ORIGINAL RESEARCH

Predictive Sepsis Risk Score in Hospitalized Neonates: A Prospective Hospital based Study

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ABSTRACT

Background: Systemic bacterial infection during the first month of life has remained a major cause of infant morbidity and mortality despite the development of broad spectrum antimicrobial agents and technological advancements in life supportive therapy.

Materials and Methods: This was a prospective hospital based study. The study was carried out in NICU of ASRAM medical college, Eluru from March 2010 to September 2011. Institutional Ethics Committee permission was obtained prior to the study. It was possible to include 50 Neonates below the age of 28 days with clinical suspicion of neonatal septicemia during the study period.

Results: 33 male babies (66%) and 17 female babies (34%) were affected by neonatal septicemia. The culture positivity rate was 52%. Most common organism isolated from blood culture in our NICU is Coagulase +ve Staph aureus (46%). Culture positive sepsis is more common in preterm babies (76.9%) compared to term babies (23%). LBW babies had more culture positive sepsis compared to normal Wt babies.

Conclusion: Males were more commonly affected than females. LBW babies had more culture positive sepsis compared to normal Wt babies. Respiratory distress can be suggested as a better marker of neonatal sepsis.

Key words: Low birth weight, neonates, culture

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INTRODUCTION

"Neonatal septicemia is defined as a bacterial infection documented by a positive blood culture in the first four weeks of life." The term neonatal sepsis, refers to systemic infection of neonates including septicemia, pneumonia, meningitis, arthritis, osteomyelitis, and urinary tract infection. Systemic bacterial infection during the first month of life has remained a major cause of infant morbidity and mortality despite the development of broad spectrum antimicrobial agents and technological advancements in life supportive therapy.[1]

The early diagnosis of neonatal septicemia still poses great difficulties. Early clinical symptomatology of neonatal septicemia is mimicked by lot of other disorders affecting the newborn. It is a major cause of morbidity and mortality and it accounts for half of all the neonatal deaths in this country. The overall incidence of neonatal sepsis varies between 1-8 cases/1000 live births.[2]

Neonatal sepsis can be divided into two subtypes depending upon whether the onset of symptoms is during the first 72 hours of life or later. Although the term early onset sepsis had been used to refer to neonatal infections occurring as late as one week of age, it should be restricted to those infections with a Perinatal pathogenesis, the usual onset of which occur within 72 hours. Early - onset sepsis is caused by organisms prevalent in genital tract or in the labour room. Ascending infection, transplacental&hematogenous spreads are important mechanisms of early onset sepsis.[3]

After the birth the baby is exposed to the environment contaminated with microorganisms, which start settling or colonizing at various places. The organisms enter the body through the umbilicus, skin or mucosa. Due to poor immunological defence of the new born, even local infections tend to become generalized. Infections are more commonly met with preterm and low birth weight babies. To prevent serious morbidity and mortality caused by untreated or lately treated neonatal septicemia; it is important that the diagnosis is made early and the treatment started as easily as possible. Even though the positive blood culture is diagnostic of neonatal septicemia, the technique of blood culture is time consuming that demands a well equipped laboratory and has a success rate of only 40%, therefore the

blood culture has its own limitations.[4]
Early treatment with rational antibiotic therapy is possible with the help of certain indirect markers such as leucopenia, toxic granules, band form to neutrophil ratio, micro-ESR and C-reactive protein. This investigation exercise is collectively known as sepsis screen.[5]
The early diagnosis of neonatal sepsis by clinical examination is vital. In the presence of predisposing factors, early clinical suspicion coupled with sepsis screen will detect neonatal septicemia earlier, which will enable the clinician to treat the infection timely and adequately, which in turn will help to reduce the neonatal morbidity and mortality.

MATERIALS AND METHODS

This is a prospective hospital based study in NICU of ASRAM medical college, Eluru.

Period of study
March, 2010 to September, 2011

Selection of cases
50 Neonates below the age of 28 days with clinical suspicion of neonatal septicemia were included in this study. Neonates admitted in our hospital from out patient department and neonates born in our hospital were included in this study group. After admission detailed history was taken and thorough clinical examination was done. These neonates had the following symptoms and signs which were suspicious of septicemia.

Symptoms
Refusal of feeding, Lethargy, Respiratory Distress, Vomiting, Abdominal distension, Irritability, Rash

Signs
Hypothermia, Hyperthermia, Apnea, Pallor, Jaundice, Sclerema, Petechiae, Purpura, Shock
All neonates were investigated as follows.

