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Maternal Factors as risk for Neonatal Sepsis

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Abstract: *Neonatal septicemia is a major cause of morbidity and mortality in new born infants. Early diagnosis and prompt treatment are the key words in the management of neonatal sepsis. The signs and symptoms of Neonatal sepsis are very vague and Anticipation is forerunner of early diagnosis.. Ignaz Semmelweis and John Snow as early as 1847 carried out the first ever scientific epidemiological studies and suggested how diseases were transmitted and how simple measures could interrupt transmission. The maternal infection play important role in the pathogenesis of neonatal infection. This prospective study was under taken to know the association between maternal predisposing factors like maternal fever, prolonged rupture of membranes, premature labour and the resultant development of sepsis by performing blood culture , the gold standard for the diagnosis of Neonatal Sepsis. 130 neonates who were enrolled in the study, Culture was bacteriologically positive in 25.4% cases. Gram negative bacilli such as KLebsiella(3.8%) and E.coli(2.3%) constituted 36.3% of isolates, gram positive organisms isolated were S.epidermidis (6.9%), S.aureus(4.6%) and Enterococcus faecalis(4.6%).Maternal risk factors observed were prolonged rupture of membranes > 12 hrs in 27.69%, Maternal complications (like abruption placentae, maternal fever) in 6.9%, Meconium stained liquor in 14.6%, outside delivery in 18.46 % and no obvious factor detected was detected in 20% of cases. Neonatal risk factors like low birth-weight was prevalent in 67.7% of cases, prematurity 54.6% of cases. Case fatality rate was 3.8% in culture positive neonates. while there was no mortality among those with negative culture results. Our study results highlights that in the presence of risk factors for sepsis, irrespective of clinical features of septicemia, neonatal sepsis screening should be performed.*

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I. Introduction

Neonates are predisposed to infections during the perinatal period due to multiple exposures and a relatively compromised immune system. The perinatal period is hazardous with multiple opportunities for exposures to virulent organisms. Of the One hundred and thirty million babies born every year, about four million die in the first four weeks of life which is the neonatal period.[1] The World Health Organization(WHO) estimates that, worldwide, approximately five million neonates die each year and that 98% of these deaths occur in developing countries. Over 40% of the under-5 deaths occur globally during the neonatal period [2] Neonatal mortality rate per 1000 live births varies from 5 in developed countries to 53 in the least developed countries. Neonatal infections are estimated to cost 1.6 million annual deaths or 40% of all neonatal deaths in developing countries. Sepsis in the neonate is a clinical syndrome characterized by systemic signs of infection and accompanied by bacteremia in the first month of life. It encompasses systemic infections of the new born including septicemia, meningitis, pneumonia, arthritis, osteomyelitis and urinary tract infections of the new born.[3]

Neonatal sepsis can be divided into two main classes depending on the onset of symptoms related to sepsis. Early onset sepsis usually presents within 72 hrs of life. Source of infection is generally the maternal genital tract. Late onset sepsis usually presents after seventy two hours of birth.[4]

The first ever scientific epidemiological studies, carried out by Ignaz Semmelweis and John Snow, were instrumental in suggesting how diseases were transmitted and how simple measures could interrupt transmission. And today it holds good. [5] The predisposing factor for early onset sepsis include: Prolonged rupture of membrane (PROM) (>12hrs), Foul smelling and/or meconium stained liquor amnii, Repeated per vaginal examinations during labour, Low birth weight (<2500gms) or pre term baby, Maternal fever, Difficult or prolonged labour with instrumentation. The source of infection is either nosocomial or community acquired. Various factors that predispose to an increased risk of nosocomial sepsis include: NICU admission, Invasive procedures, Parenteral fluid therapy, Low birth weight and prematurity, Ventilation and use of stock solution.

The signs and symptoms of Neonatal Sepsis are very vague and nonspecific and may present with one or more of the following symptoms and signs : hypothermia or fever, lethargy , poor cry , refusal to suck, respiratory distress, hypoglycemia , hyperglycemia , metabolic acidosis .

