

# A Prospective Analysis of Microbial Profile of Neonatal Sepsis at a Tertiary Care Teaching Hospital

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## ABSTRACT

**Background:** Neonatal sepsis is defined as a clinical syndrome of bacteremia with systemic signs and symptoms of infection in the first 4 weeks of life. Septicemia occurs in 2.3% of intramural live births. Over 40% of the under-5 deaths globally occur in the neonatal period.

**Aim of the study:** To assess microbial profile of neonatal sepsis.

**Materials and Methods:** The study was conducted in the Department of Microbiology, SMS Medical College, Jaipur, Rajasthan, India. For the study, we conducted an analysis on all the blood culture reports obtained from newborns admitted to the Department of Pediatrics and the Neonatal Intensive Care Unit (NICU) for the study period. All the neonates who were suspected to be having septicemia, underwent blood culture. Standard method was used to identify the gram staining of the bacterial growth. The cultures which did not show any growth for seven days were reported as negative culture.

**Results:** A total of 200 newborns were admitted to the Department with clinical symptoms of neonatal sepsis. Positive blood cultures were seen in 39 cases. Among the positive cultures, 21 were males and 18 were females. Out of 39 cases,

25 cases were early onset sepsis and 14 were late onset sepsis. 20 cases had gram negative bacilli and 19 cases had gram positive cocci.

**Conclusion:** From the results of present study, this can be concluded that most common cause of neonatal sepsis are Klebsiella and coagulase negative staphylococci.

**Keywords:** Neonatal Sepsis, Blood Culture, Neonatal Infections.


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## INTRODUCTION

Neonatal sepsis is defined as a clinical syndrome of bacteremia with systemic signs and symptoms of infection in the first 4 weeks of life.<sup>1</sup> Septicemia occurs in 2.3% of intramural live births.<sup>2</sup> Over 40% of the under-5 deaths globally occur in the neonatal period.<sup>3</sup> The World Health Organization estimates that >1 million neonatal deaths worldwide annually are caused by severe infections, and ~1 million deaths are due to neonatal sepsis or pneumonia alone. In developing countries, unsafe birthing practices have critical role to cause neonatal infections. Globally, the neonatal morbidity and mortality cases have been estimated to 2.5–3 million, annually.<sup>4</sup> Neonatal mortality rate (NMR) distribution disparities can be seen based on socioeconomic, educational and geographical parameters.<sup>5</sup>

Neonatal sepsis is broadly divided into two types according to age of onset: Early-onset sepsis (<72 hrs) and late-onset sepsis (≥72 hrs-28 days). Early-onset sepsis is acquired during fetal life, delivery, or at the nursery.<sup>6</sup> Neonatal sepsis is caused by a variety

of Gram-positive as well as Gram-negative bacteria, and sometimes yeasts. The spectrum of organisms that causes neonatal sepsis changes over times and varies from region to region. This is due to the changing pattern of antibiotic use and changes in lifestyle.<sup>7</sup>

Hence, the present study was conducted to assess microbial profile of neonatal sepsis.

## MATERIALS AND METHODS

The study was conducted in the Department of Microbiology, SMS Medical College, Jaipur, Rajasthan, India. The ethical clearance for study protocol was obtained from ethical committee of the institution. For the study, we conducted an analysis on all the blood culture reports obtained from newborns admitted to the Department of Pediatrics and the Neonatal Intensive Care Unit (NICU) for the study period. All the neonates who were suspected to be having septicemia, underwent blood culture. For blood

culture, a sample was collected from a peripheral vein using aseptic technique. The blood culture was done in a brain heart infusion broth and was incubated at 37-degree C. The subcultures were done on sheep blood agar and MacConkey agar if the indications of growth were noticed at days 1, 4, and 7. Standard method was used to identify the gram staining of the bacterial growth. The cultures which did not show any growth for seven days were reported as negative culture.

The statistical analysis of the data was done using SPSS version 11.0 for windows. Chi-square and Student's t-test were used for checking the significance of the data. A p-value of 0.05 and lesser was defined to be statistical significant.

**RESULTS**

A total of 200 newborns were admitted to the Department with clinical symptoms of neonatal sepsis. Positive blood cultures were seen in 39 cases. Among the positive cultures, 21 were males and 18 were females. Out of 39 cases, 25 cases were early onset sepsis and 14 were late onset sepsis. Table 2 shows the detailed microbiological profile of the 39 cases positive for blood culture. 20 cases had gram negative bacilli and 19 cases had gram positive cocci. The most common Gram-negative and Gram-positive organisms were Klebsiella spp. and coagulase negative staphylococci. The results were statistically non-significant (p>0.05).

