Original Article

Antibiotic Susceptibility Pattern of Clinical Isolates of Escherichia coli at a Tertiary Care Hospital

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Abstract

Infections due to multidrug resistant E.coli range from uncomplicated urinary tract infections to life-threatening sepsis. A retrospective study was conducted to determine the patterns of antimicrobial susceptibility in 173 (12.84%) Escherichia coli strains isolated from 1347 clinical specimens of different types. Isolation and identification of E.coli were done as per routine laboratory protocol directed by Cheesbrough[1]. The isolation rate of E.coli was 48.57% in stool followed by 17.68% in urine, 25% in wound swabs, and 15.38% in tracheal aspirate etc. Among the 173 isolates 102 (59%) were from males and 71 (41%) were from females. Patients were classified into five age groups: 0-15, 16-30, 31-45, 46-60 and >60 years. E.coli was found highest number in females (13.9%) of age range 31-45 years and in males (22%) belonged to age group of over 60 years. Antimicrobial susceptibility testing by the disk diffusion method was conducted for 22 different antibiotics. The majority of isolated E.coli were highly sensitive to Imipenem (98.18%), Meropenem (97.37%), Amikacin (91.67%), Amoxiclav (80%), Ceftazidime (73.33%), and Gentamycin (71.76%). The antibiotics Tobramycin and Azithromycin were found as moderately sensitive against E.coli with the susceptibility rate of 52.5% and 50% respectively. The isolates show low degree of susceptibility to Penicillin G (9.52%), Carbenicillin (10%), Erythromycin (19.48%), Amoxycillin (19.59%), and Ampicillin (25%). These findings have clinical and epidemiological significance and provide a benchmark for future studies on the pattern of susceptibility of clinical isolates of E.coli in this region as well as may help the clinician to prescribe the right empirical treatment.

Key Words: *E.coli, Antibiotics, Prevalence, Susceptibility, Clinical isolate.*

Introduction

Escherichia coli is the leading pathogen causing urinary tract infections accounting for 75 to 90% of uncomplicated UTI isolates[2,3] and is among the most common pathogens causing bacteremia[4,5] food and water-borne diarrhea[6,7] wounds, neonatal meningitis[8] otitis media[9] and other complications in humans. According to a report published by World Health Organization, one serotype of *E.coli* (ETEC) alone caused approximately 380,000 deaths annually in children less than 5 years of age[10].

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E.coli is a Gram-negative, rod-shaped, motile, facultative anaerobic, oxidase negative bacteria under the family Enterobacteriaceae[11]. Although the bacterium is the normal flora of the human and animal gastrointestinal tract, but can also be found freely in environment like soil, water, and vegetation and can pose potential health threat.

Antibiotics are among the most frequently used drugs to control *E.coli* infections in health settings. The rampant use of antibiotics is a major factor contributing to high level antibiotic resistance due to the selection and expression of antibiotic resistance genes in bacterial populations[12]. A number of researches have reported that multidrug resistance organisms pose a major problem for clinical therapeutics and improper empiric therapy has been linked to elevated morbidity and mortality[13,14]. In Bangladesh, multi drug resistant (MDR) *E. coli* emerges alarmingly and poses a greater challenge in the cost of treatment, morbidity and mortality[15,16].

The use of antibiograms to assist clinician in choosing appropriate empiric antibiotic therapy for suspected or known pathogen is a well-established practice. Antibiotic resistance has been associated with lengthening of hospital stay, increased mortality, and higher health care costs[17]. Although a large number of studies across the world have been showed the isolation rates and antibiotic susceptibility pattern of clinical isolates of *E.coli*, very little data are available regarding this in Bangladesh particularly in the region and thus crucial to be studied extensively. The findings of our study help clinician to choose appropriate antimicrobial therapy against the prevalence of the *E.coli* associated infections in this area.

