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PREVALENCE OF ANTIMICROBIAL RESISTANT ESCHERICHIA COLI IN PATIENTS WITH SUSPECTED URINARY TRACT INFECTION IN A TERTIARY CARE HOSPITAL, RIMS, RANCHI

Microbiology

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ABSTRACT

Background: Urinary tract infection (UTI) remains to be one of the most common infectious diseases diagnosed in developing countries. Widespread use of antibiotics against uropathogens has led to the emergence of antibiotic resistant species. A retrospective study was conducted in Rajendra Institute of Medical Sciences (RIMS), Ranchi, to determine the prevalence and the resistance pattern of the main bacteria responsible for UTIs Escherichia coli (E.coli). **Materials and Methods:** This retrospective study was conducted over the period of one year from 1st June 2019–1st June2020 in Microbiology laboratory of Rajendra Institute of Medical Sciences (RIMS), Ranchi to find the prevalence of antimicrobial resistant Escherichia coli in UTI isolates .Clean catch mid-stream urine samples were collected ,from all suspected UTI patients, using sterile screw capped container. The urine samples were cultured and processed for subsequent isolation. **Results:** The overall urine culture done in 12 months were 1880, out of which growth was seen in 1080 cultures, in which Escherichia coli was isolated from 518 samples(47.96%). Of the 518 isolates of E.coli 65.2% (338/518) were ESBL producing E.coli and 34.7% (180/518) were non-ESBL producing E.coli. ESBL producing E.coli was highly susceptible to nitrofurantoin (100%) and fosfomycin (100%). **Conclusion:** Increasing antibiotic resistance and appearance of multi-drug resistant (MDR) pathogens in the course of UTI is due to inadequate empirical antibiotic therapies prescribed without the antibiotic susceptibility testing, resulting in an ineffective UTI treatment (Adamus-Białek 2018). Our study emphasizes the need of antibiotic susceptibility testing to be performed routinely before prescribing antibiotics for UTI.

KEYWORDS

Antibiotic sensitivity test, Prevalence, Urinary tract infection (UTI), Extended-Spectrum Beta-Lactamase (ESBL).

INTRODUCTION

Urinary tract infection remains to be one of the most common infectious diseases diagnosed in outpatients [1]. It is most often caused due to bacteria, but may also include fungal and viral infections [2]. The most frequent isolated uropathogen is Escherichia coli, accounting for 65%–90% of urinary tract infections [3, 4]. Usually these infections are treated with a variety of antibiotics, including β-lactams, β-lactam/β-lactamase inhibitory, flouroquinolones, and carbapenems [5, 6]. However, in recent times these pathogens have increasingly become resistant to most of these antibiotics [5, 6]. Multidrug resistance of these isolates is frequently associated with the presence of extended-spectrum β-lactamase (ESBL) genes [7, 8]. Extended spectrum β-lactamase (ESBL) is an enzyme produced by Gram-negative bacilli responsible for the increasing resistances worldwide [9].The enzyme is responsible for resistance of amino and ureido penicillin, oxyimino cephalosporin, and monobactams, but not to 7-α-substituted β-lactam [10, 11]. Multidrug resistant E. coli makes it more difficult to decide the antibiotic treatment in UTI, increasing the risk of treatment failure. Early initiation of appropriate empirical therapy reduces mortality, especially in life-threatening UTIs [12]. Therefore, a better understanding of UTIs caused by antimicrobial resistant E.coli will guide clinicians in choosing appropriate empirical therapy. For this reason, we aimed to determine the prevalence of antimicrobial resistant Escherichia coli in patients with suspected urinary tract infection in our set up in RIMS, Ranchi.

Materials and methods

From June 2019 to June 2020, 518 E.coli isolates from urine cultures were included in the study. All specimens were inoculated on Cystine-Lactose-Electrolyte-Deficient agar (CLED).Using a calibrated loop of 4 mm diameter, 10 μl of the uncentrifuged urine was streaked onto the agar plate and incubated at 37°C aerobically for 24 h. Cultures were defined positive when the bacterial growth was $\geq 10^5$ colony forming units (CFU)/mL [ICMR; 2019]. The isolates were first identified as E.coli by standard biochemical techniques [ICMR; 2019], and then subjected to susceptibility testing by modified Kirby Bauer's disc diffusion method on Mueller Hinton agar plates. ESBL-producing *E. coli* were first screened for ESBL production by the phenotypic method and then was confirmed by the phenotypic confirmatory test as per Clinical and Laboratory Standards Institute (CLSI) guidelines 2014 [13].Antibiotics used for antibiotic susceptibility testing were amikacin, ciprofloxacin, gentamicin, imipenem, levofloxacin, nitrofurantoin, piperacillin/tazobactam, trimethoprim/sulfamethoxazole, cefoperazone/sulbactam. After overnight incubation of the Mueller–Hinton agar plate with antimicrobial discs at 37°C, the zone of inhibition was measured by using a ruler and interpreted by comparing the Kirby–Bauer chart. Control strain *(Escherichia coli* ATCC 25922) was used to monitor quality of antibiotic discs during antimicrobial susceptibility testing and during ESBL detection methods.

