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Extraintestinal Pathogenic Escherichia Coli (ExPEC): An Emerging but Less-Appreciated Health Threat

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ABSTRACT

Infections due to Extraintestinal pathogenic Escherichia coli (ExPEC) represent a major but little-appreciated health threat. This study was conducted in the department of Microbiology, of Guru Gobind Singh Hospital, Jamnagar from January 2012 to May 2012. A total of 100 E. coli isolates from various extraintestinal infections were studied for the antimicrobial sensitivity pattern. Out of these 100, 58 were isolated from urine, 29 were from pus, 5 from blood. The analysis of drug resistance pattern shows that maximum number (90.00%) were resistant to Cefotaxime and least (2.00%) were resistant to Gatifloxacin followed by (23.00%) to Chloramphenicol & (29.00%) to Amikacin. This study demonstrates that antimicrobial resistance is on a rise among E. coli strains that cause extra-intestinal infections. Therefore, the correct detection of antimicrobial resistance is important. Judicious use of the antibiotics and good antibiotic policy are needed to limit the emergence and spread resistance in bacteria.

Introduction

Escherichia coli (E. coli) is one of the commensals in the human intestinal tract. As a commensal, it contributes to the maintenance of the health of a person. However, E. coli, when enters into unnatural sites, can cause variety of infectious diseases such as urinary tract infections, wound infections, bacteraemia, meningitis & other soft tissue infections[1]. The ability of E. coli to cause extra intestinal infections depends largely on several virulence factors which help in the survival of E. coli under adverse conditions which are present at those sites. E. coli strains that induce extraintestinal diseases are termed as extraintestinal pathogenic E. coli (ExPEC) [2]. In terms of morbidity and mortality, ExPEC has a great impact on public health with an economic cost of several billion dollars annually [3]. Therefore, the treatment of E. coli infections is increasingly becoming difficult because of the multi-drug resistance exhibited by the organism. Extended spectrum β-lactamase (ESBL) producing organisms pose a major problem for clinical therapeutics [4]. The knowledge of the drug resistance pattern in a geographical area and the formulation of an appropriate hospital antibiotic policy will go a long way in the control of these infections. Therefore, it is necessary to know the antibiotic susceptibility pattern of pathogenic E. coli to select the correct antibiotic(s) for the proper treatment of the infections caused by it [5]. The objective of the present study was to demonstrate the spectrum of the infections which were caused by ExPEC and its drug resistance pattern.

Material and Methods

A total of 100 isolates of E. coli from extraintestinal infections obtained from January 2012 to May 2012, were included in the study. The study population included patients of all age groups hospitalised in Guru Gobindsinh Hospital, Jamnagar attached to M. P. Shah medical college. The specimens which were received by the Department of Microbiology were clean catch midstream urine, pus, blood, sputum and other body fluid from patients who were suffering from various extraintestinal samples. All the samples were inoculated on nutrient agar, Macconkey agar and blood agar. E. coli were identified by following characteristics: nutrient agar (large, smooth, opaque colonies), Macconkey agar (lactose fermenting, pink colonies), blood agar (large, grey, hemolytic colonies), gram stain morphology (gram negative bacilli), positive catalase test, negative oxidase test, IMViC test (++--), triple sugar iron test (acid slant and butt reaction with gas production). Antibiotic susceptibility was tested with the Kirby–Bauer disc diffusion method, according to the CLSI guidelines.

Antibiotic susceptibility testing

The antibiotic susceptibility pattern of all E. coli strains was determined by modified Kirby-Bauer disc diffusion method. Antimicrobial agents, shown in table-1 were tested by above mention method. All tests were performed on Muller-Hinton agar and incubated at 37ºC for 24 hrs. The diameter of zone of inhibition of a given strain around each disc was interpreted according to Clinical and Laboratory Standards Institute (CLSI) guidelines as sensitive(S), intermediate(I) and resistance(R). E. coli ATCC 25922 was used as a standard control strain.

Table 1: Antimicrobial agents used.

Antibiotics	Disc content	Zone diameter (In mm)		
		R	I	S
Ampicillin- sulbactum (AS)	20µg	≤11	12-14	≥15
Cefotaxime (CF)	30µg	≤14	15-22	≥23
Co-trimoxazole (BA)	25µg	≤10	11-15	≥16
Chloramphenicol (CH)	30µg	≤12	13-17	≥18
Ciprofloxacin (RC)	5µg	≤15	16-20	≥21
Ofloxacin (ZN)	5µg	≤12	13-15	≥16
Gentamicin (GM)	10µg	≤12	13-14	≥15
Amikacin (AK)	30µg	≤14	15-16	≥17
Gatifloxacin (GF)	10 µg	≤14	15-17	≥18

Results

Out of 688 culture positive samples, 100 E. coli were isolated. Therefore, isolation rate of E. coli from extra-intestinal samples was 14.53%.

