Original Research Article

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A Comparative Study of Antibiotic Sensitivity Pattern of *Escherichia coli* Isolated from Various Clinical Samples over a Period of 3 Years

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ABSTRACT

Keywords

Nosocomial infection, Blood stream, Bacteriological investigation, Antibiotic

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Escherichia coli, a gram negative bacillus, are present as a normal flora in human intestine. It is present in hospital environment and a common cause of nosocomial infection. In recent years it has shown resistance to various groups of antibiotics. Specimens like Urine, Pus, ET secretion; Sputum, etc were processed in Clinical Microbiology Laboratory for isolation and identification of *E. coli*. After identification *E. coli* was processed for Antibiotic Sensitivity testing using Kirby Bauer method. A total of 1237 samples had *E. coli* isolated. Out of 1237 *E. coli* isolated 540 (43.65%) were isolated from female patients while 697 (56.35%) were from male patients. Isolation was highest from Urine (50.69%) followed by Pus (36.14%) sample. Over all sensitivity of *E. coli* was as follow – Imipenam (64.63%), Amikacin (61.85%), Gentamicin (52.75%), Cotrimoxazole (37.90%), Cefepime (27.03%), Ciprofloxacin (26.62%), Cefotaxime (21.50%), Cefuroxime (12.20%), Cefoxitin (12.50%), Amoxicillin (10.54%), and Ceftazidime (4.57%). Every hospital needs to prepare antibiogram not only according to organisms but also according to clinical specimens so that empirical therapy can be started before culture and sensitivity investigation.

Introduction

Escherichia coli, a gram negative bacillus, is present as a normal flora in human intestine. It is present in hospital environment and is a common cause of nosocomial infection. In recent years it has shown resistance to various groups of antibiotics. We are now having very limited numbers of antibiotics which are effective against *Escherichia coli*. *E. coli* is

ranked as the most common cause of hospital acquired infection in many hospitals (Berkley *et al.*, 2005).

Different *E. coli* strains were found in high numbers and very frequently among the pathogenic microorganisms isolated from around ten teaching hospitals in China (Wang *et al.*, 2010). One of the leading pathogen causing urinary tract infections is *E. coli*

(Wagenlehner *et al.*, 2008; De Francesco *et al.*, 2007; Kashef *et al.*, 2010). *E. coli* is also among the most common pathogens causing blood stream infections (Biedenbach *et al.*, 2004), wound infection, otitis media and other complications in humans (Gebre-Sellassie *et al.*, 2007; Khan *et al.*, 2002). *E. coli* has caused many deaths in children below the age of 5 years in developing countries and worldwide as it is one of the common causes of food and water-borne human diarrhea (Turner *et al.*, 2006).

Decreasing rate of antibiotic sensitivity toward *E. coli* in developed and developing countries is of growing concern (Bell *et al.*, 2002; El Kholy *et al.*, 2003). In general, approximately only 5% of cases with severe symptoms are treated considering bacteriological investigation while up to 95 % of cases without it (Dromigny *et al.*, 2005). *E. coli* shows substantial variation in susceptibility profiles according to geographic location and also shows significant differences in various populations and environments (Erb *et al.*, 2007).

Present study is focusing isolation and antibiotic susceptibility pattern of *E. coli* isolated not only from urine but also from various other clinical specimens so that overall profile of antibiotic sensitivity towards *E. coli* can be used for future treatments.

Materials and Methods

Study was conducted prospectively for 3 years. Specimens like Urine, Pus, ET secretion; Sputum, etc were received in Clinical Microbiology Laboratory from various indoor patients. Specimens were processed for Culture and identification of *E. coli*. Samples were inoculated on MacConkey agar, Blood agar, Nutrient agar and then incubated aerobically at 37°C for 24 hours. From positive cultures, *E. coli* were identified

according to the standard operational procedures as per the standard microbiological methods (Cheesborough, 1991).

After identification *E. coli* was processed for Antibiotic Sensitivity testing using Kirby Bauer method. Antimicrobial susceptibility tests were done on Mueller-Hinton agar using Kirby Bauer disk diffusion method (Bauer *et al.*, 1996). The antimicrobial agents tested were: Amoxicillin, gentamicin, Amikacin, ciprofloxacin, cefuroxime, cefepime, cefotaxime, cotrimoxazole, Imipenem, ceftazidime, ceftazidime, ceftazidime. Antibiotic Sensitivity data were interpreted according to CLSI guidelines (CLSI, 2017). A reference strain of *E. coli* ATCC 25922 was used for quality control for antimicrobial susceptibility tests (CLSI, 2017).

Results and Discussion

Over a period of 3 years total of 1237 samples had *E. coli* isolated. Out of 1237 *E. coli* isolated 540 (43.65%) were isolated from female patients while 697 (56.35%) were from male patients. Isolation was highest from Urine (50.69%) followed by Pus (36.14%) sample.

Highest percentage of sensitivity towards *E. coli* was shown by Imipenem (average – 64.63%) followed by Amikacin (average – 61.85). When comparing antibiotic sensitivity among different clinical specimen, Imipenem has highest sensitivity for *E. coli* isolated from Endo tracheal secretion while lowest sensitivity for *E. coli* isolated from catheter tip.

