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ORIGINAL RESEARCH

An Observational Descriptive study on the Clinical and Bacteriological Profile of Neonatal Septicemia

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Abstract

Background: The Neonatal septicemia occupies the major cause of neonatal mortality in developing countries like India, Pakistan, Bangladesh. The present study was chosen to estimate and understand the clinical, bacterial and Antimicrobial susceptibility profile of these cases to control and reduce the total Neonatal mortality.

Research Question: What are the common bacteria and their antimicrobial susceptibility profile associated with neonatal septicemia in our center? The study was conducted at NICU (Neonatal Intensive Care Unit), Department Of Pediatrics, Rama Medical College, Hapur, Uttar Pradesh eight months observational study was conducted during the period from April 2022 to November 2022 on 200 neonatal septicemia patients admitted in NICU by studying their socio-demographic profiles, parity by the mother, preterm delivery, birth weight, clinical features, bacteriological profile and its Antimicrobial susceptibility profile etc.

Results: There was significant difference between EOS & LOS Neonatal Septicemia with reference to total number of cases, mean birth weight, preterm, positive blood culture and mortality rate etc. Among all the cases 29% were blood culture positive, 20% were mortality rate, 25.5% were preterm babies' and 2.7 kg were the mean birth weight. Predominant common clinical features were lethargy (66.4%) followed by respiratory distress (50%), refusal to feed (45%), jaundice(40%), hypothermia (25.6%), abdominal distension (20%) and convulsions (20%) etc. About 35% Gram negative bacteria were isolated and 14% Gram positive bacteria were isolated. Klebsiella pneumoniae werethe predominant pathogen among Gram negative bacteria and Staphylococcus aureus was the predominant pathogen among Gram positive bacteria. Vancomycin (100%) and meropenem (80%) drugs showed highest antimicrobial sensitivity whereas Ampicillin (60-80%), Cefotaxime (70-80%), Amikacin (40-50%) and Gentamycin (45-70%) showed highest antimicrobial resistance maximum 64% of the study group were males and 82.4% of the cases were lbw babies.

Keywords: LOS&EOS(Late Onset Septicemia& Early Onset Septicemia)

Introduction

Infection in newborn is a serious medical emergency that occurs when a baby younger than 30 days old has a life threatening infections & bacterial infections are the most common cause and it is documented by positive blood culture report in first four weeks of life[2]. This Neonatal Septicemia is major cause of neonatal morbidity and mortality world wide[3]. According to World Health Organization (WHO) calculated there are about 6milliondeathsa

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year, with 96% occurring in developing countries[4]. Neonatal mortality rate is one of the indicators of the health status of country Neonatal Septicemia accounts for 40-50% of neonatal deaths each year in developing countries [5,6] and this neonatal Septicemia and related mortality is largely preventable with proper antenatal and intranatal care and use of rational antimicrobial therapy along with aggressive supportive care.

In India according to data from "National Neonatal Perinatal Database" (NNPD) 2100, the incidence of Neonatal Septicemia has been reported 40/1000 live births in tertiary care center, Based on age of onset the neonatal septicemia is broadly divided into two types: Early onset Septicemia(<72hrs)and late onset Septicemia (>72 hours – 30day)[8]. It is caused by a variety of Gram-negative Bacteria as well as Gram positive bacteria. The spectrum of Bacteria that causes Neonatal Septicemia changes overtimes and varies from region to region which is due associated with many factors like life style, social & cultural factors.[10]

So, the present study was carried out to detect the clinical bacteriological identification along with antimicrobial susceptibility profile isolated from the blood of septicemic neonates' admitted in hospital setup.