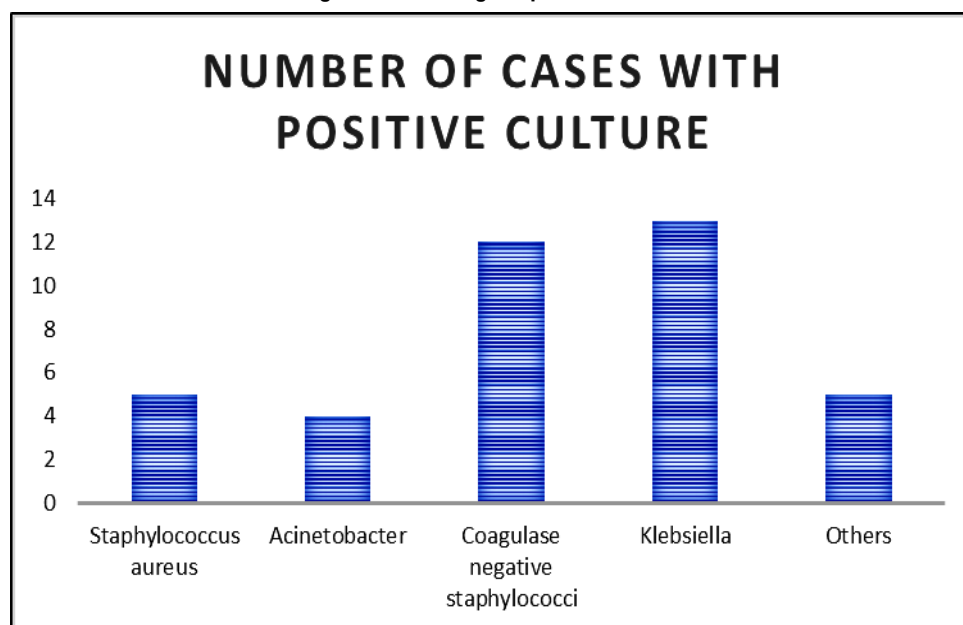
**Table 1: Demographic data of the cases for the study**

Demographic variables	n
Total number of cases admitted to hospital	200
Number of cases with positive blood culture	39
Number of males with positive blood culture	21
Number of females with positive blood culture	18
Early onset sepsis	25
Late onset sepsis	14

**Table 2: Microbiological profile of the cases with positive blood culture**

Organisms	Number of cases with positive culture	p-value
Staphylococcus aureus	5	0.21
Acinetobacter	4	
Coagulase negative staphylococci	12	
Klebsiella	13	
Others	5	
Total	39	

**Fig 1: Microbiological profile of cases**



## DISCUSSION

In the present study, we observed that 39 cases were positive for blood culture. 21 cases were male neonates and 18 were females. 25 cases were early onset sepsis and 14 cases were late onset sepsis. The most common Gram-negative and Gram-positive organisms were *Klebsiella* spp. and coagulase negative staphylococci. The results were compared with previous studies. Al-Shamahy HA et al investigated the organisms causing sepsis in the Neonatal Unit at Al-Thawra Hospital, Sana'a, Yemen, determine their resistance to antibiotics, and recommend policy for empirical treatment. A total of 158 neonates having one or more signs of sepsis, and aged from 0 to 28 days, were enrolled in this study. A blood sample was taken from each subject, cultured, and then antibacterial susceptibility tests were performed for isolates. 90 (57%) cases yielded positive cultures. Early-onset sepsis showed higher positive culture results (61.7%) than late-onset sepsis (32%). Significant positive culture results were found among the group with birth weight 0.9–2 Kg (78.6%). Gram negative bacteria constituted 97.8% of the total isolates, of which *Klebsiella pneumoniae* was the predominant pathogen (36.7%), followed by *Pseudomonas* species (30.0%). The commonest symptoms among the cases were respiratory distress (72.2%), jaundice (62.2%), cyanosis (51.1%), and lethargy (47.8%); the mortality rate was 27.8%. All Gram negative bacterial isolates were sensitive to imipenem and some isolates were sensitive to fourth-generation cephalosporins, but most isolates were highly resistant to the majority of other antibiotics tested. They concluded that gram negative organisms were the most frequent causative agents of bacterial sepsis, which is a significant cause of mortality and morbidity in the newborn, and particularly in those of very low birth weight. It can also be concluded that imipenem and fourth-generation cephalosporins can be used for empirical treatment of bacterial sepsis.<sup>8</sup>

