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STUDY ON ANTIMICROBIAL RESISTANT PATTERN AGAINST ESCHERICHIA COLI ORGANISM IN PATIENTS SUSPECTED OF URINARY TRACT INFECTION ATTENDING A TERTIARY CARE HOSPITAL IN JHARKHAND.

Medical Microbiology

Bhuvan Shome* Senior Resident, Department of Microbiology, RIMS, Ranchi.*Corresponding Author
Soofia Firdaus Resident, Department of Microbiology, RIMS, Ranchi.
Binita Biswas Resident, Department of Microbiology, RIMS, Ranchi

ABSTRACT

Background: Urinary tract infections (UTIs) are among the most common bacterial infections in humans. Their frequency varies with age, gender and socioeconomic background. Overuse of antibiotics against uropathogens has caused emergence of resistance against various species. We have conducted a retrospective study in Rajendra Institute of Medical Sciences (RIMS), Ranchi, to determine the resistance pattern of the most common bacteria responsible for UTIs- Escherichia coli (E.coli). **Materials and Method:** Study was conducted over the period of six months from 1st January 2021–30th June 2021 in bacteriology enteric laboratory of Rajendra Institute of Medical Sciences (RIMS), Ranchi in department of Microbiology to know the prevalence of antimicrobial resistant pattern in Escherichia coli isolates causing UTI. Clean catch of mid-stream urine samples were collected from all suspected UTI patients on a wide mouthed sterile screw capped universal container. The urine samples were cultured and processed for subsequent isolation followed by antibiotic susceptibility tests by Kirby Bauer disc diffusion method as per CLSI 2021 guidelines. **Results:** 894 urine samples were collected during this period for culture, out of which only 532 samples have shown growth, in which Escherichia coli were isolated from only 189 samples (35.52%). 59.25% of E.coli i.e.(112/189) were ESBL producing and 40.74% of E.coli (77/189) were non-ESBL producing. **Conclusion:** Alteration in antibiotic resistance pattern with emergence of multi-drug resistant Escherichia coli causing UTI is due to inappropriate antibiotics advised without the antibiotic susceptibility testing performed prior to its administration, causing ineffective treatment of UTIs. Present study encourages the use of antibiotic susceptibility testing to be performed routinely before prescribing proper antibiotics against most common pathogen Escherichia coli causing urinary tract infections.

KEYWORDS

Escherichia coli, urinary tract infections, antibiotic susceptibility test, ESBL.

Introduction:

Urinary tract infection (UTI) is one of the most common bacterial infections in the community with a high rate of morbidity and huge financial costs. It has been estimated that about more than 150 million people were infected with UTI every year throughout the world costing global economy of more than 6 billion US dollar [1]. UTIs is called as bacteriuria with urinary tract symptoms. UTI can affect both lower and upper urinary tracts. Cystitis is defined as lower urinary tract infection and is associated with symptoms such as dysuria, frequency, urgency, fever and sometimes suprapubic tenderness [2]. E. coli, E. faecalis, K. pneumoniae, P.aeruginosa, S. saprophyticus, S. aureus and Proteus mirabilis are the common bacteria's causing UTIs in human beings and E. coli is the commonest bacteria causing UTIs constituting approximately 85% of all cases [3]. The rapid rise in extended-spectrum beta-lactamases organisms has jeopardize the use of cephalosporins and ciprofloxacin [4, 5]. It is suggested by experts that rate of resistance against antibiotics should be less than 20% for initiating any empirical therapy, which reduces the increasing rate of drug resistance [6]. This recommendation is given by the French society of infectious diseases in their guidelines, for 20%in case of uncomplicated lower UTIs and 10% for acute renal infections, UTIs in male, lower UTIs during pregnancy, and other UTIs which could lead to complication [7]. For this reason a brief knowledge about the antibiogram for organisms causing UTIs in the respected geographic area is must in order to initiate empirical therapy [8].

Materials and methods:

The study was conducted retrospectively over a period of six months, starting from 1st of January 2021 to 30th of June 2021, during which 894 mid stream urine samples were collected aseptically. Urine specimens were examined macroscopically for the color and turbidity. All samples were screened by direct microscopy followed by culture inoculation and Gram's staining. In direct microscopy focus was on number of pus cell per high power field and if any bacteria could be seen with or without motility. Gram staining further supports the preceded findings. The uncentrifuged specimens were subsequently inoculated on Cystine Lactose Electrolyte Deficient agar (CLED) by streak culture method using a calibrated loop of 4 mm diameter with volume of 10 µl and incubated at 37 degree Celsius aerobically for overnight duration. Bacterial growth of ≥105 colony forming units (CFU)/mL were considered significant [9]. E.coli were identified following Gram's staining from overnight growths, biochemical tests like positive for sugar fermentations with gas production, indol positive, catalase positive and MR positive with negative for citrate, urease and VP. Following identification, antimicrobial susceptibility tests were done by modified Kirby Bauer's disc diffusion method on Mueller Hinton agar plates. ESBL producing E. coli were screened and confirmed by the phenotypic methods- double-disk synergy test [10]. Antibiotics used were amikacin, ciprofloxacin, gentamicin, imipenem, levofloxacin, nitrofurantoin, fosfamycin, piperacillin/tazobactam, trimethoprim/ sulfamethoxazole, cefoperazone/sulbactam, cefotaxime and ceftazidime. Following overnight incubation at 37°C, the zone of inhibitions was recorded and interpreted as per CLSI guidelines 2021. Control strain (Escherichia coli ATCC 25922) was used to compare the quality of antibiotic discs.

