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E. coli Positivity and Sensitivity in Invasive Blood Stream Infections using Automated Bactec in Tertiary Care Teaching Hospital of North India

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A B S T R A C T

Escherichia coli is one of the leading causes of invasive bloodstream infections (BSIs) caused by Gram-negative bacteria throughout the world. Hence, the present study is designed to determine the *E. Coli* positivity and sensitivity in Invasive bloodstream infections using automated Bactec systems. All the blood culture samples received in the Department of Microbiology for culture by BactecBdfx from July 2015 to June2016 were included in the study. The blood culture was observed in the BactecBdfx system for at least 5 days before they are reported as sterile. Among the total 1275 cultures which were positive for bacteria, 931(73.02%) were positive for Gram-negative bacteria. Among the total of 931culture which were positive for gram-negative bacteria, *E.coli* was isolated in 266 (28.57%) cultures. Maximum *E. coli* isolates were found in the age group of 0-1 years (33.83%) followed by 19-45 years (23.68%). Out of total isolates,50(100%) were sensitive to Colistin followed by Piperacillin/Tazobactam45(90.00%), Cotrimoxazole104(66.24%), Doxycycline 167(62.55%), Amikacin 160(60.15%), Cefepime 33(55.00%), Ampicillin 133(50.00%) and Ciprofloxacin 133(50.00%). Among the total isolates, E.Coli was resistant to Levofloxacin, 51(87.93%) followed by Cefazolin 43(78.18%), Cefotaxime/Clavulanic acid 17(77.27%), Amoxiclav 83(65.87%), Gentamycin 133 (50.38%), and Ampicillin 133(50.00%). *E.Coli* is one of the most common organisms among Gram-Negative isolates and the most commonest isolated in the neonate and infant age group. All the *E.coli* isolates showed maximum sensitivity to Colistin, Piperacillin/Tazobactam, Cotrimoxazole, and Doxycycline while it showed high-level resistance to Levofloxacin followed by Cefazolin, Cefotaxime/Clavulanic acid, Amoxiclavulanic acid, and Gentamycin.

Introduction

Escherichia coli is the gram-negative organism most frequently isolated in children and adult patients with bacteraemia and severe cases, it may lead to life-threatening complications and death. The rates of bacteremia have increased slowly and steadily

in recent years. Generally, *E. coli* are a part of the normal commensal gut microbiota of healthy human populations. However, some strains cause severe intestinal or extraintestinal infections because of specific virulence factors associated with them.[1] Isolates of *E.coli* that can access and survive in the bloodstream are known as extraintestinal pathogenic *E. coli* (ExPEC) and can cause a broad spectrum of diseases, including urinary tract infections (UTI), sepsis, and neonatal meningitis. Mostly the common extraintestinal site colonized by this bacteria is the urinary tract, which leads to bloodstream infections.[1,2]

Blood cultures are a valuable diagnostic tool and are indicated whenever there is clinical evidence of sepsis or an unknown systemic infection.[2,3] Indira Gandhi Medical College (IGMC) Shimla is a Tertiary care hospital and patients with above mentioned clinical conditions are treated both in the outpatient department (OPD) and inpatient department (IPD) and usually require blood culture to establish the etiological diagnosis.

Previously no study has been done in IGMC Shimla using an automated Bactec BD FX machine for blood culture. Hence, the present study is designed to determine the *E. coli* positivity and sensitivity in Invasive bloodstream infections using automated Bactec systems.

The main and objective of this study includes to determine the *E. coli* positivity and sensitivity in Invasive bloodstream infections using automated Bactec systems.

Materials and Methods

Study Design

Prospective study

Study Setting

Department of Microbiology, Indira Gandhi Medical College and Hospital, Shimla.

Study Period

One year from July 2015 to June2016

Inclusion criteria

All the blood culture samples received in the department of microbiology for blood culture by BactecBdfx system.

Patients willing for study.

Blood cultures from all age groups

Exclusion criteria

Patient not willing to study.

Blood cultures showing mixed growth

Materials and Methods

All the blood culture samples received in the department of microbiology for culture by BactecBdfx were included in the study. The blood culture was observed in the Bactecbdfx system for at least 5 days before they are reported as sterile.

The sample to be tested is inoculated into the Bactec ^{tm} plus aerobic/f culture bottle for adults and Bactec^{tm} Peds plus/f for children which is then inserted into the bdbactec fluorescent series instrument for incubation. Each bottle has a sensor that detects an increase in co2 produced by the growth of microorganisms. The sensor monitors every 10 minutes for an increase in its fluorescence, which is proportional to the amount of co2 present. A positive reading indicates the presumptive presence of viable

microorganisms in the bottle. The Positive bottle will be sub-cultured on Blood agar and MacConkey's agar plates. Following the subculture on solid media from each positive bottle a smear will be prepared for gram staining from that blood culture bottle. The Gram-stained smear will be examined for the presence of microorganisms and presumptive report conveyed to respective departments. The Blood agar and Mac Conkey agar plates will be incubated aerobically at 37ºc for 24 to 48 hrs and then observed for the growth of bacteria. All bacterial isolates will be identified using standard biochemical identification methods. All the positive isolates were stocked.