Material & methods

The present retrospective study was carried out in the Microbiology Laboratory Service Department of Khwaja Yunus Ali Medical College & Hospital, Sirajgonj. The hospital is catering patients mostly from North-Bengal areas of Bangladesh. The study includes clinical isolates of Escherichia coli by reviewing the registrar of the Hospital's Microbiology Lab which contains detail record of culture and sensitivity test of different clinical samples. All the samples were obtained for culture and sensitivity tests from both inpatient and outpatient departments during the period of January 2013 to December 2013. Samples included were urine, pus/ wound swabs, blood, stool, respiratory secretions (tracheal aspirate/ throat swabs/ sputum), catheter tip, bile, peritoneal fluid etc. The clinical isolates were identified on the basis of their morphological behavior on various differential media. All media were prepared according to the manufacturer's specification and sterilized at 121^0C for 15 minutes at 15 lb pressure. Further identification was then carried out by following standard microbiological methods as described by Cheesbrough[18] and Cowan[19].

Isolates showed significant colony count were put into antibiotic susceptibility test by Kirby-Bauer Disc Diffusion Technique. Muller Hinton agar was used and sensitivity test was accomplished as per recommendation of Clinical and Laboratory Standards Institute (CLSI)[20,21]. The antibiotic discs used for the susceptibility testing of the isolates were Ampicillin, Amoxycillin, Amoxiclav, Amikacin, Azithromycin, Cephradine, Cefixime, Cefuroxime, Ceftazidime, Ciprofloxacin, Gentamicin, Ceftriaxone, Carbenicillin, Doxicycline, Erythromycin, Imipenem, Levofloxacin, Meropenem, Penicillin G, Piperacillin, Cotrimoxazole, and Tobramycin. Isolates with intermediate susceptibility were considered resistant as these isolates are non-susciptible. Data analysis was performed using the SPSS windows version 23.0 software.

Results

A total of 173 *E.coli* strains were isolated from 1347 clinical specimens. Samples were mainly taken from the urine (656 samples).

Table 1. Distribution of Escherichia coli from different isolation sites:

Name of specimens	No. of specimens	No. of *E.coli* positive specimens	Prevalence (%)	Overall prevalence
Urine	656	116	17.68	12.84 %
Pus	149	14	9.40	
Blood	266	5	1.88	
Tracheal aspirate	65	10	15.38	
Throat swabs	44	1	2.27	
Stool	35	17	48.57	
Catheter tip	21	2	9.52	
Wound swabs	20	5	25.00	
Ear swabs	7	0	0.00	
Nipple discharge	6	0	0.00	
Sputum	25	1	4.00	
Bile	2	1	50.00	
CV line catheter tip	5	0	0.00	
Oral swabs	3	0	0.00	
Peritoneal fluid	11	1	9.09	
CSF	11	0	0.00	
High vagina swabs	1	0	0.00	
Pericardial fluid	2	0	0.00	
EVD Drain Tube	1	0	0.00	
Suction air	1	0	0.00	
Vaginal swabs	1	0	0.00	
Pleural fluid	6	0	0.00	
Urethral swabs	3	0	0.00	
Skin swabs	2	0	0.00	
Nasal swabs	3	0	0.00	
Suction tip	1	0	0.00	
Total	1347	173	12.84	

The second most common cultured biological material was blood (266 samples) followed by pus (149), tracheal aspirate (65), throat swabs (44) and so on. The overall prevalence of *E.coli* in all samples was recorded as 12.84%. The highest number of *E.coli* was recorded in the urine (116) followed by stool (17), pus (14) and tracheal aspirate (10) (Table 1). Patients of all age groups in both sexes were included in this study. The patients were categorized into five age groups, 0-15, 16-30, 31-45, 46-60 and >60 years. Table- 2 shows the distribution of positive isolates on the basis of their age groups and sexes.

Table 2. Distribution of 173 *E.coli* isolates among patients in different age groups and their relation to sex

Age Group in years	SEX		Total (173)	
	Female (n=71)	Male (n=102)	Frequency	Percent
0-15	2	5	7	4.0
16-30	14	10	24	13.9
31-45	24	18	42	24.3
46-60	22	31	53	30.6
>60	9	38	47	27.2

Our study shows, more male patients (59%) were suffered from *E.coli* related infections than were from female counterparts (41%) (Figure 1).

