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Clinical Profile and Drug Resistance Pattern of *Escherichia Coli* Isolated From Different Clinical Samples ofa Tertiary Care Hospital, Kolkata- An Observational Study

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Abstract: *Escherichia coli* are the most common isolated pathogen in clinical setting. Its spectrum of infection is very broad. Antimicrobial resistance in *Escherichia coli* has been reported worldwide and increasing rates of resistance among *Escherichia coli* isa growing concern in both developed and developing countries reported to be one major reason for failure of treatment of infectious disease. This study was undertaken to analyze the antimicrobial susceptibility and characterize the *Escherichia coli* isolated from clinical sourcs. Our study has demonstrated Multi-Drug Resistance (MDR) *Escherichia coli* is the major pathogen in hospital settings and shows ominously high level of resistance to different antimicrobials.Such data can be used to formulate antibiotic use protocols and also for antibiotic stewardship. Periodic monitoring of antimicrobial susceptibility both in the community and hospital settings is recommended

Keywords: *Escherichiacoli, Multi-Drug Resistance (MDR),*

I. Introduction

*Escherichia coli*are the most common isolated pathogen in clinical setting.Its spectrum of infection is very broad.*Escherichia coli*are (E.coli) 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 and is among the most common pathogens causing serious infections like blood stream infections, wounds, otitis media and other complications in humans [1].E.coli resistance to antimicrobials is creating trouble tothe healthcare system worldwide [2,3]. This complicatestreatment outcomes, increases the cost of treatment, andlimits the therapeutic options that contribute to the globalspectra of a post-antimicrobial age in which some of the mosteffective drugs lose their efficiency [4]. The bacterium isbecoming highly resistant to conventionally used antibiotics(to both the newer and older medicines) as evidenced bymany previous studies [5-9]. Adaptive resistance was supposedto be the main mechanism for the development ofresistance including that to lethal doses of the antimicrobials[10].Antimicrobial resistance in *Escherichia coli* has been reported worldwide and increasing rates of resistance among *Escherichia coli* is a growing concern in both developed and developing countries reported to be one major reason for failure of treatment of infectious diseases [11]. Occurrence and susceptibility profiles of *Escherichia coli* show substantial geographic variations as well as significant differences in various populations and environments.[12]Resistance to antibiotics is an extremely common phenomenon in bacteria isolated from clinical material. This is a serious threat to patient care all over the world. In India, antibiotic resistance has far reaching public health consequences.

II. Objective

The aim of this study was to analyze the antimicrobial susceptibility and characterizethe *Escherichia coli*isolated from clinical sources at R.G Kar Medical College & Hospital.

III. Methods

A retrospective review was done on results of cultures of urine, wounds swab (discharge from eye,ear,pus etc.),bloodand other body fluids that had been performed from December 2018 to March 2019 at R.G KarMedical College and Hospital. The *Escherichia coli* isolates and its antimicrobial susceptibility data were collected from the records using a standard data collection form.During 15th December 2018 to 31st March

2019, a total of 5072samples were analyzed for isolation and identification of bacteria and antimicrobial susceptibility testing. Samples were collected in sterile container labeled with information on the patients' age, sex, and brief clinical history. The samples were transported immediately to the laboratory, and processed for culture, identification and antimicrobial drug susceptibility as per the routine microbiological techniques. Semi-quantitative urine culture using a calibrated loop was used to isolate bacterial pathogens on blood and MacConkey agar as per the recommendations of Kass.[13] The plates were incubated at 37°C for overnight and further incubated for 48 h in culture (growth) negative cases. Following this, the isolates were identified by standard biochemical tests

Antibiotic sensitivity testing

Antibiotic sensitivity testing was done on MuellerHinton agar by Kirby–Bauer disc diffusion method[14] using following antibiotic discs (HiMedia, Mumbai) Ampicillin (AMP 10 mcg), Amikacin (AK 30 mcg), Amoxicillin-Clavulanic Acid (AMC 30 mcg), Aztreonam (AT 30 mcg), Ceftriaxone (CTR 30 mcg), Cefuroxime (CXM 30 mcg), Cefepime (CPM 30 mcg), Ciprofloxacin (CIP 5 mcg), Chloramphenicol (C 30 mcg), Gentamicin (GEN 10 mcg), Imipenem (IPM 10 mcg), Nitrofurantoin (NIT 300 mcg), Norfloxacin (NX 10 mcg), and Piperacillin-Tazobactam (PIT 100/10 mcg) as per CLSI guidelines.[15]

IV. Results

During 15th December 2018 to 31st March 2019, a total of 5072 samples were analyzed for isolation and identification of bacteria and antimicrobial susceptibility testing. E. coli was isolated from 176 samples. Of these positive cases, the isolation of E. coli was the highest in number in urine samples followed by wound sample and gradually the fluid, blood cultures as well as the sputum samples.

