

BACTERIOLOGICAL PROFILE OF NEONATAL SEPSIS IN A TERTIARY CARE HOSPITAL OF BIHAR

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Abstract

Background: The majority of studies were done in tertiary care units with SNCU hardly contributing to it. Gradually increasing trends of MDR strains in our SNCU prompted us to do this study to evaluate the isolated organism and their antibiogram pattern in neonatal sepsis. **Materials and Methods:** This was a hospital-based observational study conducted by Department of Microbiology, SKMCH, Muzaffarpur, Bihar from January 2023 to December 2023. All neonates (<28 days of life) with blood culture positive sepsis in SNCU of the hospital were included in this study after institutional ethics committee approval. Two milliliters of blood were collected from peripheral blood with all aseptic measures in BACT/ALERT PF plus a pediatric blood culture bottle. Blood culture was done by an automated method in BACT/ALERT 3D culture system (bioMerieux, Durham, NC, USA). Diagnosis of culture-positive sepsis was confirmed after isolation of microorganisms in suspected cases of clinical sepsis. Identification and antibiotic sensitivity of isolated bacteria were done by VITEK 2 Compact Automated ID/AST instrument (bioMerieux) and interpretation was done as per the guidelines of the Clinical & Laboratory Standards Institute guidelines. **Result:** Blood culture was sent for 425 suspected neonates with clinical sepsis out of which 97 (22.8%) neonates culture-positive organisms were isolated. Gram-positive organisms were isolated in (59) 60.8% of cases of clinical sepsis. Among isolated organisms, most common was *S. aureus* followed by Coagulase negative Staphylococcus (CONS), *E. coli*, *K. pneumoniae*, *Acinetobacter baumannii*, *Enterobacter* spp., *Enterococcus* spp., and *Pseudomonas aeruginosa*. **Conclusion:** Infection control guidelines and education of healthcare staff about frequent hand washing should be reinforced. Strict antibiotic stewardship should be practiced to save the babies from the development of multi-drug resistance in the future.

INTRODUCTION

Nearly one-third of neonatal mortality in India is due to neonatal sepsis and death occurs in 30% of culture-positive neonates.^[1,2] Neonatal sepsis is classified as early onset sepsis (EOS) (<72 h) and late onset sepsis (LOS) (>72 h) based on the onset of illness. EOS occurs usually due to pathogens present in the genital tract of the mother whereas LOS occurs due to pathogens acquired either from the hospital or from the community. There is a gradually increasing trend of multi-drug resistant (MDR) pathogens in tertiary care neonatal intensive care units (NICU) and special newborn care units (SNCUs) all over India. Multi-drug resistance was defined as the acquired resistance to at least one agent in three or more antimicrobial categories as per the Centers for Disease Control and Prevention (CDC) guidelines.^[3] Strict antibiotics stewardship program will enable us to counteract multi-drug resistance patterns of emerging

pathogens. The major hallmark of antibiotic stewardship is to identify the isolated culture-positive organisms and their antibiotic sensitivity pattern. The prevalence of organism in SNCUs also differ from tertiary care NICUs in our country and it is also different from that of the Western world. Strict monitoring of bacterial flora and the resistance pattern of a unit are always required as both change very frequently. Pathogens such as *Klebsiella pneumoniae* and *Escherichia coli* are the most common cause of neonatal sepsis in India and South Asia.^[4,5] The majority of studies were done in tertiary care units with SNCU hardly contributing to it. Gradually increasing trends of MDR strains in our SNCU prompted us to do this study to evaluate the isolated organism and their antibiogram pattern in neonatal sepsis.

MATERIALS AND METHODS

This was a hospital-based observational study conducted by Department of Microbiology, SKMCH, Muzaffarpur, Bihar from January 2023 to December 2023. All neonates (<28 days of life) with blood culture positive sepsis in SNCU of the hospital were included in this study after institutional ethics committee approval. Neonates with congenital malformations were excluded from the study. Blood cultures were sent from all the babies with signs and symptoms of sepsis-like lethargy, refusal feeding, breathing difficulty, poor perfusion, seizures, and temperature instability or in any baby admitted with maternal risk factors like foul-smelling liquor, chorioamnionitis, and prolonged rupture of membrane for >24 h.^[6] Two milliliters of blood were collected from peripheral blood with all aseptic measures in BACT/ALERT PF plus a pediatric blood culture bottle. Blood culture was done by an automated method in BACT/ALERT 3D culture system (bioMerieux, Durham, NC, USA). Diagnosis of culture-positive sepsis was confirmed after isolation of microorganisms in suspected cases of clinical sepsis.^[5,7] Identification and antibiotic sensitivity of isolated bacteria were done by VITEK 2 Compact Automated ID/AST instrument (bioMerieux) and interpretation was done as per the guidelines of the Clinical & Laboratory Standards Institute guidelines.^[8] Dehydrated media and antibiotic disks were procured from Hi Media Laboratories Pvt Ltd (Mumbai, India). Disk diffusion method using ceftazidime (30 µg), cefotaxime (30 µg), ceftazidime plus clavulanic acid (30/10 µg), and cefotaxime plus clavulanic acid (30/10 µg) combination was done for the detection of extended spectrum beta lactamase (ESBL) producing strains.^[8] Strains of *S. aureus* resistant to the majority group of antibiotics such as β-lactams (penicillins, cephalosporins, and carbapenems) were defined as methicillin resistant *Staphylococcus aureus* (MRSA).^[9]