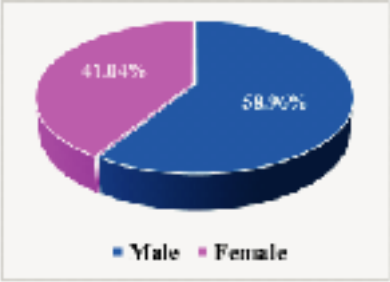

Figure 1: Occurrence of *E.coli* associated infections in males and females.

Considering age groups, the highest number of female patients (13.9%) with *E.coli* infections was found within the age group 31- 45 years while the highest number of male patients (22%) belonged to age group >60 years. Irrespective of sex, patients within the age range of 46-60 years were found as the more vulnerable group (31%) to *E.coli* infection (Figure 2).

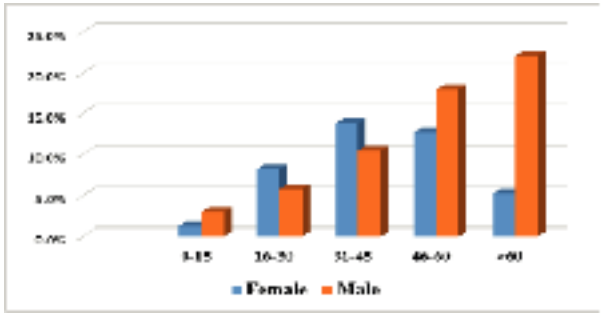

Figure 2: Distribution of *E.coli* isolates among males and females of different age group

The antimicrobial potency and spectrum of 22 selected antimicrobial agents (Oxoid, UK) against the *E.coli* isolates are summarized in table 3. The data showed a wide range of differences in the susceptibility pattern of the pathogen against the tested antibiotics. In our study, all *E.coli* isolates showed high sensitivity to Imipenem (98.18%), Meropenem (97.37%), Amikacin (91.67%), and Amoxiclav (80%), with good susceptibility to Ceftazidime (73.33%), Gentamycin (71.76%), and Tobramycin (52.5%) (Figure 3).

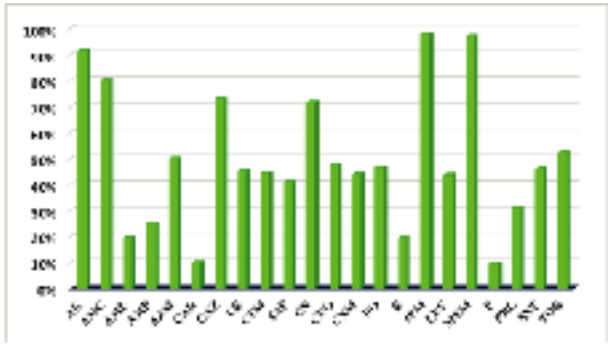

Figure 3: Pattern of antibiotic susceptibility (%) among all isolated clinical samples of *E.coli*

Antibiotics with average susceptibility against the clinical isolates of *E.coli* were observed Azithromycin (50%), Ceftriaxone (47.75%), Doxicyclin (46.75%), Cotrimoxazole (46.15%), Cephradin (45.38%), Cefixim (44.44%), Levofloxacin (43.75%), and Ciprofloxacin (41.07%). The isolates also showed high degree of

resistance to Penicillin G (9.52%), Carbenicillin (10%), Erythromycin (19.48%), Amoxycillin (19.59%), and Ampicillin (25%). The overall study showed that Penicillin G was the most resistant antibiotics followed by Carbenicillin and Erythromycin against *E.coli* (figure 4).

