

Clinical and Bacteriological Profile of Neonatal Sepsis in a Tertiary Care Hospital

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Abstract

Introduction: Neonatal sepsis is defined as an invasive bacterial infection occurring in the first 4 weeks of life. The incidence of neonatal sepsis varies in different countries. It varies from 2.7/1000 live birth in developed countries to 10-15/1000 live birth in developing countries.

Aim: To determine the clinical and bacteriological profile of neonatal septicemia and the antibiotic susceptibility of organisms.

Materials and Methods: This is a retrospective study. All the case records meeting the eligibility criteria were analyzed for 1 year.

Results: The incidence of Gram-negative sepsis was more than Gram-positive sepsis. *Klebsiella* was the most common organism isolated. The Gram-negative isolates showed good sensitivity to piperacillin-tazobactam and ciprofloxacin and showed high resistance to ampicillin. The Gram-positive organisms showed high sensitivity to vancomycin.

Conclusion: *Klebsiella* and *Staphylococcus aureus* were the most common organisms isolated. The Gram-negative organisms showed good sensitivity to piperacillin-tazobactam and ciprofloxacin, while the Gram-positive organisms showed good sensitivity to vancomycin.

Key words: Antibiotics, Neonates, Sensitivity, Sepsis

INTRODUCTION

Neonatal sepsis is the most common cause of neonatal mortality. It is responsible for 30-40% of neonatal deaths in developing countries.^{1,2} The incidence of sepsis is 30 per thousand live births according to the National Neonatal Perinatal Database. Newborn babies develop sepsis due to various maternal and neonatal risk factors. Maternal risk factors are prolonged rupture of membranes, febrile illness in the mother during or within 2 weeks of delivery. Neonatal risk factors include prematurity, low birth

weight, and asphyxia; neonatal sepsis is caused by various microorganisms such as Gram-positive and Gram-negative bacteria and yeasts.³ Neonatal sepsis can be divided into early onset sepsis (EOS) or late onset sepsis (LOS) depending on the onset is during the first 72 h or later. EOS occurs due to ascending infection following rupture of membranes or during the passage of the baby through the infected birth canal. EOS is mainly caused by group B streptococci and *Escherichia coli*. LOS occurs as nosocomial infection from the nursery or lying in ward. It is mainly caused by Gram-negative bacilli. The organisms causing neonatal sepsis differ in different places and the antibiotic susceptibility also varies. Antibiotic resistance has become a major concern worldwide. Early institution of antibiotic therapy based on rational protocol will go a long way in reducing mortality and morbidity in cases of neonatal sepsis. Hence, this study was undertaken to study the bacteriological profile and their antibiotic susceptibility pattern. The clinical profile of neonatal sepsis was also studied.

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Aim

To determine the clinical and bacteriological profile of neonatal septicemia and the antibiotic susceptibility of organisms.

MATERIALS AND METHODS

The retrospective observational study was performed in the Department of Pediatrics and Department of Microbiology at Government Kilpauk Medical College, Chennai, Tamil Nadu. Case records of babies who were admitted with features suggestive of neonatal sepsis during the period of January 2015 to December 2015 were analyzed. Babies, who had received antibiotics already, were excluded from the study. A detailed history including the risk factors, mode of delivery, gestational age, and clinical presentation was taken from the case records. Physical examination findings, as documented in the case records, were recorded. Blood samples were taken before starting the babies on antibiotics. Antimicrobial susceptibility was performed as per the CLSI guidelines.

Table 1: Distribution of neonates as per gender

Distribution	Suspected cases	Culture positive
Total number of babies	398	143
Number of male babies (%)	247 (62)	86 (60)
Number of female babies (%)	151 (38)	57 (40)

Table 2: Distribution of neonates according to mode of delivery

Type of delivery	Suspected cases	Culture positive
Total number of babies	398	143
Vaginal delivery (%)	167 (42)	66 (46)
LSCS (%)	231 (58)	77 (54)

LSCS: Lower segment cesarean section

Table 3: Distribution of neonates according to gestational age

Gestational age (weeks)	Suspected cases (%)	Culture positive (%)
<37	227 (57)	87 (61)
>37	171 (43)	56 (39)

Table 4: Distribution of neonates according to birth weight

Birth weight (g)	Suspected cases (%)	Culture positive (%)
<2550	211 (53)	83 (58)
>2500	187 (47)	60 (42)

RESULTS

A total of 398 babies were enrolled during the study period. In both suspected cases of sepsis as well as culture positive cases majority of the babies were male babies (Table 1). The incidence was more in babies delivered by cesarean section as compared to vaginal delivery (Table 2). Prematurity and low birth weights were major risk factors in both the groups (Tables 3 and 4).

Poor feeding, respiratory distress, and hypothermia were the major clinical features associated with both the groups (Table 5).

Blood culture was positive in 143 cases (35.9%). Among the culture positive cases, EOS was found in 62% of cases while LOS was found in 38% of the cases. Gram-

Table 5: Clinical features

Clinical feature	Suspected cases (%)	Culture positive cases (%)
Poor feeding	310 (78)	100 (70)
Respiratory distress	223 (56)	86 (60)
Seizures	28 (7)	20 (14)
Jaundice	48 (12)	13 (9)
Hypothermia	139 (35)	40 (28)

Table 6: Distribution of organisms isolated from blood culture

Microorganism	n (%)
Gram-positive isolates	46 (32.16)
<i>Staphylococcus aureus</i>	26 (18.18)
CONS	20 (13.98)
Gram-negative isolates	93 (65.03)
<i>Klebsiella</i>	53 (37.06)
<i>Acinetobacter</i>	21 (14.68)
<i>Escherichia coli</i>	12 (8.39)
<i>Pseudomonas</i>	7 (4.89)
<i>Candida</i>	4 (2.79)