G/Eyesus T et al identified bacterial etiologic agents, their antimicrobial susceptibility pattern and associated risk factors of neonatal sepsis among neonates. A cross-sectional study was conducted among neonates suspected to sepsis attending University of Gondar Hospital from September/2015 to May/2016. A total of 251 consecutive neonates with clinical sign and symptoms of sepsis were included in the study. Blood sample was collected and directly inoculated into Tryptone soya broth bottle and incubated at 37 °C. After 24 h of incubation it was sub-cultured in to blood agar plate, chocolate agar plate, manitol salt agar and Macconkey. The bacterial pathogens and antimicrobial susceptibility tests were identified using standard microbiological methods. Bivariate and multivariate logistic regressions were used to identify possible associated risk factors. Prior to the study ethical clearance was obtained from the School of Biomedical and Laboratory Sciences, University of Gondar. Of the 251 study participants suspected of neonatal sepsis, 117 (46.6%) showed bacterial growths, of them 120 bacteria were isolated. Gram positive bacteria were commonly isolated 81 (67.5%). The commonly isolated bacterial species were *S. aureus* 49 (40.8%) followed by coagulase negative Staphylococci 26 (21.6%) and *K. pneumoniae* 19 (15.8%). The overall rate of multidrug resistance isolates was 78 (65%: CI 95%: 56.7–72.5%). Multidrug resistant (MDR) among Gram positive and negative bacteria were 56 (69.1%) and 22 (56.4%), respectively. Independent risk factors for the occurrence of neonatal sepsis were; Apgar score < 7/5 min,

birth weight < 1.5 kg, birth weight, 1.5–2.5 kg, gestational week < 37 weeks and caesarian section delivery. They concluded that the isolation rate of bacterial pathogens in neonatal sepsis was considerably high. In addition, nearly 70% of isolates were MDR strains. Low birth weight, low Apgar score, preterm delivery and caesarian section modes of delivery were associated risk factors. Therefore, appropriate antenatal care follow up, and health education should be encouraged, especially on the importance of natural way of delivery.<sup>9</sup>

Muley VA et al determined the bacteriological profile and antimicrobial susceptibility pattern of prevalent pathogens isolated from the blood of septicemic neonates from Neonatal Intensive Care Unit (NICU). A total of 180 blood samples of septicemic neonates were studied bacteriologically. Antimicrobial susceptibility testing was done by the Kirby Bauer disc diffusion method in accordance to Clinical Laboratory Standards Institutes (CLSI) guidelines. 26.6% (48 out of 180) cases of septicemia could be confirmed by blood culture. Of these, 66.7% cases were of early onset septicemia (EOS) and 33.3% were of late onset septicemia (LOS). *Klebsiella pneumoniae* was the predominant pathogen (35.4%) among the Gram-negative pathogens and *Staphylococcus aureus* (22.9%) was the predominant Gram-positive pathogen. 28% of *K. pneumoniae* and *E. coli* isolates were extended spectrum beta-lactamase (ESBL) producers. 18.1% of the *Staphylococcus* isolates were methicillin-resistant *S. aureus* (MRSA). Multi-drug-resistance pattern was observed with all the isolates. They concluded that Ciprofloxacin and aminoglycosides were the most effective drugs against Gram-positive and Gram-negative isolates. This study highlights the predominance of Gram-negative organisms in causing neonatal sepsis and emergence of multi-drug-resistant strains in our set up.<sup>10</sup>

Pavan Kumar DV et al detected the common causative microorganisms of neonatal sepsis and their antimicrobial resistance patterns in a rural secondary hospital in Tamil Nadu, India. Neonates (0–28 days) admitted to this newborn care unit from October 2013 to September 2015, with a diagnosis of probable sepsis were studied. All the enrolled babies had blood cultures taken and were followed up till final outcome, which was discharge or death, irrespective of culture result. Univariate analysis was performed for factors associated with culture positivity, generating odds ratios, and confidence intervals. Among the 107 babies with a diagnosis of probable sepsis, 28 (26.2%) had shown bacteria in culture. The majority (94.4%) were of early-onset sepsis. The predominant organisms were *Staphylococcus aureus* (10/28) and *Klebsiella* (6/28). 100% of Gram-negative bacilli and 90% of *Staphylococcus* were resistant to Ampicillin. Gentamicin resistance among Gram-negative bacilli and *Staphylococcus* was 52.9% and 20%, respectively, while third-generation cephalosporin resistance was 31.2% and 20%, respectively. Among the neonates diagnosed as probable sepsis, idiopathic prematurity was found to have a statistically significant association with culture-positive sepsis. They concluded that the culture positivity rate among the neonates with probable sepsis in the current study was 26%. An alarmingly high degree of antibiotic resistance observed calls for robust infection control practices and an urgent evaluation and development of individual and national antibiotic policies for neonatal sepsis.<sup>11</sup>

## CONCLUSION

From the results of present study, this can be concluded that most common cause of neonatal sepsis are Klebsiella and coagulase negative staphylococci.

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