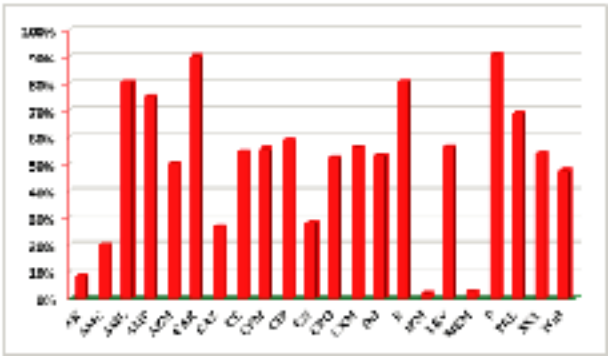

Figure 4: Pattern of antibiotic resistance (%) among all isolated clinical samples of *E.coli.*

Discussions

This paper describes the study undertaken to evaluate susceptibility patterns of clinical isolates of *E.coli* in Khwaja Yunus Ali Medical College Hospital with the collaboration of Department of Microbiology, Khwaja Yunus Ali University followed by other study[22]. The aim is to offer assistance to monitor the trend of bacterial resistance and further to improve treatment recommendations in a specific geographical region. This is a retrospective study where routine diagnostic results and susceptibility analysis are used. The isolation rate of *E.coli* in our study was 12.84 % and these records are consistent with findings reported by other researchers [23-26]. Our study showed that the prevalence of *E.coli* infection is high in adult women (31-45 years) and older men (>60 years) and the outcome is consistent with other study[27].

Antimicrobial susceptibility to *E.coli* has declined alarmingly worldwide and its resistance patterns show substantial amount of geographic variation as well as differences in population and location[28]. In all clinical specimens used in our study, *E.coli* showed high susceptibility rates of more than 90% to imipenem, Meropenem, and Amikacin and of more than 70% to Amoxiclav, Ceftazidime, and Gentamycin. The results of this study conform with the findings of other studies conducted in different parts of the world[29,30]. Our analysis in the pattern of resistance of *E.coli* to a variety of antibiotics suggests that Penicillin G, Carbenicillin, Erythromycin, Amoxycillin, and Ampicillin are antibiotics showed least susceptibility which is also comparable to susceptibility patterns reported from previous studies[31,32].

Several issues should be considered in judging our results and its potential implications. Firstly, our study was a single-center analysis, so our results may not be consistent or relevant to those of other institutions. Secondly, each of the 173 *E.coli* isolates were not tested against all the 22 antibiotics therefore, some minute variation may present in the results of susceptibility of the antibiotics.

Conclusion

Regular surveillance is required to provide better guidance about susceptibility pattern of clinical isolates of the organism to different antibiotics for optimal empirical therapy of patients with *E.coli* associated infections. Our study provides valuable laboratory data concerning isolation rate of *E.coli* infections from clinical specimen and susceptibility patterns to different antibiotics and enables the situation in the area to be compared with that in other areas of home and abroad. We recommend that empirical antibiotic therapy should be based on the knowledge of local prevalence of bacterial organisms and antibiotic susceptibilities rather than on universal guidelines.

Abbreviations

AK= Amikacin, AMC = Amoxiclav, AML = Amoxycillin, AMP = Ampicillin, AZM = Azithromycin, CAR = Carbenicillin, CAZ = Ceftazidime, CE = Cephradine, CFM = Cefixime, CIP = Ciprofloxacin, CN = Gentamycin, CRO = Ceftriaxone, CXM = Cefuroxime, DO = Doxicycline, E = Erythromycin, IPM = Imipenem, LEV = Levofloxacin, MEM = Meropenem, P = Penicillin G, PRL = Piperacillin, SXT = Cotrimoxazole, TOB = Tobramycin.

Acknowledgment

We would like to thank Mr. Mohammad Yusuf, Chairman of the Board of Trustees of Khwaja Yunus Ali University and Director of Khwaja Yunus Ali Medical College & Hospital for his valuable support to conduct this study. We are also grateful to Mr. Md. Abdul Karim, and Mr. Md. Mazharul Islam, Medical Technologist of the Department of Laboratory Services of Khwaja Yunus Ali Medical College Hospital for their assistance in laboratory work.

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