



CLINICO-MICROBIOLOGICAL PROFILE OF GRAM-NEGATIVE ORGANISMS CAUSING SEPSIS IN A TERTIARY CARE HOSPITAL, NORTH KERALA

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ABSTRACT

Introduction: Blood stream infections caused by multi drug resistant gram-negative organisms are one of the major threats to patients. Increasing incidence of sepsis mainly from intensive care unit is the basis of this study. This study is mainly concerned with clinical and microbiological profile of gram-negative organisms in our hospital. **Methods:** A prospective study was conducted from April 2023 to April 2024. The study includes patients having gram negative septicemia. Identification and sensitivity of the organism were detected by VITEK machine. Clinico-microbiological profile of the gram-negative organisms was documented. **Results:** Out of 2742 blood samples received in our laboratory, 325(11%) were culture positive. 129 out of the 325 blood samples showed gram negative bacteria. There were more male patients compared to female patients in the study. Female patients were about 41% and male patients were about 59% in the study. More cases were from Medicine and surgery ward. The primary sources of infection in these cases were urinary tract infection (47%), followed by respiratory infections (15%), metabolic disorders (13%), cardio vascular infections (12.4%), gastro intestinal system infections (7.7%) and skin and soft tissue infections (4.6%). The most common organism isolated was *E. coli* (40%), followed by *Klebsiella pneumoniae* (18%), *Acinetobacter* (11.6%), *Pseudomonas aeruginosa* (9.3%), *Salmonella* (7.7%), *Citrobacter* (3.8%), *Proteus* (3.1%) and other non-fermenting gram-negative bacteria (5.4%). *E. coli* shows more resistance to Cephalosporins, Fluoroquinolones and to Aminoglycoside like Amikacin. *Klebsiella* shows more resistance to Cephalosporins and Cotrimoxazole. *Acinetobacter* shows more resistance to Aminoglycosides like Amikacin and Gentamicin. **Conclusion:** Septicemia is one of the major life threatening situation which requires immediate attention and treatment. Blood culture is the gold standard method done to detect septicemia in the patients. The use of BACTEC and BACT/ALERT machines for early detection of bacterial growth and use of Vitek 2 for proper identification of organism and antibiotic sensitivity with MIC had made easy for proper management of septicemia. Clinico-microbiological profile of gram-negative organisms causing sepsis was done in this study. The most common isolate obtained was *E. coli* followed by *Klebsiella*. The most common source of infection for septicemia was found out to be urinary tract infection in the study. Antibiotic resistance was more commonly observed for Cephalosporins, Fluoroquinolones and Aminoglycosides. It is very important to give antibiotics only after doing culture and sensitivity to prevent the antibiotic resistance.

KEYWORDS : Sepsis, gram negative organisms, multi drug resistance

INTRODUCTION-

Blood stream infections are defined as the presence of viable micro-organisms in blood and is one of the most serious health-care associated infection which contributes to maximum cases of morbidity and mortality (1). Sepsis occurs when micro-organisms multiply and releases toxins in blood. The term sepsis is defined as a life-threatening organ dysfunction which is due to the dysregulated host response to infection (2). Sepsis requires immediate treatment with antimicrobial agents. The causes of septicemia can be virus, bacteria or fungus (3).

The incidence of blood stream infections has been alarmingly increasing in recent days. The incidence of blood stream infections in United States, which is a developed country is approximately 250,000 cases per year. India, which is a developing country the exact prevalence rate of blood stream infection is yet to be published (4).

The objective of this study is to determine prevalence and antibiotic susceptibility pattern of gram-negative bacteria causing infection in blood samples of patients admitted in the hospital. The emergence of multi-drug resistant organisms causing sepsis justifies the need for this study.

MATERIALS AND METHODS

Following aseptic precautions blood will be collected in the blood culture bottle. Surface at the site of collection will be disinfected with 70% alcohol followed by 2% tincture iodine. The paediatric and adult blood culture bottles will be inoculated with 3-5 ml and 10 ml of blood from adults and children, respectively. The bottles will be then placed in BACT/ALERT machine. When the BACT/ALERT machine flags positive direct gram stain will be done. Only gram-negative bacteria are included in the study. Then the blood will be cultured in Blood and MacConkey agar and will be incubated at 37 °C aerobically for 18-24 hours. The colonies will be identified and antibiotic susceptibility will be detected by VITEK-2 automated system. Data will be analysed by using SPSS 200.

RESULTS-

Out of 2742 blood samples received in our laboratory, 325(11%) were culture positive. 129 out of the 325 blood samples showed gram negative bacteria. There were more male patients compared to female patients in the study. Female patients were about 41% and male

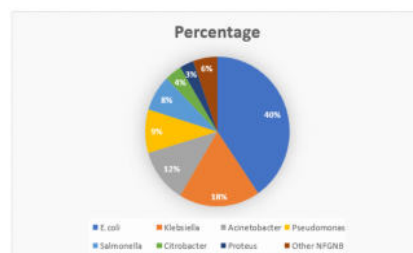
patients were about 59% in the study. More cases were from Medicine ward (52%), then from Surgery ward (27%), followed by Nephrology (11%), Neurology (7%) and from Casualty (3%).

