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ORIGINAL RESEARCH ARTICLE

ANTIMICROBIAL SUSCEPTIBILITY PATTERNS OF ESCHERICHIA COLI FROM VARIOUS CLINICAL SOURCES

R Gautam, M L Chapagain, A Acharya, N Rayamajhi, S Shrestha, S Ansari, G Upadhaya and HP Nepal *

Department of Microbiology, Chitwan Medical College, Bharatpur-10, Chitwan, Nepal.

***Correspondence to :** *Dr Hari Prasad Nepal, Department of Microbiology, Chitwan Medical College, Email: drharinepal@gmail.com*

ABSTRACT

Escherichia coli is the major organism causing the urinary tract infection, wound infection and respiratory tract infection. A total of 2376 samples of urine, wound swab and sputum were analyzed for identification of bacterial isolates and their antimicrobial susceptibility pattern. Escherichia coli (E. coli) was isolated from 357 [15%] samples. Majority of the E.coli, 307 [85.9%], were obtained from the urine samples, followed by wound swab [8.4%] and sputum [5.6%]. High degree of resistance was observed for nalidixic acid [92.8%] followed by ceftriaxone [65.7%] and cotrimoxazole [64.6%]. The isolates were highly sensitive to imipenem (100%) followed by nitrofurantoin [90.3%] and amikacin [82.1%].

Key Words: *Antimicrobial susceptibility & Escherichia coli.*

INTRODUCTION

Escherichia coli, commonly abbreviated as E. coli, is a common inhabitant of the human and animal gut, but can also be found in water, soil and vegetation. It is the leading pathogen causing urinary tract infections [1, 2, 3] and is among the most common pathogens causing blood stream infections, [4] wounds, otitis media and other complications in humans.[5, 6] E. coli is also the most common cause of food and water-borne human diarrhea worldwide and in developing countries, causing many deaths in children under the age of five years.[7]

Antimicrobial resistance in E. coli has been reported worldwide and increasing rates of resistance among E. coli is a growing concern in both developed and developing countries. [8,9] A rise in bacterial resistance to antibiotics complicates treatment of infections. In general, upto 95% of cases with severe symptoms are treated without bacteriological investigation. [10] Occurrence and susceptibility profiles of E. coli show substantial geographic variations as well as significant differences in various populations and environments. [11] Routine monitoring of antibiotic resistance provides data for antibiotic therapy and resistance control. Thus, in this study, we aimed to determine antimicrobial susceptibility of E. coli from various clinical sources at Chitwan Medical College Teaching Hospital, Bharatpur, Chitwan, Nepal.

MATERIALS AND METHODS

A retrospective study was done on results of culture and antimicrobial susceptibility of isolates from urine, wound swab, and sputum samples obtained from July 2012 to December 2012 at Chitwan Medical College Teaching Hospital, Bharatpur, Chitwan, Nepal. Patients were identified and data were extracted using the hospital information and support system.

Culture and identification

The specimens were collected aseptically in sterile containers following standard operating procedures. Clean-catch midstream morning urine specimens were collected using sterile wide-mouth glass containers. Urine samples were plated onto cystine lactose electrolyte-deficient (CLED) medium, MacConkey agar and, blood agar (HiMedia Laboratories Pvt. Limited, India) using calibrated wire loops and then incubated aerobically at 37ºC for 24 hour. From positive cultures, uropathogens were identified as per the standard microbiological methods. [12] A significant bacteriuria was considered if urine culture yielded $>10^5$ colony forming unit (CFU)/ml of urine.

Pus from wound was collected using sterile cotton swabs. Sputum samples were collected in the sterile, wide-mouth containers. Specimens were inoculated onto blood agar, chocolate agar and MacConkey agar plates (HiMedia, India). The plates were incubated at 37ºC aerobically and examined after 24 and 48 hours.

Microscopic examination

The colonies obtained from blood agar or Mac Conkey's agar plates were subjected to Gram staining and observation was noted.

Sensitivity test

Susceptibility to various antimicrobial agents was tested by the disk diffusion technique following guidelines of Clinical and Laboratory Standards Institute (CLSI). [13] The antibiotic

disks tested were amikacin, cefexime, cefotaxime, ceftriaxone, cotrimoxazole, gentamicin, imipenem, levofloxacin, nalidixic acid and nitrofurantoin. Nitrofurantoin was tested only for urinary isolates. After incubation at 37°C for 24 hour, diameter of the zone of inhibition was measured to the nearest millimeter and isolates were classified as susceptible, intermediate, or resistant according to CLSI-specified interpretive criteria. [13]

RESULTS

A total of 2376 samples were analyzed for isolation and identification of bacteria and antimicrobial susceptibility testing. E coli was isolated from 357 [15%] samples. The highest number of isolates [85.9%] were obtained from the urine samples followed by wound swab [8.4%] and sputum [5.6%] [table -1].