The early and efficient diagnosis of neonatal bacterial sepsis remains a difficult task. Blood culture is the gold standard for the diagnosis of septicemia [6] and should be done in all cases of suspected sepsis prior to starting of antibiotics . Sepsis related mortality is largely preventable with rational antimicrobial therapy and aggressive supportive care. [4]

Early diagnosis and prompt treatment are the key words in the management of neonatal sepsis. Anticipation is forerunner of early diagnosis. In this study the relationship between the presence of risk factors and subsequent development of neonatal sepsis was done by using Blood culture as gold standard for diagnosis of sepsis in the newborn.

II. Material And Methods

A total of 130 neonates aged 02 to 28 days with clinical suspicious of septicemia who were admitted in NICU of Vydehi Institute of Medical Sciences & Research Centre, Whitefield, Bangalore, over a period of one year from January 2009 to December 2009 were prospectively enrolled in the study. This study was approved by the Ethics Committee of Vydehi Institute of Medical Sciences & Research Centre.

Inclusion Criteria Signs suggestive of sepsis being
- poor feeding
- Respiratory distress
- Fever or hypothermia

Mothers with history of
- prolonged rupture of membranes (> 12 hrs)
- maternal fever
- premature labour

Exclusion Criteria Babies > 28 days of age
- Sick babies on ventilators

Blood samples were collected with all aseptic precaution, 2 different samples were collected from two different sites, to reduce the chance of introducing contaminating organisms from the skin. 1 ml sample of blood was added to a blood culture bottle containing 5 to 10 ml of Blood culture media.

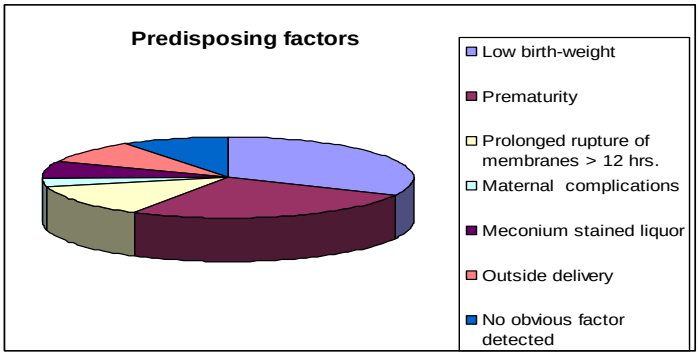
Statistical analysis:

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean ± SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5 % level of significance Chi-square/ Fisher Exact test has been used to find the significance of study parameters on categorical scale between two or more groups. 95% Confidence Interval has been computed to find the significant features. Confidence Interval with lower limit more than 50% is associated with statistical significance.

III. Result

Out of 130 neonates with clinical suspision of septicemia studied 86.2% (112) and 13.8%(18) belonged to EOS (0-3 days) and LOS (4-28 days) respectively 53.8% were males and 46.2% were females. 54.6% and 45.4% were preterm and term) respectively. 16.2%, 51.5% and 32.3% belonged to VLBW(<1500 gms), LBW(1500-2500 gms) and >2500 gms respectively. Neonatal risk factors like low birth-weight was prevalent in 67.7% of cases, prematurity 54.6% of cases. Maternal risk factors observed were prolonged rupture of membranes > 12 hrs in 27.69%, Maternal complications (like abruption placentae, maternal fever) in 6.9%, Meconium stained liquor in 14.6%, outside delivery in 18.46 % and no obvious factor detected was detected in 20% of cases.In 80% of cases there was one or more predisposing factor present.