Table 2: Distribution of E. coli from various extra-intestinal samples.

Name of sample	No. of E. coli isolated	%
Urine	58	58.00%
Pus	29	29.00%
Blood	05	5.00%
Sputum	02	2.00%
Ascitic fluid	02	2.00%
Drain fluid	02	2.00%
ET discharge	01	1.00%
Ear discharge	01	1.00%
Total	100	100%

Table 2 shows maximum clinical isolates of E. coli were isolated from urine 58(58.00%), followed by pus 29(29.00%), blood 5(5.00%), sputum, ascitic fluid and drain fluid 2(2.00%) each, and ET discharge and ear discharge 1(1.00%) each.

Table 3: Resistance pattern of E. coli isolates

Name of antibiotic	Resistance (%)
Ampicilln+sulbactum (AS)	83.00
Co-trimoxazole (BA)	62.00
Cefotaxime (CF)	90.00
Chloramphenicol (CH)	23.00
Ciprofloxacin (RC)	88.00
Ofloxacin (ZN)	80.00
Gentanicin (GM)	53.00
Amikacin (AK)	29.00
Gatifloxacin (GF)	2.00

Table 3 shows analysis of drug resistance pattern, that among 100 isolates of E. coli maximum number 90 (90.00%) were resistant to Cefotaxime and resistant was lowest to Gatifloxacin 2(2.00%) followed by Chloramphenicol 23(23.00%) & Amikacin 29(29.00%).

Among the isolates from urine, the maximum resistance was observed for Ciprofloxacin 54(93.10%), followed by Cefotaxime 51(87.93%), Ofloxacin 51(87.93%), Ampicillin-sulbactum 47(81.03%), Co-trimoxazole 35(60.34%), Gentamicin 27(46.55%), Amikacin 14(24.14%), Chloramphenicol 7(12.07%) and Gatifloxacin 1(0.72%). In isolates from pus, the maximum resistance was observed for Cefotaxime 27(93.11%), Ampicillin-sulbactum 26(89.66%), followed by Ciprofloxacin 24(83.76%), Ofloxacin 22(75.86%), Co-trimaxazole 20(68.97%), Gentamicin 19(65.52%), Chloramphenicol 11(37.93%), Amikacin 10(34.48%), and Gatifloxacin 00(0.00%). Among the blood isolates, maximum resistance was observed for Cefotaxime 5(100.00%), Ampicillin-sulbactum 5(100.00%), followed by Gentamicin 4(80.00%), Amikacin 4(80.00%), Chloramphenicol 3(60.00%), Ciprofloxacin 3(60.00%), Co-trimoxazole (40.00%), Ofloxacin 2(40.00%), and Gatifloxacin 1(80.00%).

Discussion

E. coli has widely been implicated in various clinical infections, namely hospital acquired and community infections, as reported by Shah et al [6]. Extraintestinal, pathogenic Escherichia coli (ExPEC) possesses virulence traits that allow it to invade, colonize, and induce diseases in bodily sites outside of the gastrointestinal tract [7] by overcoming the host defence mechanisms. E. coli is therefore able to cause a variety of infections such as urinary tract infections (UTIs), soft tissue infections, bacteraemias, respiratory tract infections, etc, as was seen in our study, with UTIs being the predominant type of infection (58.00%). This was similar to the findings of a study (66.70%), done by Asima banu et al [8]. In our study, the antibiotic susceptibility pattern was studied for all the isolates of E. coli. Resistance was observed to the commonly used antibiotics such as Cefotaxime, Ciprofloxacin, Ampicillin-sulbactum, Ofloxacin and Co-trimoxazole. A greater prevalence of the resistance to the common antibiotics has also been reported by other workers [9,10]. The presence of multidrug resistance may be related to the dissemination of antibiotic resistance among the hospital isolates of E. coli. Such multi drug resistance has serious implications for the empiric therapy of the infections which are caused by E. coli and for the possible co-selection of the antimicrobial resistance which is mediated by multi drug resistance plasmids [11].

Conclusion

The continued development of antimicrobial resistance among E. coli isolates is a threat and it requires both careful surveillance and new approaches to slow the emergence of resistance. The proper selection of antibiotics for the treatment depends on the antimicrobial resistance pattern of E. coli. Since antimicrobial resistant patterns are constantly evolving, and as this is a present global public health problem, there is a necessity for constant antimicrobial sensitivity surveillance. This will help the clinicians to provide safe and effective empiric therapies.

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