Sepsis screen
i. **Total leucocyte count** was done by using Neubauer's chamber. Leucopenia with count < 5000 / cmm was considered positive for septicemia.
ii. **Peripheral smear** prepared with a drop of blood from heel prick and stained with Leishman's stain. The neutrophil is about 10-12 microns in diameter. The cytoplasm contains fine pale violet granules and number of nuclear lobes increase with maturity.
iii. **Micro – ESR**: is simple and inexpensive. It was obtained by collecting capillary blood in standard pre-heparinised micro haematocrit tube of 75 mm length, 1.1 mm internal diameter and 1.5 mm outer diameter. Fall of erythrocyte column was read after one hour.
During neonatal period a value of more than 15 mm at the end of 1st hr was considered as suggestive of infection.
iv. **C – reactive protein**: C-reactive protien was detected by latex agglutination test. CRP ≥ 12 was taken as positive
v. **Blood Culture:** In all neonates the blood sample was collected from peripheral vein with all aseptic precautions, prior to administration of any antibiotic therapy.
0.5 ml of blood was collected in 5 ml of glucose broth. This sample was immediately sent to Microbiology Department Three subcultures were observed after 24, 48 and 120 hrs. If no growth was observed after five days culture was reported as negative. If growth was observed material was further analysed for specific organisms.
Gram negative organisms showed characteristic colonies on nutrient agar and MacConkey medium. E Coli on MacConkey medium showed pink colonies. On nutrient agar Staphylococci showed colonies of different colours.

RESULTS

This was a prospective hospital based study. The study was carried out in NICU of ASRAM medical college, Eluru from March 2010 to September 2011 among 50 neonates.
Male babies were more 33 (66%) affected by neonatal septicemia than female babies 17 (34%) (Table 1).
52% of cases with suspected sepsis had Blood culture positive, which is gold standard test for the diagnosis
Most common organism isolated from blood culture was Coagulase +ve Staph aureus (46%) and Enterococci were found in only one case.
The culture positivity rate was very high among male babies (60.6%) compared to female babies (35.3%). This was found to be statistically significant. Out of 33 male babies, 20 (60.6%) had culture positive sepsis
Out of 26 culture positive cases 20 (76.9%) were preterm babies. Culture positive sepsis is more common in preterm babies (76.9%) compared to term babies (23%)

Culture	Culture Positive	Culture Negative	Total
No. of cases	26 (52%)	24 (48%)	50 (100%)

Table-1: Distribution of cases according to culture positivity

Out of 29 inborn cases, 9 (31%) had culture positive sepsis. Out of 21 out born cases, 17(81%) had culture positive sepsis. Culture positive cases are more among out born babies (65.3%) compared to inborn babies (34.6%)

Out of 19 LBW babies, 15(78.9%) had culture positive sepsis. Out of 31 normal Wt babies, 11 (35.5%) had culture positive sepsis. LBW babies had more culture positive sepsis compared to normal Wt babies

Table 2 shows the predictive values of each clinical features. The gold standard for comparison was culture positivity. It is seen that refusal of feeds has the highest sensitivity and respiratory distress has the highest specificity. Hence among all these signs and symptoms, respiratory distress can be considered as a better marker of neonatal sepsis as it has good sensitivity and good specificity.

DISCUSSION

33 male babies (66%) and 17 female babies (34%) were affected by neonatal septicemia. Piyush Gupta et al[1] observed male predominance (64.7%) in neonatal septicemia. N. Somu et al[2], Philip et al[3] observed that males were affected more than females. Khatua et al[4] found that males were affected in (70.7%) of cases. Wilson DH[5] stated that increased incidence of sepsis neonatorum in male infants in probably related to the higher incidence of congenital anomalies of the urinary tract in the males, resulting in primary urinary tract infection and secondary sepsis.

The culture was positive in 26 cases (52%). So in our study culture positivity rate was 52%. Sharma et al[6], Khatua et al[4], Namedo et al[7], Bhatia et al[8], Chaturvedi et al[9] and Sugandhiet al[10] observed culture positivity rate of 56%, 59.8%, 50%, 66.7%, 73% and 42.5% respectively. Although blood culture are normally the basis for a diagnosis of bacterial infection, the bacteremic phase of the illness may be missed by poor timing blood sample size So also before drawing blood sample for culture the patient may be treated with some parenteral antibiotic by private practioners or other hospital. Due to this the blood cultures have low sensitivity.

