria using urine culture [10]. Clinicians may use other antibiotics like meropenem or amikacin when dealing with multidrug-resistant E. coli strains [11]. Proper hydration and pain management with analgesics like phenazopyridine are advised to reduce symptoms during treatment [12]. This research aids in exploring the multidrug-resistant bacteria in hospital or community settings.

Materials and Methods

This cross-sectional study was conducted for four months at Chaudhary Muhammad Akram Teaching and Research Hospital in Lahore. A total of 276 patients with confirmed diagnosis of UTI were considered for this study. Urine samples were collected from each patient in sterile urine container. These samples were used to perform culture and sensitivity testing. Medium sized round colonies were appeared with smooth edges and pink color on MacConkey agar. The Gram staining helped in the identification of bacterial classification and guide further testing for antibiotics or other treatments. As, E. coli is a gram-negative bacterium so, it was identified on gram staining appearing purple color. In Indole testing, a pink, red or pink color layer developed at the top of the broth after addition of Kovac's reagent, which indicated the test is positive and E. coli was present in the sample. In TSI Testing, Lactose fermenter E. coli fermented glucose or other sugars in the medium and no H2S produced. This is consistent with E. coli, which is a lactose fermenting, indole-positive bacterium. Antibiotic susceptibility testing was performed using the Kirby-Bauer disk diffusion method to determine antibiotic resistance pattern of E. coli isolates.

Results

Statistical data analysis was performed using IMB SPSS Statistics version 23. The demographic analysis of the study population, which included 276 patients, revealed that the majority were from age group of 21 to 40 (40.58%). Gender distribution highlighted a significant majority of females (74.2%) as compared to males (28.8%). A majority (54.2%) came from the OPD, followed by wards (37.8%) and ICU (8.0%) as mentioned in Table 1.

Table 1: Sociodemographic Data of patients

Sr. No.	Gender	Number	Percentage
1	Female	205	74.3 %
2	Male	71	25.7 %
		276	100.0 %
	Age distribution		
1	0 – 20 Years	61	22.10 %
2	21 – 40 Years	112	40.58 %
3	41 – 60 Years	103	37.32 %
		276	100.0 %
	Department		

1	OPD	149	54.2 %
2	Wards	104	37.8 %
3	ICU	22	8.0 %
		276	100.0 %

E. coli, the most common causative agent of UTI was found in 116 (42.02%) patients, followed by Candida 37 (13.40%), Staphylococcus saprophyticus 33 (11.95%) Proteus spp**.** 30 (10.87%), Enterococcus spp. 26 (9.42%), Pseudomonas aeruginosa 17 (6.16%) and Klebsiella spp. 15 (5.43%) as mentioned in Table 2.

Table 2: Percentage of Organism Isolated from Collected Samples

Sr. No.	Organism	Number	Percentage
1	E. coli	116	42.02 %
2	Candida	37	13.40 %
3	Staphylococcus saprophyticus	33	11.95%
4	Proteus spp.	30	10.87 %
5	Enterococcus spp.	26	9.42 %
6	Pseudomonas aeruginosa	17	6.16 %
7	Klebsiella spp.	15	5.43 %
		276	100.0 %

The antimicrobial susceptibility pattern of E. coli against various antibiotics. Fosfomycin showed the highest sensitivity (78.2%), followed by Amikacin (72.6%) and Imipenem (69.1%). In contrast, high resistance was observed with Ampicillin (94.4%), Ceftriaxone (93.5%), and Gentamycin (91.8%). This suggests that E. coli shows better response to Fosfomycin and carbapenems as compared to aminopenicillins and cephalosporins as mentioned in Table 3.

Table 3: Antimicrobial susceptibility pattern of E. coli

Sr. No.	Antimicrobials		Code	Antimicrobial Susceptibility Pattern		
				S	I	R
1	Aminoglycosides	Amikacin	AK	72.6%	3.0%	24.4%
2	Aminoglycosides	Gentamycin	CN	8.2%	-	91.8%
3	Aminopenicillins	Ampicillin	AMP	5.6%	-	94.4%
4	Carbapenems	Imipenem	IMP	69.1%	-	30.9%
5	Carbapenems	Meropenem	MEM	68.4%	-	31.6%
6	Cephalosporins	Ceftriaxone	CFN	6.5%	-	93.5%
7	Cephalosporins	Cefixime	CFX	9.4%	-	90.6%
8	Fluoroquinolones	Levofloxacin	LEV	29.6%	2.1%	68.3%
9	Fluoroquinolones	Ciprofloxacin	CIP	44.1%	3.3%	52.6%
10	Misc Agent	Fosfomycin	FOS	78.2%	4.2%	17.6%

Discussion:

E. coli, the main causative agent of urinary tract infections (UTIs) is among the most common bacterial illnesses in the world. It is essential to comprehend its patterns of antibiotic susceptibility to treat the bacterium effectively and deal with the problems brought on by rising antimicrobial resistance (AMR). Notably, Amikacin had the highest sensitivity (77.6%) which is in line with

earlier results as mentioned in literature. Fosfomycin maintained a high efficacy of 78.2%, supporting the previous findings.

Gentamicin demonstrated remarkably low sensitivity (8.2%) which was much lower than earlier studies (30–50%) and suggested a reduction in efficacy that was probably caused by rising resistance. Similar to previous studies that reported reduced efficiency (<15%), ampicillin (5.6%) and ceftriaxone (6.5%) showed low susceptibility, highlighting the widespread resistance to these beta-lactam antibiotics.

The increasing antibiotic resistance in E. coli is caused by a number of causes. Antibiotic overuse and abuse in agriculture and human medicine are major causes of resistance. The selection of resistant bacteria may be aided by the improper use of broad-spectrum antibiotics, such as the empirical treatment of viral infections with antibiotics or insufficient therapy regimens [13]. The likelihood of resistance emerging in hospitals is increased by the widespread use of broad-spectrum antibiotics and the frequent use of invasive devices such as catheters [14].

Conclusion

This study offers crucial information about antibiotic susceptibility pattern of E. coli isolates from patients with urinary tract infections (UTIs). E. coli strain showed resistance to widely used antibiotics, such as beta-lactams, quinolones, cephalosporins and aminoglycosides. The findings highlight how crucial local susceptibility information is in directing the empirical management of UTIs. When choosing antibiotics, physicians must utilize an evidence-based strategy to make sure the best treatment is administered because resistance tendencies vary by region.

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