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Original Research Article

Bacteriological profile and antibiotic susceptibility pattern of neonatal septicaemia-a prospective study

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ABSTRACT

Background: Neonatal sepsis is one of the major cause of mortality and morbidity Globally, objective of this prospective study was to evaluate the microorganisms profile involved in neonatal septicemia and their antibiotic susceptibility.
Methods: This prospective study conducted in neonate admitted to Mahatma Gandhi Mission Medical College and Hospital Aurangabad Maharashtra in NICU, from June 2021 to May 31, 2022. Data was analysed by percentages of each antibiotic used. And which organism was responsible for neonatal sepsis.
Results: In this study we have found that high bacterial prevalence of *Klebsiella* at 36%, *Enterococci* at 23.5 and staph aureus at 19.8% in neonatal sepsis. While the antibiotics most used was Piperacillin and tazobactam, meropenam, colistin, cefotaxime, amikacin. In our setting we found that bacteria are still sensitive to third generation cephlosporings.
Conclusions: From our study we can conclude that, in our tertiary care hospital *Klebsiella* is major cause of neonatal sepsis, along with-it sensitivity with effectiveness of cephalosporin.

Keywords: Neonatal sepsis, Antibiotics, Microorganism

INTRODUCTION

The major cause of mortality in neonates is neonatal sepsis in developing countries. It may be presented nonspecific clinical signs and may lead to severe consequences.[1-4] According to Global Health Observatory data suggest, in 2016, 2.6 million neonates died. Prematurity, low birth weight, infections, asphyxia and birth trauma are main cause of neonatal death. Around one third death in neonates world widely cause by sepsis.[5] Definition of neonatal septicemia is a clinical syndrome characterized by systemic signs and symptoms of inflammatory response following the appearance or confirmation of infection during the first month of life.[6,7]

There is atypical presentation of early signs and symptoms of neonatal infection especially sepsis it lack specificity. The symptoms are like primary apnea, simple febrile disease, feeding intolerance, anemia and other non-infectious diseases, which are difficult to diagnose which is responsible for delay in treatment or may lead to overtreatment.[8,9] Early diagnosis of neonatal septicaemia and initiation of proper antibiotic is main in treatment.

There is variation in microorganisms which cause sepsis. In developing countries *Klebsiella paneumonie* is the

most common organism.[10] The study conducted in China; it was found that. In earlier studies in China, *Klebsiella pneumoniae* and *Staphylococcus aureus* was the common organism responsible for neonatal sepsis, same as in India.[10] In developed countries In the United States and Australia, group B *Streptococcus* was considered as the most common pathogenic bacteria causing neonatal septicemia.[11,12] Acinetobacter is becoming increasingly important as a potential pathogen in neonatal septicaemia in recent years, due to frequent isolation.[13] Nevertheless, there is little evidence to evaluate the clinical outcome role of microbiological characteristics in the neonatal septicemia. Long-term hospitalizations (mainly in ICUs), highly complex and invasive procedures, and the great need for broad-spectrum antibiotics, neonatal septicaemia generates enormous expenses for the health system and great burden on country health system.[14] To avoid antibiotic resistance accurate and evaluation of diagnosis of neonatal septicaemia required. Proper treatment plan has great help for, shortening the NICU hospitalization time, and reducing the disease burden.

The aim of this study was to evaluate the microorganisms profile involved in neonatal septicemia and their antibiotic susceptibility pattern, in neonatal septicemia. This study may be helpful for the diagnosis and starting appropriate treatment plan or good supportive care for neonatal septicaemia in clinician.

METHOD

A prospective analysis of neonate admitted to Mahatma Gandhi Mission medical college and hospital Aurangabad Maharashtra in NICU, from June 2021 to May 31, 2022, was performed, after getting the ethical clearance from institutional ethics committee. We identified patients who met the inclusion criteria of being referred and admitted to the MGM NICU during June 2021 to May 2022 with sepsis or other clinical diagnosis of infection. Other patient who had jaundice, low birth weight was excluded. Neonatal sepsis conformed on the clinical and laboratory indicators regarding infection. Demographic data included birth weight, gestational age, postnatal age, and treatment as well as survival outcome. Clinical and laboratory data included the number of days between birth and admission to the NICU, admitting and discharge diagnoses, and pharmacological treatment. Neonates were classified as having proven sepsis, probable sepsis, or other infection. We defined proven sepsis based on clinical signs, laboratory findings, and confirmation by blood culture. A positive blood culture was considered growth within 5 days on BacT/ALERT PF culture medium using minimum of 0.5 cc of blood with 2 cultures performed if possible. Patients with clinical symptoms and/or laboratory findings with no growth on culture medium were considered to have probable sepsis. Other infections were defined by clinical diagnosis. Culture-positive sepsis was categorized as early onset sepsis, defined as 0-6 days, and late onset sepsis, defined as 7 days-3 months. Only patient data from those admitted in study period included pharmacological treatment information.

The data was analysed by percentage.