Statistical analysis

The data was analyzed using statistical analysis-epi info7.the data collected was entered into a spreadsheet. The data was checked for any missing values and completed. analysis in terms of demographic variables, positivity in the processed samples, type of species prevalent, was done using statistical software epi-info version 7(7.1.1.0).

Results and Discussion

In the current study, among the total of 5473 samples suspected of BSI's received in the Department of Microbiology, IGMC, Shimla, 1441 were positive. Among the total positive culture, 1275(88.48%) were positive for Bacteria while 166(11.52%) were positive for Fungi. Among the total 1275 cultures which were positive for bacteria, 931(73.02%) were positive for gram-negative bacteria while the rest 344(26.98%) were of gram-positive bacteria. Among the total of 931culture which were positive for gram negative bacteria, *E.coli* was isolated in 266 (28.57%) cultures. Maximum *E. coli* isolates were found in age group of 0-1 years (33.83%) followed by 19-45 year (23.68%), 46-65 years (19.92%), >66 years (14.29%), 5.64% in 2-5 years and 2.63% in 6-18 years.(Table-1) (Figure-1)

In the present study, Out of total isolates, 50(100%) were sensitive to Colistin followed by Piperacillin/ Tazobactam45(90.00%), Cotrimoxazole 104 (66.24%), Doxycycline 167 (62.55%), Amikacin 160(60.15%), Cefepime 33 (55.00%), Ampicillin 133 (50.00%), Ciprofloxacin 133 (50.00%), Gentamycin 131 (49.62%), Meropenam 50 (44.25%) Ampisal 56 (40.29%), Amoxiclavulinic acid 43 (34.13%), Imipenem 35(28.69%), Ceftriaxone 20 (24.39%) Cefotaxime/ Clavulanic acid5 (22.73%), Polymixin B 29 (21.64%), Aztreonam 20 (20.62%), Cefazolin 8 (14.55%), Levofloxacin 4(6.90%) and Cefopodoxime 5(2.45%) (Table-2) Among the total isolates, *E.Coli* was resistant to Levofloxacin 51(87.93%) followed by Cefotaxime 43 (78.18%), Cefotaxime/ Clavulanic acid 17(77.27%), Amoxiclavulanic acid 83(65.87%), Gentamycin 133 (50.38%), Ampicillin 133(50.00%) Cipro 131(49.25%), Cefopodo 97 (47.55%), Cefepime 27(45.00%), Amikacin 106 (39.85%) Doxycycline 99(37.08%), Cotrimoxazole 53 (33.76%), Aztreonam30 (30.93%), Polymyxin B 38(28.36%), Ceftriaxone21 (25.61%), Meropenem 20(17.70%), Imipenem 15(12.30%) and Piperacillin Tazobactum 5(10.00%).

Blood stream infections (BSIs) can lead to life-threatening complications in the clinical course of patients receiving Immuno Suppressive medications and *Escherichia coli* represent one of the most encountered causes of such bloodstream infections (BSIs) involving Gram-negative bacteria.[4]

Studies have shown an increasing incidence of *E. coli* early-onset sepsis in neonates, with incidence more and steadily increasing than group B *Streptococcu*s for the last several years. Beyond that, *E. coli* resistant strains are

also increasing equally in all respective age groups, with higher resistance rates to first-line antibiotics that is ampicillin and gentamycin which are initiated empirically.[5]