Fig(1): Predisposing factors

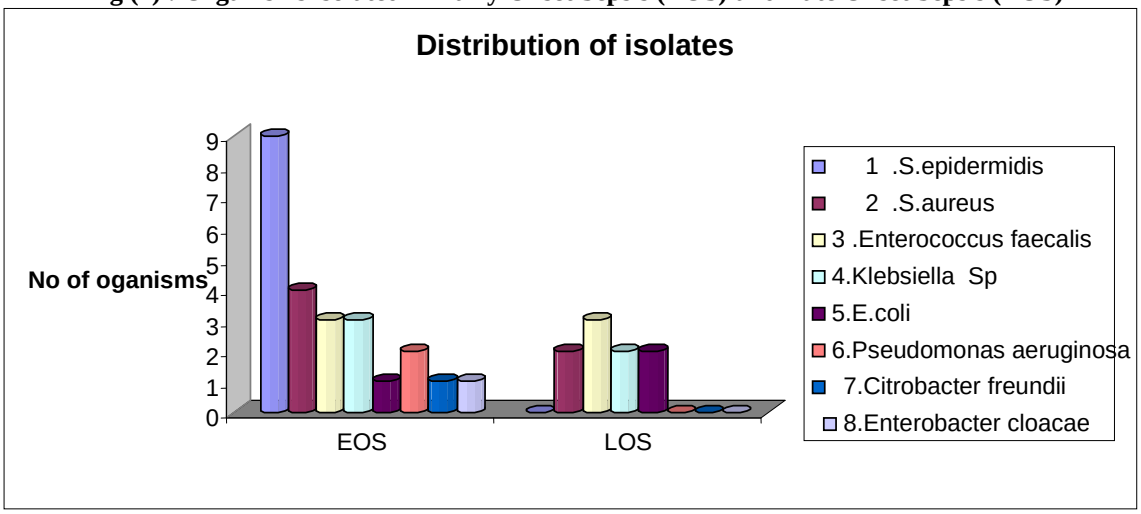


Out of the 130 samples processed 33(25.4%) were positive for Blood culture and the organisms isolated were S.epidermidis 9(27.27%), S.aureus 6(18.18%), Enterococcus faecalis 6(18.18%), Klebsiella pneumoniae(4)+ Klebsiella oxytoca(1) (15.15%), E.coli 3(9.09%), Pseudomonas aeruginosa 2(6.06%), Citrobacter freundii 1(3.03%) and Enterobacter aerogenes 1(3.03%). Predominant organisms isolated in EOS were S.epidermidis, S.aureus along with Pseudomonas aeruginosa , Citrobacter freundii and Enterobacter aerogenes. And the predominant organisms isolated in LOS were Enterococcus faecalis, Klebsiella spp,S aureus and E.coli.

Table (1): Organisms isolated in culture positive cases

Sl no	Organisms Isolated	No	Percentage
1	S.epidermidis	9	27.27
2	S.aureus	6	18.18
3	Enterococcus faecalis	6	18.18
4	Klebsiella Sp	5	15.15
5	E.coli	3	9.09
6	Pseudomonas aeruginosa	2	6.06
7	Citrobacter freundii	1	3.03
8	Enterobacter cloacae	1	3.03

Fig (2) : Organisms isolated in Early Onset Sepsis (EOS) and Late Onset Sepsis (LOS)



That case fatality rate was found to be 3.8% (5 neonates). The organisms isolated were Klebsiella(2), S aureus, Enterococcus fecalis and Enterobacter cloacae. Cultute positivity was significantly assocated with premature neonates with P value equal to 0.016. and a significant association was found between low birth weight and prematurity with a P value less than 0.001.

Table (2): Correlation of Gestation with Culture positivity

Gestational age	Number of neonates	Culture report			
		Positive		Negative	
		No	%	No	%
Preterm	71 (54.6%)	24	72.7	47	48.5
Term	59(45.4%)	9	27.3	50	51.5
Total	130(100.0%)	33	100.0	97	100.0

Fig(3): Correlation of Gestation with Culture report

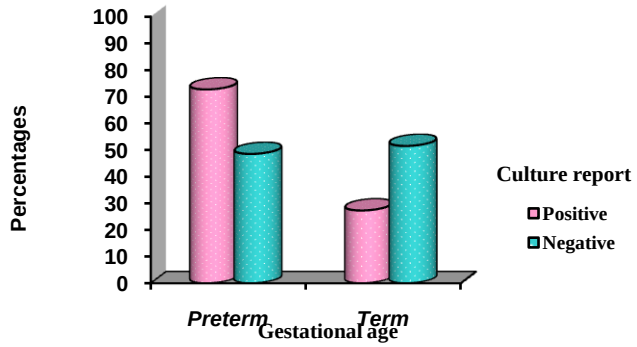


Table (3) : Correlation of gestation with Birth weight

Gestational age	Number of neonates	Birth weight (gm)					
		<1500 gm		1500-2500 gm		>2500 gm	
		No	%	No	%	No	%
Preterm	71 (54.6%)	19	90.5	41	61.2	11	26.2
Term	59(45.4%)	2	9.5	26	38.8	31	73.8
Total	130(100.0%)	21	100.0	67	100.0	42	100.0