RESULTS

There were 360 neonates admitted to the NICU between May 2021 to June 2022 and 360 (68.1%) were diagnosed with any infection (Figure 1). Of total admissions, 45% were diagnosed with proven sepsis or probable sepsis. Out of the 162 proven sepsis cases, 91 cases (56.9%) were early onset and 71 cases (43%) were late onset. Of probable sepsis cases, Various demographics of neonates in our sample are summarized here and table 1. Of 162 admitted in MGM during May 2021-June 2022 periods, 161 were discharged and 1 expired. Of these, 61% were male, 19% were born by C-section, and the most common diagnosis was “other infection” which included acute bronchiolitis, bronchopneumonia, and pneumonia. A majority of neonates were born at or near term; 21% were born premature. In addition, 70% of neonates were born weighing between 2.00 and 3.50 kg, 1% were born above 4.0 kg, and 29% weighed between 1.00-1.5 kg.

Almost half (n=74.5,46%) of the 161 total patients admitted during 2022 were treated with Piperacillin and tazobactam combination during their stay, and 31% were treated with meropenam. Neonates with a gestational age under 37 weeks were treated with an average of 3.24 antibiotics, while neonates with a gestational age between 37 and 42 weeks were treated with an average of 1.93 antibiotics. Table 3 demonstrates that in cases of proven sepsis there was a high bacterial prevalence of Klebsiella at 36%, *Enterococci* at 23.5 and staph aureus at 19.8% notably with no cases of group B *Streptococcus* reported. *Klebsiella* species also comprised 25% of the bacterial profile for proven of early and late onset sepsis.

Most common antibiotics in our NICU is Piperacillin and tazobactam, meropenam, colistin, cefotaxime, amikacin.

Table 1: Demographic data.

Characteristics	N
Total	162
Gender	
Male	93
Female	69
Gestational age (Weeks)	
Preterm (<37)	34
Term (37 up to 42)	127
Mode of delivery	
Normal	131
Caesarean section	31
Onset	
Early	91
Late	71

Patients admitted in 2021 with early onset sepsis were treated with an average of 4.27 antibiotics, with 93.1% receiving piperacillin and tazobactam 87.3% receiving a meropenam, and 52.4% receiving cefotaxim.

Of these patients. In addition, most patients with early onset sepsis were treated with combination of piperacillin and tazobactam, or cefotaxim with the colistin and amikacin.

Patients with late onset sepsis treated with an average of 3.15% antibiotics, with 80.1% receiving piperacillin and tazobactam, 79% receiving, meropenam, 54% cefotaxim and 12% colistin and 54% amikacin.

Table 2: Bacteriological profile in neonatal septicaemia.

Microorganism	Early, (n=91)	Percentage (%)	Late, (n=71)	Percentage (%)	Total	Percentage (%)
Coagulase-negative *Staphylococci*	-	-		-	-	-
Klebsiella	31	34	27	38	58	36
Serratia marcescens	2	2	1	2	3	1.8
S. aureus	15	16	17	24	32	19.8
Acinetobacter	9	10	2	3	11	6.8
Achromobacter	7	7	1	1	8	4.9
Enterococci	20	23	18	25	38	23.6
Pseudomonas	4	4	4	7	8	4.9
E. coli	1	1	-	-	1	0.62
Other	2	3	-	-	2	1.24

Table 3: Percentage of patients treated by various antibiotics.

Antibiotics	Early onset sepsis (%)	Late onset sepsis (%)
Piperacillin and tazobactam	93.1	80.1
Meropenam	87.3	79
Colistin	10	12
cefotaxime	52.4	54
Amikacin	43	54

DISCUSSION

Neonatal infection by systemic infections is around 1.6 million every year, mostly in middle- and low-income countries.[15] Research studies in South-east Asian reported high resistance to antibiotics used commonly for empirical treatment of neonatal sepsis.[16] Most of the studies stated that widespread use of third-generation cephalosporins and lack of reliance on blood culture reports could be a major cause for this resistance. This study was planned to evaluate causative organisms of neonatal sepsis and their antibiotic sensitivity pattern in a setting with third-generation cephalosporin use because now a days in clinical practices negligible amount of third generation cephalosporin are use.

Incidence of blood culture proven sepsis was comparable to the largest dataset reported from tertiary care hospitals of India.[17] EOS constituted majority (85%) of culture-proven cases in our study as we included only intramural babies. The spectrum of pathogens in India and south-east Asian countries is different from Western data where group B *Streptococci* and coagulase negative *Staphylococci* (CONS) predominant pathogens.[18] Gram-negative bacilli are predominant pathogens in developing countries with *K. pneumoniae* being the most common.[17]

Our study shows the same result. Recently, *S. aureus* has emerged as predominant pathogen in studies from developing countries.[20,21] This changing pattern of organisms from gram negative to gram positive has been attributed to prolonged stay, improved intensive care facilities and invasive procedures.[21] The higher rates of *S. aureus* sepsis in both EOS and LOS and a similar profile of isolated bacteria indicate that majority of EOS in inborn babies may be hospital-acquired rather than maternally acquired.[22] We observed high resistance to oxacillin but good sensitivity to piperacillin and tazobactam, among cefotaxime and meropenem active against *S. aureus* isolates. While colistin active for enterobactor and *E coli*. Low cephalosporin resistance was noticed in this study.

Major limitation of our study was sample size, this is time bound study, so the patient number was limited. This type of study should be conducted in larger number of patients, it will be helpful for more accurate data.

CONCLUSION

From our study we conclude that the causative organism for neonatal sepsis is same pattern as mention in old literature. The judicial use or limited use of the antibiotics

can decrease the resistance pattern in the bacteria. As in our setup third-generation cephalosporin is still sensitive.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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