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ORIGINAL ARTICLE

BACTERIOLOGICAL PROFILE OF NEONATAL SEPSIS: A HOSPITAL BASED STUDY OF NICU, KRISHNA INSTITUTE OF MEDICAL SCIENCES, KARAD, MAHARASHTRA

C. D. Aundhakar[1], Anand Patil[2], Jaiom Dagar[3], G. S. Karande[4]

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ABSTRACT: INTRODUCTION: As many as 2% of foetus are infected in utero, and up to 10% of infants have infections in the 1st month of life. Neonatal sepsis is a major cause of mortality and morbidity in newborn. The reported incidence of nosocomial sepsis in India ranges from 1.5-37%. Klebsiella is emerging as an important cause of nosocomial sepsis. Outcome depends upon weight, maturity of neonate, type of etiologic agent, antibiotic sensitivity, adequacy of specific and supportive therapy. **OBJECTIVE:** To evaluate various microorganisms associated with sepsis in neonates admitted in NICU. **MATERIALS AND METHODS:** This is a retrospective, observational analysis of all babies admitted to NICU KIMS, Karad, showing clinical features of sepsis, in whom laboratory investigation was suggestive of the diagnosis of sepsis during a 3 year study period from July 2011 to June 2014. **RESULTS:** A total of 1945 neonates were admitted during the study period. Out of these 216 were enrolled in the study, 28 were lost during follow up. The male female ratio of culture proven sepsis was 1.6:1. It was most commonly noted between 1000-1500 grams. Septic screen was positive in 86.87%, CRP (79.70%), blood culture (62.50%). Early onset sepsis was most commonly observed in 50.5% cases, with most common organism being klebsiella pneumonia (41.3%). Mortality due to neonatal sepsis was 17.59% in our study.
KEYWORDS: Sepsis, Micro-organisam, NICU, Mortality.

INTRODUCTION: Neonatal sepsis is an important cause of morbidity and mortality among neonates. It is responsible for 30-50% of the total neonatal deaths in developing countries.[1,2] It is estimated that up to 20% of the neonates develop sepsis and approximately 1% die of sepsis related causes.[2] The incidence of neonatal sepsis according to the data from National Neonatal Perinatal Database (NNPD, 2002-03) is 30 per 1000 live births. The database comprising 18 tertiary care neonatal units across India found sepsis to be one of the commonest causes of neonatal mortality contributing to 19% of all neonatal deaths.[3] There are many additional factors that predispose newborns in developing countries at a greater risk for developing neonatal sepsis compared with newborns in developed countries.

These include intrinsic factors and extrinsic factors in the antenatal, intra-partum and the neonatal period.[4] Intrinsic factors in the developing world include higher rates of prematurity, intrauterine growth retrardation, birth asphyxia, premature and prolonged rupture of membranes and maternal peripartum infections. Among the most important extrinsic factors contributing to the high risk of sepsis are the lack of antenatal care, unhygienic birth practices and birth attended by an untrained birth attendant. The absence of skilled personnel at delivery also results in a failure to identify and refer high-risk newborns to better centers and a delay in managing complications when they occur The infection can be contracted from the mother via transplacental route, ascending

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infection, during passage through an infected birth canal, or exposure to infected blood at delivery.[5] The newborn infants are more prone to bacterial invasion than the older children or adults, due to their weaker immune system, premature babies being even more susceptible.[6]

Neonates are deficient in humoral and cellular immunity; they produce immunoglobulins at a lower rate than adults.(7) Transplacental maternal antibodies mediate humoral immunity primarily, hence very low birth weight (VLBW) premature infants are less likely to receive as many immunoglobulins as term infants. T–cell function is also less efficient in neonates.(8)

This report provides information regarding the common aetiological agents of both early and late neonatal sepsis at our institution.

METHODOLOGY: This was a retrospective, observational study conducted in the neonatal intensive care unit, KIMS, Karad, over 3 year study period from July 2011 to June 2014 in neonates with suspected sepsis in whom laboratory investigation support the diagnosis of sepsis. This was a retrospective clinical-laboratory study. Laboratory registers were reviewed to identify all positive blood culture isolates in neonates over a three year period between July 2011 to June 2014. Subsequently, patient files were reviewed and data from 216 patient isolates was analysed. It is routine practice in our institution to perform a blood culture in all cases of high fever and suspected sepsis. Blind subculture were made on blood agar, and Mac Conkey agar after 24 hours, 48 hours, 72 hours and 7 days, which were further incubated at 37°C for 18–24 hours. The plates were observed the following day but extended to 48 hours if there was no bacterial growth within 24 hours. If no growth was observed on plates after 7th day, the sample was reported as negative. Antimicrobial susceptibility test was carried out on isolated and identified colonies using commercially prepared antibiotic disk (Hi Media) on Mueller Hinton agar plates by the disk diffusion method, according to the Central Laboratory Standards Institute (CLSI) guidelines.[9]

RESULTS: During the study period there were 1945 neonates admitted in the NICU. Out of these, 216 met the inclusion criteria, 28 neonates were lost during follow up. The incidence of sepsis was 11.10% in our NICU. Among them blood cultures were done in 216 cases as a part of septic screening in suspected neonatal sepsis cases. There were 135(62.5%) male and 81(32.5%) female neonates among them with the male to female ratio of 1.6:1. The age of culture positive neonates ranged from 12 hours to 28 days with the mean age of 9.4 days.