Material & methods

The study was conducted at NICU, Department of Pediatrics, Rama Medical College, Hapur, Uttar Pradesh, India. The study was conducted during the period from April 2022 to November 2022. According to the hospital census the prevalence of the neonatal cases admitting to NICU were found to be 52% and the sample size was calculated by using the formula $N=4P/L^2$ where P=35.5%, Q=100-P that is 64.5% and L=20% allowable error in 'P' that is 6%, so N=182 and assuming there may be 10% attrition, additional 10% were taken which was calculated and rounded to 200. All the cases of clinically diagnosed Neonatal septicemia admitted in NICU during the above period. All the samples were included after fulfilling inclusion and exclusion criteria. Written consent was taken from the mother after discussing the purpose and details that will be done during the study. All those parentswilling to participate were selected as inclusion criteria. The aim of the study was to isolate and identify the bacterial agents responsible for Neonatal Septicemia and to detect the antibiotic susceptibility profile of these bacteria and to study the clinical features and associated factors of Late and Early Onset of Neonatal Septicemia.

After receiving the filled consent form of mother the required data were collected by using a pretested proforma pertaining to their socio-demographic profiles, risk factors, clinical features and the results of blood culture report along with antimicrobial susceptibility testing etc. In this study the antimicrobial susceptibility testing was performed by antibiotic susceptibility method. In accordance to the guidelines framed by clinical laboratory standards institutes. (CLSI)

Finally, the collected data was analyzed by using appropriate statistical tools like percentages, proportions, measures of central tendency, measures of dispersion, standard error of mean and tests of significance with the help of computer software.

Results

Table 1: Sex wise distribution of LBW factor among EOS & LOS Cases

Sr. no.	Sex	LBW(n=164)		Total
		EOS	LOS	
1.	Female	38(19%)	20(10%)	58(35.3%)
2.	Male	72(31%)	34(17%)	106(64.6%)
Total		**110(67%)**	**54(33%)**	**164(100%)**
Where, <P 0.01 which is considered to be statistically significant				

P<0.01

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Significant difference was observed between EOS & LOS cases with regard to Low Birth Weight distribution among male and female study group.