Table 1: Distribution of *Escherichia coli* from clinical sources at R G Kar Medical College and Hospital(15th December 2018 to 31stMarch 2019).

Sample	Number of samples tested	Number of positive cultures	Number positive for *Escherichia coli*	% of positive cases
Urine	1966	502	94	19
Sputum	814	54	06	22
Wound	1212	136	54	40
Fluid	300	46	06	13
Blood	780	86	10	12
Total	5072	824	176	

- Between 15th December 2018 to March 2019, a total of 5072 samples were analyzed for isolation and identification of bacteria and antimicrobial susceptibility testing, of them 824 showed positive cultures. Among the positive cultures *Escherichia coli* was isolated from 176 (21.36%) positive culture samples. Of these positive cases, the isolation rate of *Escherichia coli* was the highest in urine samples 94 (19%), followed by wound 54 (40%) , 12(22%) in sputum,10(12%) in blood and 6 (13%) in fluid

Table 2: Gender wise Distribution of *E.coli*isolates

Sample	Number of Sample positive for *E.coli*	Gender	
		Female	Male
Urine	94	44	50
Sputum	12	6	6
Wound	54	16	38
Fluid	6	4	2
Blood	10	6	4
Total	176	76	100

Table 3: Distribution of *E.coli*isolates among OPD/IPD settings

Sample	Number of Sample positive for *E.coli*	Ward	
		Outdoor	Indoor
Urine	94	30	64
Sputum	12	4	8
Wound	54	12	42
Fluid	6	0	6
Blood	10	0	10
Total	176	46	130

- 30 were isolated from ICU/CCU/TCU/ITU/SNCUsamples

Table 4: Overall Antimicrobial susceptibility patterns of *Escherichia coli from* clinical sources at R G Kar Medical College and Hospital(15th December 2018 to 31st January 2019).

Antimicrobials	Total Number of tests on isolates	Resistant N(%)	Intermediate N(%)	Sensitive N(%)
Amikacin(AK)	176	93(52.84%)	33(18.75%)	50(28.41%)
Amoxicillin+Clavulanate(AMC)	176	135(76.70%)	9(5.11%)	32(18.18%)
Ceftazidime(CAZ)	176	122(69.31%)	5(2.84%)	49(27.84%)
Ceftriaxone(CTR)	176	134(76.13%)	0	42(23.86%)
Cotrimoxazole(COT)	176	115(65.34%)	0	61(34.66%)
Doxycycline(DO)	176	56(31.81%)	0	120(68.18%)
Imipenem(IPM)	176	61(34.67%)	9(5.11%)	106(60.23%)
Levofloxacin(LE)	176	123(69.89%)	0	53 (30.11%)
Piperacillin+Tazobactam(PIT)	176	58(32.95%)	9(5.11%)	109(61.93%)
Fosfomycin(FO)	94	38(40.43%)	0	56(59.57%)
Nitrofuratoin(NIT)	94	15(15.96%)	0	79(84.04%)
Norfloxacin(NX)	94	76(80.85%)	0	18(19.15%)
Aztreonam(AT)	70	46(65.71%)	5(7.14%)	19(27.14%)
Meropenem(MRP)	70	15(21.43%)	0	55(78.57%)
Polymyxin-B(PB)	70	3(4.28%)	0	67(95.7%)
Chloramphenicol(C)	64	11(17.18%)	14(21.88%)	39(60.93%)
Tigecycline (TGC)	16	2(12.5%)	0	14(87.5%)

Significantly high resistance rates to Norfloxacin (80.85%), Amoxycillin+Clavulanate(76.70%), Ceftriaxone(76.13%).On the other hand, significantly high degree of sensitivity rates to Polymyxin-B(95.7%), Tigecycline, (87.5%), Nitrofuratoin(84.04%). MDR (resistance to >2 classses of antimicrobials) in E.coli is 112(63.63%)

Table 3: Multiple antimicrobial resistance patterns of E. coli isolates from clinical sources at

Sample	Number positive for *Escherichia coli*	All drugs sensitive cases	Resistant To 2 or< 2 classes of antibiotics	MDR strains	Carbapenem resistant isolates
Urine	94	18	16	60(63.83%)	14(14.89%)
Sputum	12	2	2	8(66.67%)	2 (16.67%)
Wound	54	16	4	34(62.96%)	5 (9.26%)
Fluid	06	1	1	4(66.67%)	1(16.67%)
Blood	10	2	2	6 (60%)	2(20%)
Total	176	39(22.16%)	25	112(63.63%)	24 (13.63%)

- Among the MDRs 22 are from intensive care units,69 from other IPD s and 21from OPD.Carbapenem resistance mostly in intensive care units 19 out of 24, 5 from IPD, no isolates were from OPD patients .