It was most commonly noted between 1000-1500 grams. Septic screen was positive in 86.87%, CRP (79.70%) and blood culture (52.50%).

The total number of culture positive cases was found to be 145 with the culture positivity rate of 7.45%. Klebsiella pneumoniae constituted the majority of the isolated organisms followed by coagulase positive Staph. aureus. (Table 4). Late onset sepsis cases were found to be in proportionate with early onset sepsis (Fig. 1).

Klebsiella pneumoniae was responsible in more than half (50.5%) of the cases in early onset sepsis. It was isolated more in both early onset and late onset sepsis; however, Staph aureus was more common in late onset sepsis as compared with early onset sepsis and was statistically significant. The mortality rate in our study was 17.59%.

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DISCUSSION: National Neonatal Forum of India has defined neonatal sepsis as follows:[10]

1. **PROBABLE (CLINICAL) SEPSIS:** In an infant having clinical picture suggestive of septicemia, if there is the presence of any one of the following criteria:
   - Existence of predisposing factors: maternal fever or foul smelling liquor or prolonged rupture of membranes (>24 hrs) or gastric polymorphs (>5 per high power field).
   - Positive septic screen - presence of two of the four parameters namely, TLC (< 5000/mm), band to total polymorphonuclear cells ratio of >0.2, absolute neutrophil count < 1800/cumm.
   - C-reactive protein (CRP) >1mg/dl and micro ESR > 10 mm-first hour.
   - Radiological evidence of pneumonia.

2. **CULTURE POSITIVE SEPSIS:** In an infant having clinical picture suggestive of septicemia, pneumonia or meningitis, if there is presence of either of the following:
   - Isolation of pathogens from blood or CSF or urine or abscess (es).
   - Pathological evidence of sepsis on autopsy.

The incidence and microbiology of neonatal sepsis varies worldwide. Blood culture has been regarded as the gold standard for the confirmation of sepsis. Reports from all over world show the isolation rates on blood culture to vary from 6.7% to 55.4%.[11] In the present study, blood culture positivity is 52.50%.

Overall the isolation of gram negative bacteria was higher than gram positive bacteria. These results were consistent with the findings of many previous studies which also reported gram negative bacteria to be more common in neonatal sepsis.[12,13] Most of the studies carried out in developing countries have shown K. Pneumoniae as the most implicated gram negative bacteria for neonatal sepsis.[13] In our study also Klebsiella pneumoniae was most implicated organism in neonatal sepsis. Among the gram positive bacteria, S. aureus was the most common to be associated with neonatal septicaemia which is similar to studies conducted elsewhere.[14,15,16]

NEONATAL SEPSIS IS OF TWO TYPES:

EARLY ONSET SEPSIS (EOS): Early onset sepsis presents within first 72 hours of life. In severe cases the neonate may be symptomatic in utero (fetal tachycardia, poor beat to beat variability). Clinically, the neonate usually presents as respiratory distress and pneumonia. Presence of the following risk factors has been associated with an increased risk of EOS:[17,18]

- Low birth weight (<2500gms) or preterm baby.
- Febrile illness in the mother within 2 weeks prior to delivery.
- Foul smelling and/or meconium stained liquor amnii.
- Prolonged rupture of membrane (>24 hours).
- More than 3 vaginal examinations during labor.
- Prolonged and difficult delivery with instrumentation.
- Perinatal asphyxia (Apgar score <4 at 1 minute of age) or difficult resuscitation.

Neonates with presence of foul smelling liquor or three of above mentioned risk factors should be considered to have EOS & treated with antibiotics. Presence of ≥2 risk factors should be investigated with sepsis screen and treated accordingly.[19]

LATE ONSET SEPSIS (LOS): Late onset sepsis usually presents after 72 hours of age. The source of infection is either nosocomial or community acquired and neonates usually present with septicemia, pneumonia or meningitis.[20,21] Risk factors for development of LOS include:

- NICU admission.
- Poor hygiene.
- Low birth weight (LBW).
- Poor cord care.
- Prematurity.
- Bottle feeding.
- Invasive procedure.
- Superficial infection (Pyoderma, umbilical sepsis).

CONCLUSION: Klebsiela pneumoniae was the commonest organism in the study. Staph aureus were significantly more common in late onset sepsis as compared to early onset sepsis. Development of sepsis in a neonate is a medical emergency and generally the clinicians do not wait for microbiology report and start treatment empirically. Local microbiological databases should be prepared including information regarding the commonly isolated organisms and their drug resistance patterns. These databases should be monitored and reviewed regularly to provide updated information to guide clinicians in forming an effective empirical therapy for management of neonatal sepsis. This study has demonstrated an increased incidence of late onset infection in VLBW infants and this represents no-socomial infection. Strategies aimed at prevention of nosocomial infection such as limiting the excessive use of broad-spectrum empiric antibiotics, the development of a hand washing programme and periodic review and continuous reinforcement of infection control policies must be instituted.