Clinical feature	Sensitivity	Specificity	Positive predictive value
Refusal of feeds	96.2	50	67.6
Jaundice	92.6	41.7	63.2
Temp. Instability	84.6	58.3	68.8
Lethargy	88.5	66.7	74.2
Respiratory distress	80.8	70.8	75

Table-2: Sensitivity, Specificity & positive predictive value (PPV) of each clinical features

Most common organism isolated from blood culture in our NICU is Coagulase +ve Staph aureus (46%), which is not consistant with other studies. Others are coagulase -ve staph aureus (19%), Pseudomonas (16%), Klebsiella (15%) and Enterococci (4%). Meharban Singh[11] observed Klebsiella pneumonia (29.7%) Staphylococcus aureus (14.7%) E.coli (13.9%) pseudomonas (9.2%) were common pathogens in analysis from hospital based data collected by National Neonatal Perinatal Database Net work from different centres in our country. Wilson[5] stated that the organisms causing neonatal septicemia vary considerably in different nurseries and in different places.

Male babies (76.9%) are more affected with culture positive sepsis compared to the female babies (23%). Nelson[12] stated that males have an approximately two fold higher incidence of sepsis than females.

Out of 26 culture positive cases 20 (76.9%) were preterm babies. Culture positive sepsis is more common in preterm babies (76.9%) compared to term babies (23%). Anand et al[13] observed that 62% preterm babies were affected. Khatua et al[4] observed that out of 92 babies with neonatal septicemia 58 were preterm in 56.52%. Fanaroff et al[14], Koutouby et al[15], Piyush Gupta et al[16], N. Mehrotra et al[17] found that preterm babies were more affected than full-term babies by neonatal sepsis. Higher incidence of many complications of labor and resuscitation are more common in preterm babies than full term neonates. Premature babies are relatively immuno- compromised and immuno-inexperienced. These factors predispose them to infection.

Out of 29 inborn cases, 9 (31%) had culture positive sepsis. Out of 21 out born cases, 17(81%) had culture positive sepsis. Culture positive cases are more among out born babies (65.3%) compared to inborn babies (34.6%)

LBW babies had more culture positive sepsis compared to normal Wt babies. Nellian et al[18], N Mehrotra et al, Piyush Gupta et al, Agarwal et al, Khatua et al and Koutociby et al observed that low birth weight new born have higher in cidence of neonatal septicemia. N. Sinha et al[19] observed that babies with low birth weight predominanted (64.9%). Nelson[12] and Cloherty[20] stated that the low birth-weight was the single most important factor in neonatal septicemia. There was 3-10 fold higher incidence of septicemia in these infants than in normal birth-weight infants.

A score of one was given to each of 5 clinical features. Refusal of feeds has highest sensitivity in detecting sepsis, followed by Jaundice> Lethargy>Temp.instability> Respiratory distress. Respiratory distress has

highest specificity and positive predictive value. Commonly observed clinical manifestations were refusal to feeds (72%) temperature abnormality (62%), jaundice (76%), Lethargy (58%), Respiratory distress (56%). Other clinical features were present in less than 30% of suspected cases of neonatal sepsis. Hence only these five clinical features were taken in analysis of neonatal sepsis.

Khatua et al[4] observed that refusal of feeds, lethargy, diarrhea, temperature abnormality, abdominal distension, jaundice and vomiting were most common presenting features. Mishra et al[21] observed that common clinical presentations were juandice, lethargy, refusal of feeds, vomiting and respiratory distress.

Agarwal et al[22] observed that refusal to suck, sluggish activity, fever, jaundice were common clinical features. Gupta et al[1] observed that lethargy, feeding problems, abdominal distension, respiratory distress, hypothermia apnea and irritability were the most common presenting features. Somu et al[2] observed that abdominal distention, diarrhea, refusal of feeds, lethargy, vomiting, pallor were common presenting features. Anand et al[13] observed that refusal of feed, lethargy, temperature changes, sclerema were predominant clinical features.

CONCLUSION

Males were more commonly affected than females. LBW babies had more culture positive sepsis compared to normal Wt babies. Respiratory distress can be suggested as a better marker of neonatal sepsis.

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