V. Discussion

Antimicrobial resistance in *Escherichia coli* has increased worldwide and its susceptibility patterns showsubstantial geographic variation as well as differences in population and environment[16,17].Antimicrobial resistance makes it harder to eliminate infections from the body as existing drugs become less effective. As a result, some infectious diseases are now more difficult to treat than they were just a few decades ago. As more microbes become resistant to antimicrobials, the protective value of these medicines is reduced. Overuse and misuse of antimicrobial medicines are among the factors that have contributed to the development of drug-resistant microbes. The isolation rate of E. coli in the present study was 21 % and it was commonly isolated from urine samples 94(53.4%). These findings are in conformity with reports by other researchers [18]

In this study, the overall resistance of E. coli to antimicrobials was high. The result is consistent with the findings of previous studies[20]. The resistance rates recorded in this study are higher than the results of Khan et al.[21] and lower than the results of Iqbal and Patel [22] and Okonko et al. [23].

Our cross-sectional study showed that the E. coli isolated from urinary specimens were resistant to fluoroquinolones and β-lactam antibiotics in a significant proportion. Similar results have been reported by authors from different parts of India. As seen here, *Escherichia coli* isolated from clinical specimens in different parts of India have shown resistance to various antibiotics. The actual antibiotics against whom the organisms are resistant vary according to samples. For example, β-lactam antibiotic resistance seemed to be more common in the urine whereas aminoglycoside resistance was higher in the blood and wound samples. MDR of *Escherichia coli* is also a concern, not only in India but all over the world. In the study from South India mentioned in introduction, MDR organisms were isolated in 76.5% cases.[16] In our study, 112 (63.63%) of the isolates were MDR. This is an ominous trend because MDR *Escherichia coli* are a serious threat to infection control. From earlier studies in India, it was shown that organisms isolated from nosocomial infection cases were more likely to be resistant to multiple antibiotics. However, recent (2014) studies[19,20] have shown that even

organisms isolated from community-acquired infections have a very high level of resistance ,in our study we found 45.65% of OPD isolates were MDR. This observation effectively means that even for common infections, the choice of antibiotics becomes restricted. UTI is more common in conditions such as diabetes[19]thus; antibiotic resistance will have serious augmenting effect on the overall chronic cost of treatment in these diseases.

Different factors have been implicated in increasing antibiotic resistance of bacteria in India. One of the most potent factors is the easy availability of antibiotics over the counter and the tendency of using antibiotics for most symptoms[21] Thus, this is related to access to drugs. Most of the studies reporting antibiotic resistance in India are from large cities, where people have more access to drugs and thus more chances of misuse exist. Studies from rural areas are rare. One study from a rural teaching hospital in South India showed that out of the isolated E. coli, only 1.5% were resistant to Nitrofurantoin and only 10% were resistant to amikacin[**23**]as in our study we found isolated E. coli, 15.96% were resistant to Nitrofurantoin and only 52.84% were resistant to Amikacin.Although this is significant, the resistance data for other antibiotics, including β-lactams were no different from ours and also urban figures in the same study[24]. Thus, whether increasing access to antibiotics is the main reason for increasing resistance or whether there is some other inciting factor remains to be discovered. This increasing trend of antibiotic resistance is a global phenomenon[26, 27]. A study from Thailand showed a high percentage of resistance to common antimicrobials for both Salmonella and *E. coli*. A study from Iran has also shown the same results for *E. coli*. Similar reports have been published all over the world.[21,23] Although there are more studies on E. coli due to its ubiquitous nature, studies on other organisms have also revealed a similar trend of antibiotic resistance[20,25,27] This increasing ominous trend demands swift action. Strategies include antibiotic stewardship, publication of protocols, and identification of still useful antibiotics. But these are difficult targets. Even in the developed countries[28], it is estimated that up to 50% of antibiotic prescriptions are unnecessary. Thus, proper control of antibiotic use, thereby reducing the selection pressure on organisms, is not an easy strategy. In India, studies have also shown very high rate of prescription of antibiotics, both in public and private sectors. Sometimes, studies showing antibiotic resistance can act as impetus to prescribe higher antibiotics as physicians may start to think that common drugs will be useless. But a multi-sector coordinated approach is needed to tackle the problem and preserve some medicines for the future.

VI. Conclusion

Our study has demonstrated MDR*Escherichia coli*is the major pathogen in hospital settings and shows ominously high level of resistance to different antimicrobials. Such data can be used toformulate antibiotic use protocols and also for antibiotic stewardship. Periodic monitoring of antimicrobial susceptibility both in the community and hospital settings is recommended. Further studies on the etiology of this trend of antibiotic resistance are necessary.

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