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Sex	No. of cases (n=216)	Percentage
F	81	37.50
M	135	62.50

Table 1: Sex Distribution in Sepsis

Weight Distribution	No. of cases (n=216)	Percentage
ELBW	09	4.16
VLBW	109	50.46
LBW	61	28.24
Normal	37	17.12

Table 2: Weight Distribution with Sepsis

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Outcome	Frequency (n=216)	Percentage
DAMA	28	12.96
CURED	150	69.44
EXPIRED	38	17.60
TOTAL	216	100

Table 3: Neonatal Sepsis and Outcome

Organisms	EONS	LONS	Total
Klebsiella species	31	29	60
Coagulase Positive Staphylococcus aureus	21	36	57
Acinetobacter species	3	6	9
Pseudomonas	2	5	7
E. coli	4	3	7
Others	2	3	5
	63	82	145

Table 4: Distribution of organisms between early neonatal sepsis and late neonatal sepsis

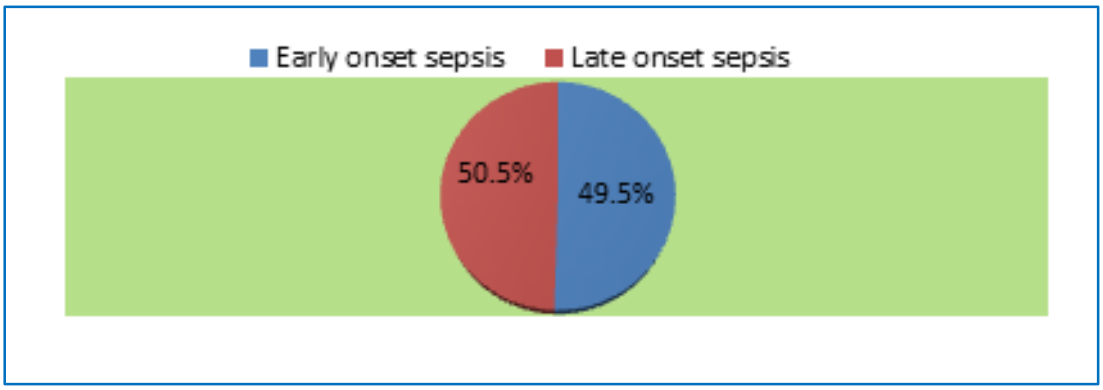

Fig. 1: Distribution of cases by type of sepsis

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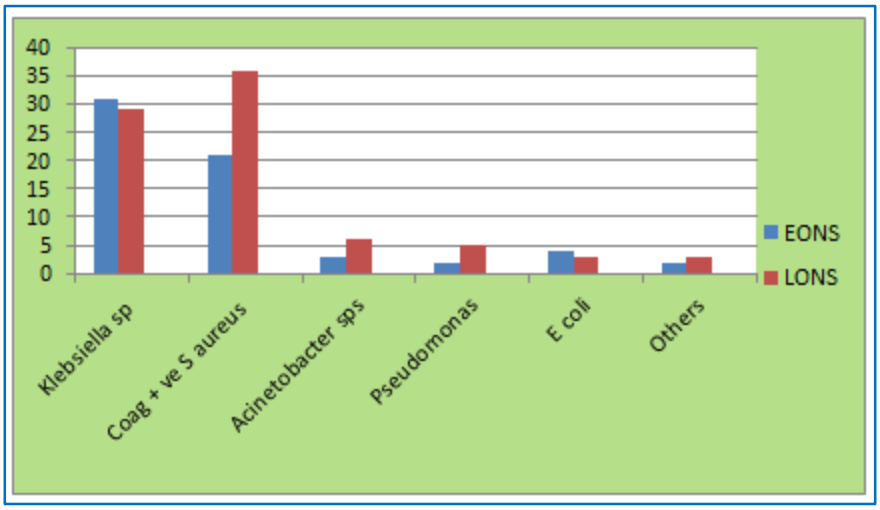

Fig. 2: Distribution of pathogens in EOS & LOS

AUTHORS:

1. C. D. Aundhakar
2. Anand Patil
3. Jaiom Dagar
4. G. S. Karande

PARTICULARS OF CONTRIBUTORS:

1. Professor & HOD, Department of Paediatrics, Krishna Institute of Medical Sciences University, Karad, Maharashtra.
2. Resident, Department of Paediatrics, Krishna Institute of Medical Sciences University, Karad, Maharashtra.
3. Resident, Department of Paediatrics, Krishna Institute of Medical Sciences University, Karad, Maharashtra.
4. Professor & HOD, Department of Microbiology, Krishna Institute of Medical Sciences University, Karad, Maharashtra.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:
Dr. Anand Patil,
Resident, Department of Paediatrics,
Krishna Institute of Medical Sciences University,
Karad-415110, Maharashtra, India.
E-mail: dranandpatil19@gmail.com

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