The primary sources of infection in these cases were urinary tract infection (47%), followed by respiratory infections (15%), metabolic disorders (13%), cardio vascular infections (12.4%), gastro intestinal system infections (7.7%) and skin and soft tissue infections (4.6%)

TABLE-1: DISTRIBUTION OF CASES AMONG THE PATIENTS-

Sl NO.	Clinical Diagnosis	Cases	Percentage
1.	Urinary tract infections	61	47%
2.	Respiratory tract infections	20	15%
3.	Metabolic infections	17	13%
4.	Cardio vascular system infections	16	12.4%
5.	Gastro intestinal system infections	10	7.7%
6.	Skin & soft tissue infections	5	4.6%

The most common organism isolated was *E. coli* (40%), followed by *Klebsiella pneumoniae* (18%), *Acinetobacter* (11.6%), *Pseudomonas aeruginosa* (9.3%), *Salmonella* (7.7%), *Citrobacter* (3.8%), *Proteus* (3.1%) and other non-fermenting gram-negative bacteria (5.4%).

FIGURE-1: AETIOLOGY OF SEPSIS

ANTIMICROBIAL RESISTANCE PATTERN

The antimicrobial resistance pattern of the three most common isolates – *E. coli*, *Klebsiella* and *Acinetobacter* are shown in the table below-

TABLE-2: ANTIMICROBIAL RESISTANCE PATTERN OF ISOLATES-

ANTIBIOTICS	E. COLI (Total=52)	KLEBSIELL A (Total=24)	ACINETOBAC TER (Total= 15)
1. Ciprofloxacin Resistance	44 (84.6%)	7 (29.1%)	6 (40%)
2. Gentamicin Resistance	15 (28.8%)	10 (41.6%)	8 (53.1%)
3. Cotrimoxazole Resistance	22(42.3%)	11 (45.8%)	7 (46.6%)
4. Cefepime Resistance	30 (57.6%)	13 (54.1%)	6 (40%)
5. Piperacillin Tazobactam Resistance	8 (15.3%)	8 (33.3%)	7 (46.6%)
6. Amikacin Resistance	5 (9.6%)	6 (25%)	8 (53.1%)
7. Imipenem Resistance	7 (13.4%)	10 (41.6%)	7 (46.6%)
8. Meropenem Resistance	5 (9.6%)	8 (33.3%)	6 (40%)

DISCUSSION

Blood stream infections are one of the most serious infections in health care settings. Therefore, these infections should be detected earlier with prompt identification and antibiotic sensitivity pattern. Due to the deficiency of proper identification methods available there is a wide spread use of broad-spectrum antibiotics to treat septicaemia before the microbiology reports are available. This had led to over use of antibiotics and wide spread antibiotic resistance. To control the resistance, there should be proper surveillance of etiological agents and antibiogram of organisms causing sepsis.

The percentage of blood culture positivity in our study was 11 %. This can be compared with the study of Roy et al. (5) who obtained 16.04% and Banik et al. (6) who obtained 14.24%. Females were less compared to males in the study. Female patients were about 41% and male patients were about 59% in the study. Similarly, the study of Aroop Mohanty et al. (7) also showed male has more incidence than females. More number of cases were isolated from Medicine ward in our study. It was about 52 %. This can be due to a greater number of serious immunocompromised patients and may be due to more exposure to life saving invasive procedures in medicine ward. Similar study finding is obtained by Sakshi Shah et al (8) in her study where a greater number of patients were from medicine ward (34%).

Urinary tract infections were the most common primary source of blood stream infection in our study which was about 47% and is followed by respiratory tract infections which was about 15%. Similar results have been obtained by Bewin Oral et al (9) in his study where urinary infections followed by respiratory infections.

The most common organism isolated was E. coli (40%), followed by Klebsiella pneumoniae (18%) and Acinetobacter (11.6%). Similar results have been obtained by NIMS Jaipur (10) where the most common organism isolated was E. coli followed by Klebsiella. But in a study conducted by Meshram et al. (11) Klebsiella was the most common bacteria isolated.

ANTIBIOTIC RESISTANCE-

E. coli showed more resistance to Cephalosporins, Fluoroquinolones and to Aminoglycoside like Amikacin. The same results were obtained by Juliana et al. (12) in her study. Klebsiella shows more resistance to Cephalosporins and Cotrimoxazole. Acinetobacter shows more resistance to Aminoglycosides like Amikacin and Gentamicin.

CONCLUSION

Septicaemia is a serious life-threatening condition which requires immediate attention and the etiological agents and sensitivity pattern should be available as soon as possible to start the appropriate treatment. Blood culture is the gold standard method done to detect septicaemia in the patients. The use of BACTEC and BACT/ALERT machines for early detection of bacterial growth and use of Vitek 2 for proper identification of organism and antibiotic sensitivity with MIC had made easy for proper management of septicaemia. Clinico-microbiological profile of gram-negative organisms causing sepsis was done in this study.

The most common organism isolated was E. coli (40%), followed by Klebsiella pneumoniae (18%). The most common source of infection for septicaemia was found out to be urinary tract infection in the study. Antibiotic resistance was more commonly observed for

Cephalosporins, Fluoroquinolones and Aminoglycosides. It is very important to give antibiotics only after doing culture and sensitivity to prevent the antibiotic resistance.

CONSENT FOR PUBLICATION

Not applicable

FUNDING

There was no funding involved in this study.

ETHICAL APPROVAL

This study was approved by the Institutional Ethics Committee of Malabar Medical College and Research Centre. (CDSCO Reg.No.ECR/1248/Inst/1248/Inst/KL/2019/RR-22, DHR Reg No: EC/NEW/INST/2022/1471 and approval number-39).

CONFLICT OF INTEREST

No conflict of interest.

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