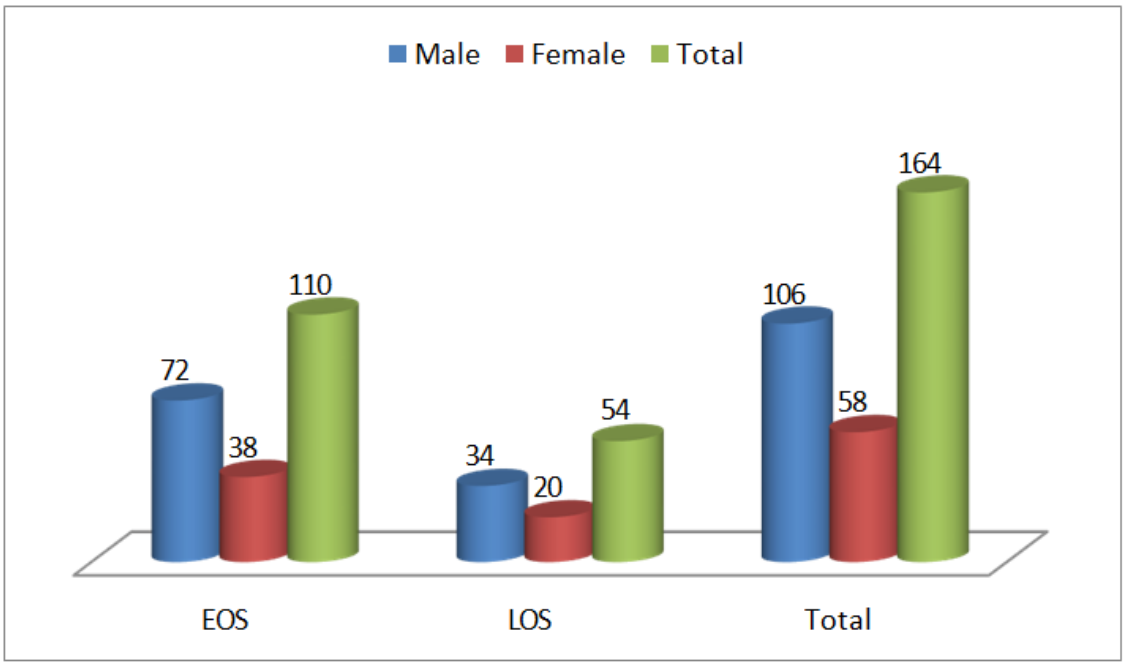

Table 2: Graphical data Early Onset Septicemia & Late Onset Septicemia

Factor of High risk	<72hrs EOS	>72hrs LOS	P-Value	Total
1.Number of cases	134 (67%)	66(33%)	P<0.01	200(100%)
2.Preterm	40(30%)	16(8%)	P<0.01	56(28%)
3.Mean birth weight	2.07kg	2.25kg	-	1.16G
4.Positive Blood Culture	36(26.8%)	17(25.7%)	P>0.05	53(26.5%)
5.Birth Anoxia	62(46.2%	18(27%)	P<0.01	80(40%)
6.Mortality	25(19%)	15(15%)	P<0.01	40(20%)

It was observed that there was significant difference between EOS & LOS Neonatal Septicemia with reference to mean positive blood culture, birth weight, preterm, and mortality

Table-3 Clinical Presentation of Neonatal Septicemia

SI. No.	Sign/Symptom	No. of Cases	Percentage
1.	Respiratory Distress	100	50%
2.	Lethargy	90	45%
3.	Refusal to feed	132	66%
4.	Hypothermia	50	25%
5.	Jaundice	80	40%
6.	Convulsions	40	20%
7.	Abdominal distention	40	20%
8.	Fever	20	10%
9.	Sclerema	24	12%
10.	Cyanosis	12	6%
11.	Diarrhea	4	2%
12.	Vomiting	14	7%
13.	Hepatomegaly	20	10%

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Predominant common feature were Lethargy(66.3%), followed by Respiratory Distress(50%), Refusal tofeed (45.2%), Jaundice ((40%), Hypothermia (25.4%), Abdominal distension (20%) and Convulsions (20.1%) etc.