Table 1: Distribution of specimens and culture positivity of E. coli

Sample	No. of samples tested	Positive for E. coli	Positive %
Urine	1864	307/357	85.9
Pus	285	30/357	8.4
Sputum	227	20/357	5.6
Total	2376	357/2376	15

The age of the patients ranged from 2 months to 90 years (table 2). E. coli was most common in the age group of 21-30 years followed by age group upto 10 years.

Table 2: Age and gender wise distribution of wound infection

Age group (years)	Male	Female	Total
Upto 10	9	36	45
11-20	9	27	36
21-30	9	75	84
31-40	3	24	27
41-50	6	30	36
51-60	12	27	39
61-70	15	27	42
71-80	24	12	36
81-90	9	3	12
Total	96 [26.7%]	261 [73.1%]	357 [100%]

The overall antimicrobial susceptibility pattern of E. coli isolates from various clinical sources is given in the table 3.

Table 3: Antimicrobial susceptibility pattern of E. coli isolates

Antimicrobial agents	Total No of isolates tested	Susceptible isolates		Resistant isolates	
		Total No.	%	Total No.	%
Amikacin	285	234	82.1	51	17.8
Cefexime	48	12	25	36	75
Cefotaxime	204	78	38.2	126	61.7
Ceftriaxone	333	114	34.2	219	65.7
Cotrimoxazole	339	120	35.3	219	64.6
Gentamicin	327	153	46.7	174	53.2
Imipenem	9	9	100	0	0
Levofloxacin	210	87	41.4	123	58.5
Nalidixic acid	210	15	7.1	195	92.8
Nitrofurantoin	279	252	90.3	27	9.6

DISCUSSION

The isolation rate of E. coli in the present study was 15% and it was commonly isolated from urine samples [85.9%]. These findings are in conformity with the reports by other researchers.[1,14]

Although E.coli is generally perceived as an 'antibiotic friendly' pathogen, resistance has increased over the past decade. [15] In this study, the overall resistance of E. coli to antimicrobial agents was high. Increasing irrational consumption rate of antibiotics, self medication due to over- the- counter availability of antibiotics, non-compliance with medication, sales of substandard drug, consumption of food from animals that have received antibiotics, and transmission of resistant isolates between people may account for the rise in antibiotic resistance. Among the various antibiotics tested, it showed highest rate of resistance to nalidixic acid [92.8%] followed by ceftriaxone [65.7%] and cotrimoxazole [64.6%]. Resistance seen in this study are slightly higher than the previous study conducted in this hospital in 2009 which showed 90% resistance to nalidixic acid, 57% to ceftriaxone and 55.8% to cotrimoxazole. [1] Therefore, increasing rate of resistance against these important antibiotics is being observed in E. coli in this region.

Fluoroquinolone or co-trimoxazole resistance by E. coli has been detected at a high rate in the Asia-Pacific region in recent years. [16,17,18] Moreover, some countries in Asia do not currently consider fluoroquinolone as a first line treatment for recurrent cystitis. [16,19] High rate of resistance (58.5%) has been detected in the present study for levofloxacin, one of the important members of fluoroquinolones. Consequently, in the setting of high resistance against fluroquinolone, new therapeutic options need to be sought.

In this study, E. coli exhibited 17.8% and 53.2% resistance to the commonly used amynoglycosides i.e amikacin and gentamicin respectively. As aminoglycosides are the antibiotics that can be used to treat serious hospital-acquired Gram-negative infections, resistance to these drugs is disconcerting because persistent infections may require treatment with newer, more expensive drugs of last resort.

Susceptibility to nitrofurantoin has remained practically unchanged since its introduction into clinical practice more than 50 years ago. [20] Since standard medication with nitrofurantoin does not achieve therapeutic concentrations in the bloodstream, its use is advised only for complicated cystitis. [20] Significantly high degree of sensitivity (90.3%) was observed in this study for nitrofurantoin, the finding being similar to the previous studies conducted in Nepal. [1,14]

Carbapenems (e.g, imipenem) are one of the antibiotics of last resort for many bacterial infections, such as E. coli and Klebsiella pneumoniae. [21] Recently, alarm has been raised over the spread of drug resistance to carbapenem antibiotics among these coliforms, due to production of the New Delhi metallo-β-lactamase, NDM-1. There are currently no new antibiotics in the pipeline to combat bacteria resistant to carbapenems, and worldwide spread of the resistance gene is considered a potential nightmare scenario. [22] Fortunately, we did not encounter any isolates resistant to imipenem in the present study. Thus, imipenem can be considered a reserved drug for treating infections which have failed to respond to other antibiotics.

CONCLUSION

E. coli remains common pathogen among patients with urinary tract infection, wound infection and respiratory tract infection. It exhibits high rate of resistance to the commonly used antibiotics. Therefore, we must adapt guidelines to recommend antibiotics and design a comprehensive control program to reduce the high levels of bacterial antibiotic resistance among our population.

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