Amikacin has highest sensitivity for Ascitic fluid and lowest sensitivity for Endo tracheal secretion. Lowest percentage of sensitivity towards *E. coli* was shown by ceftazidime followed by amoxicillin. Sensitivity pattern of *E. coli* for urine was as follow – Imipenem

(77.90%), Amikacin (68.10%), Gentamicin (56.86%), Cotrimoxazole (35.13%), Cefepime (24.42%), Ciprofloxacin (24.28%), Cefotaxime (17.71%), Cefuroxime (14.68%), Cefoxitin (13.0%), Amoxicillin (8.20%), and Ceftazidime (5.44%). Over all sensitivity of *E. coli* was as follow – Imipenam (64.63%), Amikacin (61.85%), Gentamicin (52.75%), Cotrimoxazole (37.90%), Cefepime (27.03%), Ciprofloxacin (26.62%), Cefotaxime (21.50%), Cefuroxime (12.20%), Cefoxitin (12.50%), Amoxicillin (10.54%), and Ceftazidime (4.57%).

The above study was conducted in a tertiary care hospital with a state of art facility of Clinical microbiology laboratory.

Our study shows over all antibiotic sensitivity of *E. coli* as well as antibiotic sensitivity of *E. coli* for different clinical specimens. Various clinical specimen shows difference in antibiotic sensitivity pattern. A study by Rugira Trojan *et al.*, showed isolation rate of *E. coli* from pus specimen to be 51.2 % while it is 36.14% in present study (Rugira Trojan, 2016).

A study by Adinortey *et al.*, shows 100% sensitivity to Imipenam for urine and other clinical specimen while it is ranging from 41.67 % to 79.36 % in present study. Same author has demonstrated susceptibility of amikacin ranging from 75.8% to 100 % among various clinical samples while present study is having sensitivity of amikacin ranging from 35.2% to 81.9% (Adintory *et al.*, 2017).

Many studies have shown higher resistance of *E. coli* towards Fluoroquinolone and cotrimoxazole (Lee *et al.*, 2003; Arslan *et al.*, 2005, Akram *et al.*, 2007). In Asia some countries are not considering fluoroquinolone as a treatment of first line for recurrent cystitis (Lee *et al.*, 2003; Gobernado *et al.*, 2007).

Present study shows sensitivity of ciprofloxacin ranging from 4.76% to 41.67% and cotrimoxazole sensitivity from 20.63% to 58.33%.

The isolation rate of *E. coli* from urine samples in study by Kibret *et al.*, (2011) was (45.5%). The present study and study by other researchers also have similar findings (Yismaw *et al.*, 2010; Al-Tawfiq, 2006; Gangoué *et al.*, 2004). In present study, the overall resistance of *E. coli* to antimicrobials was high.

The result is consistent with the findings of previous studies (Kibret *et al.*, 2011; Orrett *et al.*, 2001). In most of the clinical samples, *E. coli* showed high resistance rate of > 80% to amoxicillin.

The results of the present study are in line with the findings of other studies conducted in different parts of the world (Bharathi *et al.*, 2008; Briscoe *et al.*, 2005).

The resistance rates recorded in this study are higher than the results obtained by various other studies (Khan, 2002; Iqbal *et al.*, 2002; Okonko *et al.*, 2009; Zhanel *et al.*, 2006; Karlowsky *et al.*, 2002; Barrett *et al.*, 2000; Iqbal *et al.*, 2002; Kurutepe *et al.*, 2005). This can be because of the duration of gap between present and previous studies.

The present study shows very high rate of resistance of *E. coli* isolated from various clinical specimens. *E. coli* should be treated promptly and effectively to prevent further increase in resistance.

Every hospital needs to prepare antibiogram not only according to organisms but also according to clinical specimens so that empirical therapy can be started before culture and sensitivity investigation (Table 1 and 2).

Table.1 Shows number of *E. coli* isolated from different clinical specimens

Specimen	No of <i>E. coli</i> isolated	Percentage
Urine	627	50.69
Pus	447	36.14
Sputum	70	5.66
Blood	43	3.48
Endo Tracheal Secretion	15	1.21
Ascitic Fluid	14	1.13
Pleural Fluid	7	0.57
CSF	6	0.48
Catheter Tip	5	0.4
Peritoneal Fluid	3	0.24
Total	1237	100

Table.2 Shows Percentage sensitivity of different antibiotics towards *E. coli* isolated from various clinical specimen.

Antibiotic	Amoxicillin	Gentamicin	Amikacin	Cefuroxime	Cefepime	Cefotaxime	Ciprofloxacin	Imipenem	Cotrimoxazole	Cefoxitin	Ceftazidime
Specimen											
Urine	8.20	56.86	68.10	14.68	24.42	17.71	24.28	77.90	35.13	13.00	5.44
Pus	6.31	55.03	59.75	14.73	31.35	17.80	30.80	77.35	33.46	11.94	4.77
Sputum	3.67	64.55	77.58	10.74	39.40	8.72	39.91	77.13	38.62	4.68	5.75
Blood	17.44	61.22	76.45	13.95	28.90	10.08	40.84	74.10	28.27	10.30	0.00
Endo Tracheal Secretion	4.76	30.16	35.24	4.76	0.00	0.00	4.76	79.36	20.63	17.78	0.00
Ascitic Fluid	6.67	55.48	81.90	4.76	30.95	35.71	13.09	60.48	50.71	13.09	4.76
Pleural Fluid	0.00	66.67	61.11	16.67	11.11	16.67	16.67	50.00	22.22	0.00	0.00
CSF	0.00	62.50	66.67	8.33	62.50	50.00	20.83	58.33	58.33	4.17	0.00
Catheter Tip	41.67	41.67	41.67	0.00	8.33	41.67	41.67	41.67	41.67	33.33	8.33
Peritoneal Fluid	16.67	33.33	50.00	33.33	33.33	16.67	33.33	50.00	50.00	16.67	16.67
Total	10.54	52.75	61.85	12.20	27.03	21.50	26.62	64.63	37.90	12.50	4.57

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