

Antimicrobial susceptibility pattern of *Escherichia coli* from clinical specimens in a tertiary care hospital, Dhaka, Bangladesh

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Abstract

Background: *Escherichia coli* is one of the leading causes of mortality & morbidity throughout the world. The improper use of antibiotics leads to the emergence of drug resistant pathogens, which is a great public health challenge.

Objective: To determine antimicrobial susceptibility pattern of *Escherichia coli* from various clinical specimens in a tertiary care hospital, Dhaka, Bangladesh.

Methods: This retrospective cross-sectional study was conducted at Holy Family Red Crescent Medical College laboratory between July 2020 to June 2021 on 287 isolates of *E. coli* from various clinical specimens (urine, blood, sputum, wound swab/pus) of patients. Written consent was taken from the concerned authority. The samples were processed according to the standard conventional methods and the isolates were identified by standard biochemical tests. Antimicrobial susceptibility testing was performed on Muller-Hinton agar using Kirby-Bauer disc diffusion method. The antibiotic discs were selected according to the protocol recommended by Clinical Laboratories Standards Institute (CLSI) guideline. Data were analyzed by SPSS version 18.

Results: A total 287 (36.46%) *E. coli* were isolated from 790 of various clinical specimens collected from the patients of all age & both sex group attending various inpatient and outpatient departments. Out of 287 *E. coli* strains maximum sensitivity was shown against meropenem 90.94%, gentamicin 78.75%, nitrofurantoin 77.35% & amikacin 71.43%.

Conclusion: Nitrofurantoin, gentamicin & amikacin are suitable treatment options because of their high sensitivities and affordability. Although meropenem showed high sensitivity, its use should be restricted due to its status as a reserve drug. It is recommended to regularly monitor antimicrobial susceptibility pattern for *E. coli* in order to improve treatment modalities and reduce drug resistance.

Keywords: *E. coli*, Meropenem, Gentamicin, Amikacin, Nitrofurantoin.

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Introduction:

E. coli is a Gram-negative, rod-shaped, motile, oxidase negative, facultative anaerobic bacteria under the family Enterobacteriaceae.¹ It is a normal flora of the human and animal gastrointestinal tract, but can also be found freely in soil, water, and vegetation and can be a potential threat for various infections. *E. coli* is responsible for a wide variety of infections including both hospital and community onset infections.² *E. coli* is the most frequent cause of Urinary Tract Infection (UTI) and is among the most important pathogens causing Blood Stream Infections (BSI), nosocomial pneumonia, meningitis, wound infection & otitis media.³⁻⁵ *E. coli* is a major cause of waterborne and foodborne human diarrhea worldwide, especially in developing countries, causing significant number of deaths, particularly in children under five-years-old.⁶

Urinary tract infection (UTI) is the most common infection of human population. Most susceptible groups are neonates, girls, young women and men. In case of adults, it occurs more commonly in women than men due to short length of female urethra, which is closer to anus. Therefore, up to 40% women develop UTI at least once during their lifetime; a significant number of these women suffer

recurrent UTI.⁷ Around 90% *E. coli* infection was acquired from human community compared with 50% of nosocomial UTI.⁸

The improper use of antibiotics leads to the emergence of drug resistant pathogens, which is a great challenge to the health services. Different studies have been conducted time to time across the globe to assess the bacterial profile and the antibiotic susceptibility pattern in different samples. These studies help clinicians to decide on empirical treatment of patient before the results of confirmatory laboratory cultures.⁹

The emergence of multidrug-resistant *E. coli* is a growing problem around the world.¹⁰ Treatment failure resulting in increased morbidity, mortality & cost of health services. Regular monitoring of antibiotic sensitivity report provides data for antibiotic therapy and resistance control. Thus, in this study, the aim is to determine antimicrobial susceptibility pattern of *E. coli* from various clinical specimens in a tertiary care hospital in Dhaka, Bangladesh

Materials & Methods:

The present study is a retrospective observational study and was conducted at Holy Family Red Crescent Medical College laboratory between July 2020 to June 2021. During the study period 287 isolates of *E. coli* were isolated from various clinical specimens (urine, blood, sputum & wound swab/ pus) obtained from the OPD & IPD patients of Holy Family Red Crescent Medical College Hospital, Dhaka, Bangladesh. Written consent was taken from the concerned authority. All isolates of *E. coli* isolated from various clinical samples were included in this study. All other bacteria except *E. coli* were excluded from the study.

The samples were processed according to the standard conventional methods and the isolates were identified by standard biochemical tests. Antimicrobial susceptibility testing was performed on Muller-Hinton agar using Kirby-Bauer disc diffusion method.¹¹ Antibiotic discs were selected according to the protocol as recommended by Clinical Laboratory Standards Institute (CLSI) guideline.¹² Nitrofurantoin was used only in urine samples. Data was analyzed by SPSS version 18.

Results:

A total 287 (36.46%) of *E. coli* were isolated from 790 clinical specimens, collected from inpatient and outpatient department patients from all age groups and both sex groups.