IV. Discussion

Neonatal septicemia is a major cause of morbidity and mortality in newborn infants. The clinical manifestations are non-specific and vague and therefore demand a high index of suspicion for early diagnose and prompt treatment. So it is important to make the diagnosis early and to start the treatment as early as possible to prevent serious morbidity and mortality caused by untreated or lately treated septicemia. In this study out of the 130 neonates neonates with clinical suspision of septicemia studied 33 (25.4%) were positive for blood culture. Among the various predisposing factors determined, Common neonatal factors observed were low birth weight (67.7%) and prematurity (54.6%). Tallur SS et al[7], Gerdes J S et al[8], Anand NK et. Al[9], Gupta P et. Al[10], observed low birth weight as important factor and found increase in incidence of neonatal septicemia in preterm babies. Nelson[11] and Cloherty[12] stated that the prematurity and low birth weights were the most important predisposing factors in neonatal septicemia. Common maternal factors observed were prolonged rupture of membranes (27.69%), Outside delivery (18.46%) Maternal complications (like abruption placentae, maternal fever) in 6.9%, Meconium stained liquor in 14.6%. Schuchat A . et al[13]. found neonatal sepsis was associated with intrapartum fever and frequent vaginal examinations . An obstetric risk factor like preterm delivery, intrapartum fever, or membrane rupture $\geq$18 hours was found in 49% of GBS cases and 79% of other sepsis**.** Anand NK et. al[9] observed prolonged rupture of membranes in 29.3% of cases . Gerdes J S et al[37] noted seven fold increase in the incidence of sepsis after prolonged rupture of membranes and with maternal fever risk increased four fold . Zardi KM et al[8]. observed that unsterile delivery provides an obvious source of inoculation of the new born with potentially pathogenic organisms. Berman[14] emphasized the important role of maternal infection in pathogenesis of neonatal infection. Staphylococcus epidermidis was the predominant organism 9(27.27%), followed by S.aureus 6(18.18%), Enterococcus faecalis 6(18.18%). Klebsiella pneumoniae 4(12.12%). E.coli 3(9.09%), Pseudomonas aeruginosa 2(6.06%) . One each of Citrobacter freundii 1(3.03%) , Enterobacter cloacae 1(3.03%) and Klebsiella oxytoca 1(3.03%). Staphylococcus epidermidis was the most predominant organism (27.27%) in the present study. This finding is correlated with other

workers shown in the table. However workers like Kumhar G.D. et al [15], Jain N.K. et al[16], Agnihotri N. et al[17], Jain N.K. et al. [18], found that Gram negative bacilli such as Klebsiella Sp and E.coli were most common organisms isolated followed by Staphylococcus aureus as the second most common cause of neonatal sepsis unlike in developed countries were Group B Streptococci predominates.

Bang A.T. et al[19], Stoll B.J. et al[20], Kumhar G.D. et al[15] and Agnihotri N. et al[17] had isolated 3.6%, 3.3%, 4.25%, 5.1% of Enterococci respectively. Chaturvedi P. et al[21], Jain N.K. et al[16], Agnihotri N. et al[17], MovahedianA.H. et al[22] and Jain N.K. et al[18] had isolated Pseudomonas in the range of 13.4 - 36%. In the present study the predominant organisms isolated in EOS were S.epidermidis, S.aureus which is comparable with the study done by Rao P.S et al who found that, S.aureus and S.epidermidis were predominantly responsible for EOS and Pseudomonas and Salmonella typhimurium were responsible for LOS. The case fatality rate was found to be 3.8% . Out of 5 neonatal deaths 2 were due to sepsis with Klebsiella Sp and all of them were preterm. 1 neonate had VLBW (800 gms), 3 neonates had low birth weight.

V. Conclusion

Clinical features of neonatal septicemia are nonspecific and vague and may be clinically indistinguishable from those occurring in noninfectious condition during neonatal period. Our study highlights that prematurity, low birth-weight neonates are more prone to develop septicemia. Early-onset septicemia is more common than late-onset septicemia. Prematurity, low birth weight, prolonged rupture of membranes, outside delivery predispose neonate to infections. Gram-positive organisms are common cause of early-onset septicemia. Mortality is higher in preterm and low birth-weight babies.

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