Results:

894 urine cultures were done over a period of six months, out of which growth occurred in 532 samples, among these Escherichia coli was isolated from189 samples (35.52%). ESBL production were seen in 112 (59.25%) isolated E.coli. ESBLproducing E.coli showed maximum resistance against ciprofloxacin, levofloxacin, cefotaxime and ceftazidime. All the ESBL-producing isolates were sensitive to, nitrofurantoin, fosfomycin, piperacillin/tazobactam and imipenem. Suggesting these antimicrobials are most active against the ESBLproducing E.coli isolated from urine. 77 (40.74%) isolates among 189 E.coli were non-ESBL producing strains.

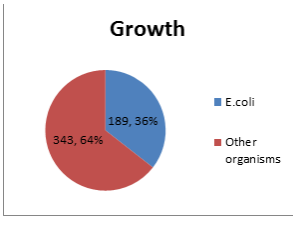

Chart-1: Chart showing E.coli growth among all the positive cultures.

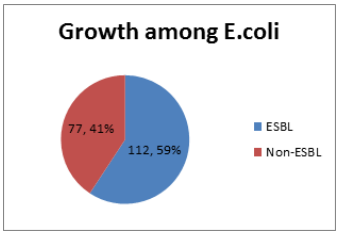

Chart-2: Chart showing percentage of ESBL & Non ESBL isolates

Table 1- Antimicrobial susceptibility patterns of ESBL producing E. coli isolates.

Antimicrobials	ESBL producing E.coli - 112	
	Resistan Percentage (%)	Sensitive Percentage (%)
Amikacin	55.6	44.4
Ciprofloxacin	92	08
Gentamicin	68.25	31.75
Levofloxacin	93.7	6.3
Nitrofurantoin	0.00	100
Fosfomycin	0.00	100
Piperacillin/tazobactam	10.3	89.7
Trimethoprim/ sulfamethoxazole	59.8	40.2
Cefoperazone/sulbactam	64.1	35.9
Cefotaxime	71.6	28.4
Ceftazidime	69.3	30.7
Imipenem	11.9	88.1

Table 2- Antimicrobial susceptibility patterns of Non-ESBL producing E. coli isolates.

Antimicrobials	Non-ESBL producing E.coli - 77	
	Resistance Percentage (%)	Sensitive Percentage (%)
Amikacin	43.3	56.7
Ciprofloxacin	82	18
Gentamicin	53.7	46.3
Levofloxacin	77.4	22.6
Nitrofurantoin	0.00	100
Fosfomycin	0.00	100
Piperacillin/tazobactam	10.1	89.9
Trimethoprim/ sulfamethoxazole	37.2	62.8
Cefoperazone/sulbactam	66.8	33.2
Cefotaxime	70.9	29.1
Ceftazidime	64.1	35.9
Imipenem	17.6	82.4

Discussion:

This conducted study has shown that E.coli was the causative agent for 35.5 % of UTI in overall significant growths. These findings were somehow similar to findings from tertiary care centre located in Puducherry, southern part India [11]. Moreover, relatable finds were reported from J N M C Hospital Aligarh, India that Escherichia coli formed the major causative agent for UTI [12]. In our study 59.25% were ESBL-producing E.coli, which is somehow lesser in percentage than a similar study conducted in a pediatric tertiary care hospital [13]. 65% of ESBL-producing E.coli was isolated in a study in northern India [14]. In another study which was conducted in in the Department of Microbiology, Kalinga Institute of Medical Sciences (KIMS), Bhubaneswar there was 61.1 % of isolated E.coli [15]. In the present study, the most effective antibiotic against ESBL-producing E coli isolates was nitrofurantoin (100%) and fosfomycin (100%) followed by pepracillin-tazobactum (89.7%) and Imipenem (88.1%). These findings were contrary to that in Alsamarai study which concluded that the most effective antimicrobial agent was imipenem [16]. There was increase in resistance against ciprofloxacin (92%), levofloxacin (93.7%), cefotaxime (71.6%) and ceftazidime (69.3%) was found in our study. Similar results were obtained from other investigators [17]. Hence, the susceptibility patterns against the antimicrobials are changing rapidly all around the globe and the most common reason behind this is overuse of antimicrobials, irrational use and self medications [18].

Conclusion:

The chief reason against the increase in antibiotic resistance against pathogens in the course of UTI is due to surge in habit of inappropriate antibiotic therapies prescribed to the patient without doing antibiotic susceptibility testing, leading to ineffective UTI treatment. Present study may help clinicians to appropriately select antimicrobial for patients suspected of having urinary tract infections caused by ESBL producing E.coli and against Non ESBL producing ones.

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