Table 1: Age and sex distribution of isolated *E. coli* (n=287)

Gender	Children up to 18 yrs No.	Adult patients No.	Total No. (%)
Male	32	92	124 (43.20%)
Female	14	149	163 (56.80%)
Total	46 (16.03%)	241 (83.97%)	287 (100%)

In Table 1, 241(83.97%) adult patients had *E. coli* infections

in comparison to child group 46(16.03%). The highest number of female patients 163(56.80%) were suffered from *E. coli* infections than the male patients 124 (43.20%).

Table 2: *E. coli* isolated from different specimens (n=787)

Samples	No. of samples	Total Culture positive (%)
Urine	562	243 (43.24%)
Wound swab/pus	102	26 (25.49%)
Blood	85	10 (11.76%)
Sputum	38	8 (21.05%)
Total	787	287 (36.46%)

A total of 787 different kinds of samples were analyzed for isolation, identification and susceptibility pattern of *E. coli*. Among them culture positive *E. coli* was 287 (36.46%). Of these positive cases the isolation rate of *E. coli* is highest 243 (43.24%) in urine, followed by 26 (25.49%) in wound swab/ pus, (11.76%) in blood and 8 (21.05%) in sputum (Table 2).

Table 3: Antibiotic sensitivity pattern of *E. coli* (n=287)

Antibiotics	Disc potency	Sensitive	Percentage
AMC	30 µg	135	47.03%
CXM	30 µg	66	22.99%
CRO	30 µg	92	32.05%
CAZ	30 µg	78	27.17%
CFM	30 µg	126	43.90%
F/M	30 µg	222	77.35%
CIP	5 µg	116	40.42%
GN	10 µg	226	78.75%
AK	30 µg	205	71.43%
SXT	25 µg	157	54.70%
MEM	10 µg	261	90.94%

AMC- Amoxicillin/clavulanic acid, CXM- Cefuroxime, CRO- Ceftriaxone, CAZ - Ceftazidime, CFM- Cefepime, F/M- Nitrofurantoin, CIP- Ciprofloxacin, GN- Gentamicin, AK- Amikacin, SXT- Co-trimoxazole, MEM- Meropenem.

Out of 287 *E. coli* strains maximum sensitivity was shown against meropenem 90.94%, gentamicin 78.75%, nitrofurantoin 77.35% & amikacin 71.43%, followed by co-trimoxazole 54.70%, amoxicillin – clavulanic acid 47.03%, cefepime 43.90% and ciprofloxacin 40.42%. Very low sensitivity was found in ceftriaxone 32.05%, ceftazidime 27.17% & cefuroxime 22.99% (Table 3).

Discussion:

E. coli is one of the most common causative agents of bacterial infections. An antimicrobial resistance pattern of

E. coli is a great threat that leads to prolonged hospitalization and treatment failure. Therefore, this study aimed to determine antimicrobial susceptibility pattern of *E. coli* from various clinical specimens. In our study, adult patients 241(83.97%) had *E. coli* infections in comparison to child group 46(16.03%). *E. coli* infection is higher in female patients 163(56.80%) were suffered from *E. coli* infections than the male patients 124(43.20%) (Table 1). Similar observation was seen in a study where *E. coli* was common in female 58.06 % as compare to male 41.96%.¹³ The isolation rate of *E. coli* in this study was 287(36.46%) (Table 2) which is inconsistent with findings reported by other researchers where they found 75.32% and 12.84% isolation rate of *E. coli*.^{14,15} A low isolation rate of *E. coli* 14.2% was also identified in another study and samples were urine ear discharge, wound swab & eye discharge.¹⁶ It may be variation of disease in different area.

In this present study, we found that meropenem was highly sensitive in 90.94% of cases. This is due to its limited use as it is reserve drug and expensive. Similarly, gentamicin (78.75%), amikacin (71.43%) and nitrofurantoin (77.35%) have good susceptibility rates, which may also be due to their limited use. Conversely, 2nd, 3rd, 4th generation cephalosporins, amoxicillin-clavulanic acid and cotrimoxazole due to their overuse (Table 3). Nitrofurantoin is relatively cheap, easily available drugs and showed higher sensitivity though it has some side effects. Ciprofloxacin showed low sensitivity due to overuse and misuse of this drug (Table 3). In a study, out of 62 *E. coli* strains maximum sensitivity was shown against nitrofurantoin 82.5% followed by meropenem 79.03%, ciprofloxacin 61.30%, amikacin 56.45%. Cefepime, ceftazidime, ceftriaxone showed lower sensitivity like 43.54%, 38.71% & 37.09%.¹³ In another study from Bangladesh, *E. coli* showed highest susceptibility rates to meropenem, and amikacin (>90%), high susceptibility rates to amoxicillin-clavulanic acid, ceftazidime, and gentamycin (>70%).¹⁵

Conclusion:

Nitrofurantoin, gentamicin & amikacin are suitable treatment options because of their high sensitivities and affordability. Although meropenem showed high sensitivity, its use should be restricted due to its status as a reserve drug. It is recommended to regular monitor antimicrobial susceptibility pattern for *E. coli* in order to improve treatment modalities and reduce drug resistance.

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