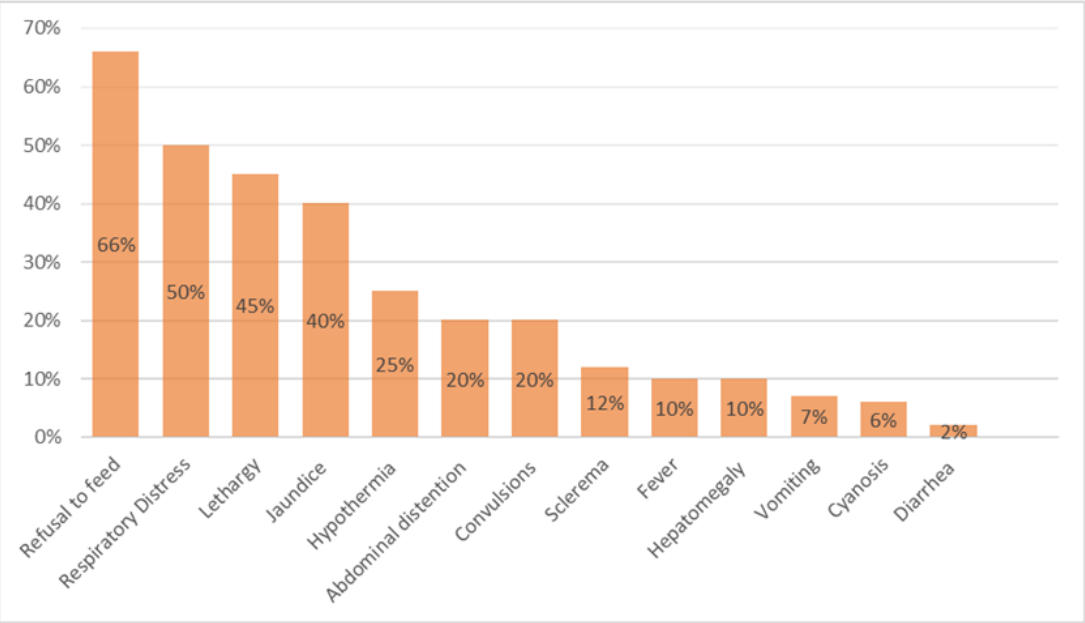

Table-4 Bacteriological Profile and Antibiotic susceptibility Profile in table form

Bacteria isolated	EOS	LOS	Total	Antimicrobial Resistance(%)							
				CEF	AMp	CIP	AMK	GEN	MRP	VAN	LIN
Gram Negative Bacteria											
Klebsiella Pneumonia	18(46.1%)	8(42.1%)	2.6(44.52%)	8.9	75	80	40	60	0	-	-
scherichia coli	7(17.7%)	4(2.3%)	11(18.8%)	54	65	80	48	70	25	0	0
Pseudomonas	3(7.6%)	2(10.5%)	5(8.6%)	90	80	85	36	55	0	0	0
Total	28(71.7%)	14(73.6%)	42(72.4%)								
Gram Positive Bacteria											
taphylococcus aureus	8(20.6%)	3(15.6%)	11(18.9%)	70	60	80	36	70	14	0	0
CONS	3(7.6%)	2(10.5%)	5(8.6%)	80	78	70	33	45	0	-	-
Total	11(28.2%)	5(26.2%)	16(27.5%)								

Whereas,CEF-Cefotaxime,AMP-Ampicillin,CIP-Ciprofloxacin,AMK-Amikacin,GEN-Gentamicin,MRP- Meropenem, VAN- LIN- Linezolid and CONS- Coagulase Negative Staphylococci.
P<0.01

Klebsiella was the commonest pathogen isolated among all the bacteria and among all Gram negative and Staphylococcus aureus was the commonest pathogen isolated among all the Gram-positive bacteria.

Discussion

In our study, the neonatal septicemia were more among male babies (64%) when compared to

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female babies (34%) which correlates with the figures of Rekha Sriram et al study [11], Naeeye et al study[7] and Jyothi P et al [12]study. And significantly it were noticed that out of the total LBW babies (82%) morenumber of babies (67%) belong to EOS neonatal septicemia as it were also seen in many other studies. In this study, the total number of EOS (<72 hrs) were 67% where as LOS (>72 hrs) accounted for 44%. Similar findings were seen in P Jyothi et al [12], Vrishali Avinash Muley et al [13], Movahedian et al [14] and many other studies. With reference to association .of high risk factors like mean birth weight, preterm, percentage of positive blood culture, birth anoxia and mortality rate etc there were significant difference between EOS & LOS seen in this study. As our present study were associated with higher number of LBW babies (82%), preterm babies (29.3%) and 30.3% of mortality rate correlating to studies of other workers like NB Mathur et al [15], Rekha Sriram et al[11], Saxena et al[16], SS Tallur et al[17], Khatua et al[18] and Buetow KC et al[19] which means that the above factors were strongly associated with the higher incidence of Neonatal Septicemia in our set up.

Regard to the clinical presentation of cases in our study, predominant common feature were Refusal to feed (60.3%) followed by Respiratory distress (50.2%), Lethargy (45.6%), Jaundice (40.5%), Hypothermia (35.4%), and Abdominal Distention (25.8%) and Convulsions (22.2%) etc. But on other studies like Jimba Jotsho et al [20] Respiratory Distress (67%), followed by fever (43.6%) feeding intolerance (48.2%), Jaundice (39.3%) and Lethargy (26.4%) were noticed as common features and also in studies like Chandan kumar Shawa et al[21] Janudice (85%), SS Tallur et al[17] Respiratory distress and Jaundice, Dr. Deependra Garg et al [22] refusal to feed, poor sucking & Jaundice were quoted as the predominant common features.