Statistical analysis

Demographic profiles such as gestation, sex, birth weight, day of onset of illness, inborn/outborn cases, isolated organisms, and their antibiogram pattern were recorded for analysis using Microsoft Excel. Multi-drug resistance pattern among each Gram-negative and Gram-positive species was described. For data collection, Microsoft Excel 2013 (Microsoft, Redmond, WA, USA) was used whereas descriptive statistics like percentages and means ± standard deviations were used to describe variables. The SPSS Statistics for Windows, version 21.0 (IBM Corporation, Armonk, NY, USA) was used for statistical analyses.

RESULTS

Blood culture was sent for 425 suspected neonates with clinical sepsis out of which 97 (22.8%) neonates

culture-positive organisms were isolated. Gram-positive organisms were isolated in (59) 60.8% of cases of clinical sepsis. The mean birth weight was 2.0 ± 1.8 kg, and the mean gestational age was 33.9 ± 6.4 weeks in neonates with culture-positive sepsis. Table 1 showed the demographic profile of the culture-positive neonates. Among isolated organisms, most common was *S. aureus* followed by Coagulase negative *Staphylococcus* (CONS), *E. coli*, *K. pneumoniae*, *Acinetobacter baumannii*, *Enterobacter* spp., *Enterococcus* spp., and *Pseudomonas aeruginosa*. [Figure 1] All Gram-negative organisms were resistant to ampicillin whereas cephalosporin resistance was found in majority of cases. Out of carbapenem-resistant Gram-negative bacilli, around 90% of organisms were sensitive to colistin. ESBL producing bacteria was isolated in 40% of neonates [Figure 2] All Gram-positive organisms are sensitive to vancomycin whereas resistance to penicillin was seen in majority of cases. The MRSA-producing strains were isolated in approximately one-fifth of the samples. [Figure 3]

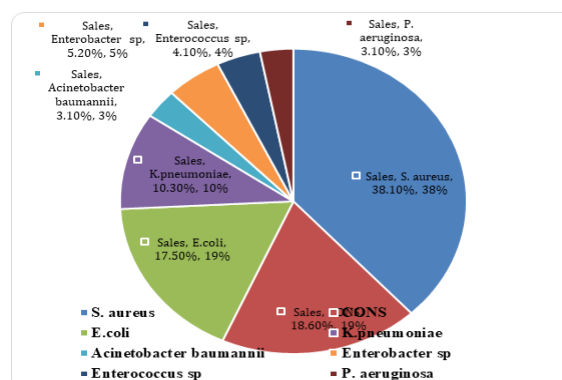


Figure 1: Distribution of culture positive samples based on the isolated organism

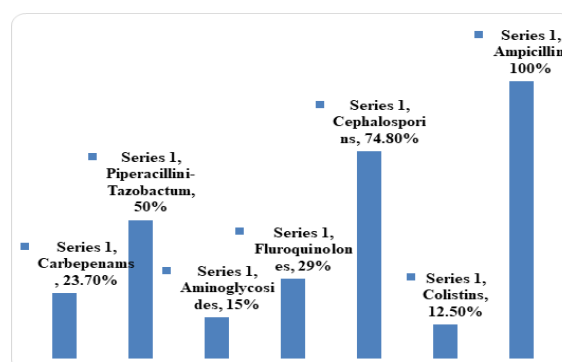


Figure 2: Resistance pattern of Gram-negative organism among culture-positive neonates