RESULTS

The overall urine culture done in 12 months were 1880, out of which growth was seen in 1080 cultures, in which Escherichia coli was isolated from 518 samples(47.96%). Of the 518 isolates of E.coli 65.2% (338/518) were ESBL producing. All isolates of ESBL-producing E.coli showed maximum resistance to ciprofloxacin and levofloxacin as described in [Table1]. However, it was found that 100% ESBL-producing E.coli isolates were sensitive to, nitrofurantoin and fosfomycin. No single antibiotic showed 100% resistance to all ESBL producing E.coli isolates. These findings suggest that nitrofurantoin and fosfomycin as the most active antimicrobial agent (among 10 antibiotics) against all the ESBL-producing E.coli isolated from urine. Moreover, the antimicrobial susceptibility pattern of all non-ESBL-producing E.coli isolates (34.7%) was as shown in [Table2].

Table1. Antimicrobial susceptibility patterns of ESBL-producing E. coli isolates from urine samples of patients with urinary tract infection

Antibiotics	ESBL producer n= 338			
	Resistance		Sensitive	
	No.	%	No.	%
Piperacillin+Tazobactum	262	77.5%	76	22.5%
Imipenem	203	60%	135	40%
Amikacin	199	58.75%	139	41.25%
Gentamycin	241	71.25%	97	28.75%
Ciprofloxacine	317	93.75%	21	6.25%
Levofloxacine	317	93.75%	21	6.25%
Nitrofurantoine	0	0%	338	100%
Trimethoprime+Sulphamethoxazole	211	62.5%	127	37.5%
Cefoperazone+Sulbactam	292	86.25%	46	13.75%
Fosfomycin	0	0%	338	100%

Table2. Antimicrobial susceptibility patterns of non-ESBL-producing E. coli isolates from urine samples of patients with urinary tract infection.

Antibiotics	Non-ESBL producer (n= 180)	
	Resistant	Sensitive
	%	%

Piperacillin+Tazobactum	50%	50%
Imipenem	50%	50%
Amikacin	45%	55%
Gentamycin	55%	45%
Ciprofloxacine	80%	20%
Levofloxacine	80%	20%
Nitrofurantoine	0%	100%
Trimethoprime+Sulphamethoxazole	35%	65%
Fosfomycin	0%	100%
Cefoperazone+Sulbactam	75%	25%

DISCUSSION

The present study showed that E.coli was responsible for 47.96 % of UTI. This result was consistent with the findings of a study Nazdar [14]. Moreover, a similar result was reported in Hilla reporting that Escherichia coli formed the major causative agent (49%) in children with UTI [15]. Our study showed 65.2% ESBL-producing E.coli in urine. Similar results were reported by a study [16] in Iraq, who reported around 65% of ESBL-producing E.coli. On the contrary, a study conducted by Aka [17] in Erbil city showed lower prevalence rate of ESBL-producing E. coli isolates in urine. In the present study, the most effective antibiotic against ESBL-producing E coli isolates was nitrofurantoine(100%) and fosfomycin followed by imipenem (40%). These results were opposite to that in Alsamarai [18] study which reported that among the most effective antimicrobial agent was imipenem. Alarming resistance to ciprofloxacin (93.75%) and levofloxacin (93.75%) followed by trimethoprim-sulfamethazole (62.5%) was found in our study. Similar results were obtained from other investigators [19]. Thus, susceptibility to antibiotics is changing worldwide. The main reason for this trend is the increase in antibiotic consumption, abuse of board spectrum antibiotics or self-medication [20].

CONCLUSION

The increase of antibiotic resistance and appearance of multi-drug resistant (MDR) pathogens in the course of UTI is related to high rates of inadequate antibiotic empirical therapies prescribed without the antibiotic susceptibility testing, resulting in an ineffective UTI treatment (Adamus-Białek 2018). Our study results may help physicians select appropriate antimicrobial therapy in patients suspected of having urinary tract infections caused by ESBL-producing E.coli

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