CONS: Coagulase negative staphylococci

Table 7: Organisms causing EOS and LOS

Organism	EOS	LOS
<i>Klebsiella</i>	38	15
<i>Staphylococcus aureus</i>	19	7
<i>Acinetobacter</i>	14	7
CONS	7	13
<i>Escherichia coli</i>	9	3
<i>Pseudomonas</i>	2	5
<i>Candida</i>	0	4
Total (%)	89 (62.2)	54 (37.8)

LOS: Late onset sepsis, EOS: Early onset sepsis, CONS: Coagulase negative staphylococci

Table 8: Antibiotic sensitivity

Antibiotics	Organisms (%)					
	<i>Klebsiella</i> (43)	<i>Staphylococcus aureus</i> (26)	<i>Acinetobacter</i> (21)	CONS (20)	<i>Escherichia coli</i> (12)	<i>Pseudomonas</i> (7)
Piperacillin tazobactam	33 (76.74)	16 (61.53)	12 (57.14)	4 (20)	7 (58.33)	4 (57.14)
Ciprofloxacin	22 (51.16)	14 (53.84)	11 (52.38)	13 (65)	6 (50)	3 (42.85)
Amikacin	16 (37.20)	8 (30.76)	7 (33.33)	11 (55)	4 (33.33)	4 (57.14)
Gentamicin	13 (30.23)	6 (23.07)	3 (14.28)	7 (35)	3 (25)	2 (28.57)
Vancomycin	-	25 (96.15)	1 (4.76)	18 (90)	-	-
Imipenem	7 (16.27)	-	16 (76.19)	1 (5)	9 (75)	5 (71.42)
Cefotaxime	14 (32.55)	6 (23.07)	7 (33.33)	2 (10)	5 (41.66)	2 (28.57)
Ceftriaxone	16 (37.20)	7 (26.92)	9 (42.85)	1 (5)	4 (33.33)	3 (42.85)
Ceftazidime	7 (16.27)	-	2 (9.52)	-	6 (50)	4 (57.14)
Cefoperazone	8 (18.60)	1 (3.84)	5 (23.80)	-	3 (25)	2 (28.57)
Ampicillin	9 (20.93)	3 (11.53)	3 (14.28)	7 (35)	4 (33.33)	1 (14.28)

CONS: Coagulase negative staphylococci

negative bacteria (65.03%) were more frequently isolated than Gram-positive bacteria (32.16%) *Klebsiella pneumoniae* (37.06%) was the most commonly isolated organism followed by *Staphylococcus aureus* (18.18%) and *Acinetobacter* (14.68%) EOS was caused by *Klebsiella* followed by *S. aureus* and *Acinetobacter*. LOS was caused by *Klebsiella* followed by coagulase-negative staphylococci (CONS). *Candida* was isolated in 4 cases (Tables 6 and 7).

Antibiotic sensitivity, in 43 *Klebsiella* cases; 76.74% cases are sensitive to piperacillin-tazobactam, 22% are sensitive to ciprofloxacin (Table 8).

DISCUSSION

Sepsis is an important cause of neonatal morbidity and mortality. The incidence and the causative organisms of sepsis vary from place to place. A number of male babies were found to be affected as compared to the female babies in our study. Similar male preponderance has been reported in other studies also.^{4,5} The incidence of sepsis was found to be more in preterm babies and low birth weight babies. This is in accordance with other studies that have been done previously.^{5,6} Presentation of sepsis varies depending on the severity of disease process and the immune status of the baby. Poor feeding, respiratory distress, and hypothermia were the major presentations in our study. Jain *et al.*⁷ have reported respiratory distress and lethargy as the predominant features in their study. Blood culture is the gold standard for the diagnosis of neonatal sepsis. The culture positivity rate varies in different places. In our study, the culture positivity was 35.9%. This is similar to other studies which have shown a similar culture positivity rate.^{8,9} EOS was found in 62.2 % of the cases while LOS was found in 37.7% of the cases in our study. Chugh *et al.*¹⁰ have also reported number of EOS in their study than LOS. Other studies have reported a higher incidence of EOS than LOS.¹¹ EOS was caused by *Klebsiella*

followed by *S. aureus*. LOS was caused by *Klebsiella* followed by CONS. Overall, the incidence of Gram-negative sepsis (65.03%) was more than Gram-positive sepsis (32.16%) in our study. This is similar to another study done by Joshi *et al.*¹² The most common organism isolated in our study was *Klebsiella*. The National Neonatal Perinatal Database also states that *Klebsiella* is the most common organism causing neonatal sepsis.¹³ However, a study by Marwah *et al.*¹⁴ found *S. aureus* as the most common organism. The Gram-negative organisms showed good sensitivity to piperacillin-tazobactam and ciprofloxacin and high resistance to ampicillin. This finding is similar to another study done by Rao *et al.*¹⁵ The Gram-positive organisms showed very high sensitivity to vancomycin. Another study was done by Shah *et al.*¹⁶ also showed similar findings.

CONCLUSION

In our study, Gram-negative organisms were the predominant organisms causing neonatal sepsis. *Klebsiella* was the predominant Gram-negative organism causing neonatal sepsis. *S. aureus* was the predominant Gram-positive organism causing sepsis. Organisms causing neonatal sepsis and their antibiotic susceptibility vary from place to place. Each neonatal unit should have its own antibiotic policy based on antibiotic susceptibility studies. This will help the pediatricians to choose appropriate empirical treatment for the management of neonatal sepsis. This will also avoid the use of irrational drugs and help in reducing drug resistance.

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