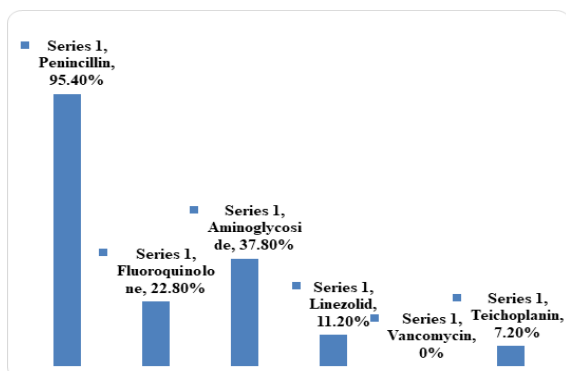


Figure 3: Resistance pattern of Gram-positive organism among culture-positive neonates

Table 1: Demographic profile of the enrolled patients (Culture positive and negative)

| Variable | | Culture report | | Total [425] |
|--------------|-------------|----------------|----------------|-------------|
| | | Positive [97] | Negative [328] | |
| Gestation | <28 weeks | 5 (5.2%) | 17 (5.2%) | 22 (5.1%) |
| | 28-32 weeks | 24 (24.7%) | 61 (18.6%) | 85 (20%) |
| | 32-36 weeks | 31 (31.9%) | 101 (30.8%) | 132 (31.1%) |
| | >37 weeks | 37 (38.1%) | 149 (45.4%) | 186 (43.8%) |
| Birth weight | <1 kg | 9 (9.3%) | 13 (3.9%) | 22 (5.8%) |
| | 1-1.5 kg | 36 (37.1%) | 62 (18.9%) | 98 (23.1%) |
| | 1.5-2.5 kg | 22 (22.7%) | 121 (36.9%) | 143 (33.6%) |
| | >2.5 kg | 30 (30.9%) | 132 (40.2%) | 162 (38.1%) |
| Gender | Male | 58 (59.8%) | 193 (58.8%) | 251 (59.1%) |
| | Female | 39 (40.2%) | 135 (41.2%) | 174 (40.9%) |
| Inborn | | 61 (62.9%) | 211 (64.3%) | 272 (64%) |
| Outborn | | 36 (37.1%) | 117 (35.7%) | 153 (36%) |

DISCUSSION

In our study, clinical sepsis was confirmed in 22.8% of cases with isolation of organisms in blood culture which is similar to other studies.^[10-12] As the majority of referral centers do not have facilities for blood cultures, the start of empirical treatment before taking a blood culture in more than 50% of cases may be the reason for sterile culture in most of the cases.

Gram-positive organisms were found in the majority (60%) of the cases similar to findings of other studies.^[13,14] But Gram-negative organisms are most commonly found in the majority of studies done in tertiary care centers in India.^[15,16] As per NNPD data, *K. pneumoniae* was the most common pathogen of neonatal sepsis, followed by *S. aureus* and *E. coli*.^[17] Newly emerging pathogens of tertiary care NICUs like non-fermenting Gram-negative bacilli were found to be very few in our study unlike other studies.^[18] The main reason for it may be due to lack of mechanical ventilation and other interventions as it is an SNCU with a level II facility. In our study, *S. aureus* was found to be the most common Gram-positive organism followed by CONS, but MRSA strain was found to be an important pathogen associated with endemic infections in other NICU population. Isolation of CONS in 20% of cases in our study may be due to contamination during sampling or during birth from the mother's birth canal. Hence healthcare staff education and infection control guidelines should be reinforced. *S. aureus* was isolated in the majority of cases in both EOS and LOS out of which MRSA was isolated in 18% of cases similar to other studies.^[19] It could be due to poor personal hygiene. Isolation of *S. aureus* in inborn

cases may be the result of a lack of strict hand washing, infrequent or improper sterilization, and cleaning of ICU.

In our study, Gram-negative and Gram-positive organisms were resistant to ampicillin in approximately 100% of cases. Resistance of Gram-negative organisms to cephalosporins was found in 75% of cases which is similar to the resistance pattern found in a study by Pavan Kumar et al.^[14] Starting of antistaphylococcal antibiotics as empirical therapy should be considered in view of the high prevalence of *Staphylococcus* as a causative organism in both EOS and LOS. Due to gradually increasing resistance to extended-spectrum cephalosporins, there is a need to change the choice of empirical antibiotics policy. The prevalence of ESBL producing bacteria in our study was 40% which is lower than other studies in India.^[20,21]

CONCLUSION

It is important to analyze the blood culture report and its sensitivity pattern as well as to formulate local antibiotic usage for better clinical outcomes. *S. aureus* followed by CONS were found to be the most common cause of sepsis in SNCUs. A high degree of resistance of organisms to penicillins and cephalosporins calls for a re-evaluation of antibiotic policy and protocols for empirical treatment in neonatal sepsis. Infection control guidelines and education of healthcare staff about frequent hand washing should be reinforced. Strict antibiotic stewardship should be practiced to save the babies from the development of multi-drug resistance in the future.

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