In our study the total Blood culture positivity were 39% among which EOS 67.2% & LOS 32.8% contributed in accordance to the other studies Vrishali Avinash Muley et al[13], (26.6%), Pavan Kumar et al [23] (36%), Mathur M et al [24] (25.88%), P Jyothi et al[12] (19.3%) and Mohakud NK et al[25](25.4%) but lower percentage of positivity were seen in Kaistha N et al[3] (13%), Jimba Jatsha et al[20] (14%) & Nikhita Sing Yadav et al[26] (16.9%) whereas higher percentage were noticed interestingly in Murthy et al[27] (66%) Rajendra Prasad et al[28] (47.6%) & Sharma et al[29] (59%) studies with the significant difference between EOS & LOS. The prior administration of antibiotics and the possibility of infection with anaerobes might be the factors associated with low blood culture isolation rate. Normally the blood culture positivity rate varies between 34% to 50% for aerobic bacterias[30].

In our study the Gram negative and Gram positive septicemia were reported to be 72.4% & 27.6% respectively which were comparable to the findings ofthe studies conducted by P Jyothi et al[12] 68% & 32.3%, Kaistha N et al[3] 80.6% & 36% . Kumar GD et al[31] 50% & 30%, Agnihotri et al[32] (59.6%) & (41.5%) and Priyam Vada Roy et al[33] (57% & 43%) etc. Klebsiella spp were the predominant Gram negative pathogen (44.6%) isolated in this study which correlates with the report of the National-Neonatal-Perinatal- Database (29%)[30] and reports made by the other workers[3,12,13,17,20,24,25,34] And similarly Staphylococcus aureus were the predominant Gram positive pathogen (18.8%) isolated in our study which were also the same finding in many other studies.[26,31]

In this study the antibiotic susceptibility profile for all the bacterial isolates and the maximum resistance were analysed to Ampicillin whereas least were to Linezolid and Vancomycin which were supported by the work of other researchers also [3,12,13,23,25,26,&36]. The high resistance Profile was analysed against the commonly used antibiotics such as Ampicillin, Amikacin, Gentamicin and Cefotaxime etc which were provenby the other studies also[17,20]. So it is understood that inappropriate and frequent use of antibiotics, not following the therapeutic dose & schedule of may be the factors associated with high & multi drug resistance profile in developing countries and under developed countries. In this study the

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maximum antibiotic sensitivity profile were analysed for Linezolid, Vancomicin and Meropenem etc as these drugs are not being used indiscriminately and the same observation were supported by other studies also[3,12,13,&26].

Conclusions and recommendations

- In this study we analysed that as EOS was much common than LOS, more attention should be paid towards strengthening of antenatal services in order to control and prevention of premature deliveries as well as LBW babies in the community, early reach of tertiary care in centre case of PROM, increase of knowledge level regarding maternal proper hygiene among pregnant ladies and peripheral health care workers and overall measures should be taken to raise the standard of living of people belonging poverty line etc. To decrease the incidence of LOS in our Centre it is important to implement comprehensive and systematic infection control measures like establishment and proper functioning of "Hospital Infection Control team in every hospital and conducting periodical workshops in every three months, Train personnel working in the hospital regarding hand working practices, personal hygiene and how to maintain aseptic environment at treating places etc.
- Regular blood culture of admitted patients for isolation of bacteria and knowing antibiotic susceptibility helps in empirical and rational use of appropriate antibiotics in NICUs. As our study reported that the higher percentage of resistance was analysed mainly against to commonly used antibiotics Amikacin, Ampicillin, Cefotaxime and Gentamicin etc. it is alarming us to take precautions towards availability and usage of antibiotics through supervision and prescription by qualified medical registered doctors.

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