Table.1 Distribution of *E.coli* infection

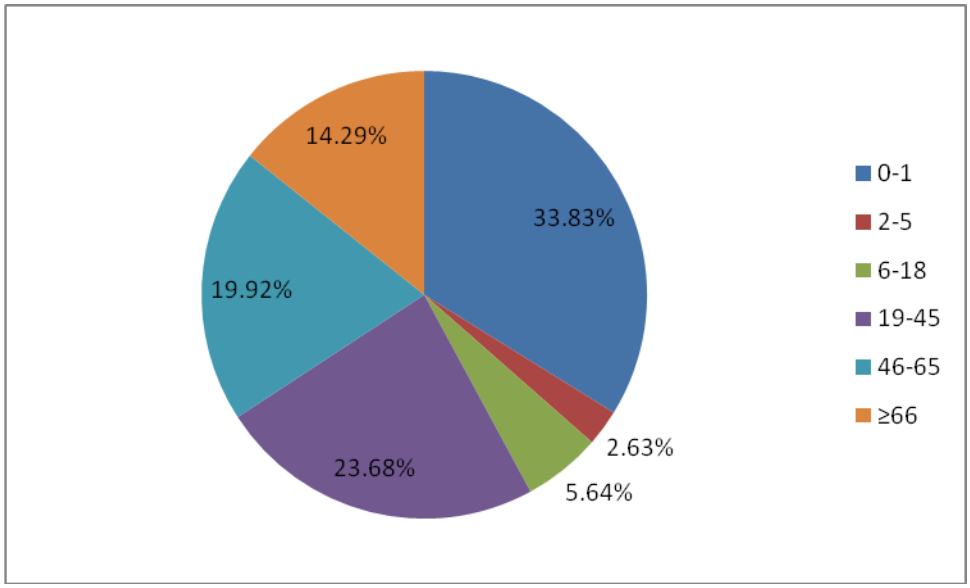
(n=266)

S. No.	Age Group	Frequency	Percent
1.	0-1	90	33.83%
2.	2-5	7	2.63%
3.	6-18	15	5.64%
4.	19-45	63	23.68%
5.	46-65	53	19.92%
6.	≥66	38	14.29%
7.	Total	266	100.00%

Table.2 Sensitivity of *E coli*

Drugs	Sensitive	ses%	Resistant	res%	Intermediate	int%	Total
Amika	160	60.15	106	39.85	0	0.00	266
Amoxiclav	43	34.13	83	65.87	0	0.00	126
Ampicill	133	50.00	133	50.00	0	0.00	266
Ampisal	56	40.29	0	0.00	83	59.71	139
Aztreon	20	20.62	30	30.93	47	48.45	97
Cefepime	33	55.00	27	45.00	0	0.00	60
Cefopodo	5	2.45	97	47.55	102	50.00	204
Ceftri	20	24.39	21	25.61	41	50.00	82
CFZ	8	14.55	43	78.18	4	7.27	55
CFZ/CLV	5	22.73	17	77.27	0	0.00	22
Cipro	133	50.00	131	49.25	2	0.75	266
Colis	50	100.00	0	0.00	0	0.00	50
Cotri	104	66.24	53	33.76	0	0.00	157
Doxy	167	62.55	99	37.08	1	0.37	267
Genta	131	49.62	133	50.38	0	0.00	264
Imip	35	28.69	15	12.30	72	59.02	122
Levo	4	6.90	51	87.93	3	5.17	58
Mero	50	44.25	20	17.70	63	55.75	113
PB	29	21.64	38	28.36	67	50.00	134
Piper+Taz	45	90.00	5	10.00	0	0.00	50

Fig.1 Distribution of *E.coli* infection (n=266)



In the current study among the total of 931culture which were positive for gram-negative bacteria, *E. coli* was isolated in 266 (28.57%) cultures. This is in agreement with a study in different parts of Africa in which high incidence of *Escherichia coli* bacteremia have been reported (Berkley *et al.*,).[6] This difference in the incidence could be due to the differing criteria for patient selection. In the present study, Out of total isolates, 50(100%) were sensitive to Colistin followed by Piperacillin/Tazobactam45(90.00%), Cotri-moxazole 104 (66.24%), Doxycyclin 167 (62.55%), Amikacin 160(60.15%), Cefepime 33 (55.00%), Ampicillin 133(50.00%) and Ciprofloxacin 133(50.00%). Among the total isolates, *E.coli* was resistant to Levofoxacin 51(87.93%) followed by Cefotaxime 43 (78.18%), Cefotaxime/Clavulanic acid 17 (77.27%), Amoxiclavulanic acid 83 (65.87%), Gentamycin 133 (50.38%), and Ampicillin 133(50.00%)

The last two decades have witnessed a significant rise in the number of infections caused by antibiotic-resistant strains of *E. coli*, and this leads to adverse outcomes of BSIs. Multidrug-resistant (MDR) *E. coli* strains and particularly those which produce extended-spectrum β-lactamases (ESBL) not only are present in many health care settings but also have become an important causative factor of Community-acquired infections. These organisms are resistant to many of the antimicrobial agents generally initiated for the treatment of infections caused by *E.coli*, so the relative chances are quite high that empirically prescribed antimicrobial therapy will be less effective against these infections.[7]

E.coli was one of the most common organisms among Gram-Negative isolates and the most commonly isolated in the neonate and infant age group. All the *E.coli* isolates showed maximum sensitivity to Colistin, Piperacillin/ Tazobactam, Cotrimoxazole, and Doxycycline while it showed high-level resistance to Levofloxacin followed by Cefotaxime, Cefotaxime/Clavulanic acid, Amoxiclav, and Gentamycin.

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