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Original Research Article

A Study on Correlation Between Positive Blood Culture with CRP Level in Neonatal Sepsis Patients in Tertiary Care Centre in South Bihar

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Abstract:

Neonatal Sepsis is Systemic blood stream infection of neonates during the first 30 days of life. It is one of the most common causes of morbidity and mortality in newborns. Neonatal sepsis may have an early onset (birth to three days) or a late onset (four days or 30days). Onset is more rapid in premature neonates. C-reactive protein is an important inflammatory biomarker of neonatal sepsis in association with blood culture that aids in the timely diagnosis of neonatal septicaemia. The gold standard for diagnosis of bacterial sepsis is blood culture, may be primary or secondary to a focal infection. The risk factors for neonatal sepsis are prematurity, low birth weight etc. C-reactive protein (CRP) is a part of a protein group called acute phase reactants that is produced by the liver and is considered as an inflammatory biomarker.

Materials and Methods: This is prospective and laboratory-based study was conducted in department of Microbiology from Feburary 2024 to July 2024 in NMCH Jamuhar Sasaram. Total 108 blood samples were taken from Clinically suspected patients of neonatal septicemia from NICU, and processed by BACT/ALERT 3D automated Blood culture instrument and quantitative assessment of CRP were done by STANDARD F CRP (SD BIOSENSOR). Isolates were identified by morphological, cultural and biochemical characteristics.

Results and Discussion: A total of 108 blood sample of suspected neonatal septicaemia cases is analyzed. 28(26%) cases were blood culture positive while 72 (66.6%) were CRP positive. Out of total blood culture positive, 23(82%) cases are CRP positive. This study shows the sensitivity, specificity, NPV and PPV of CRP to detect neonatal septicaemia are 82.1%,38.75%,86% and 32% respectively. Out of 28 culture positive, 16 are gram negative bacilli, 10 are gram positive cocci and 2 are Candida species isolated. In our study 72 out of 108 total samples had positive results for CRP test i.e. 66.6%. Out of the total 28 culture positive detected sample of neonatal septicemia 23 samples were CRP positive.

Conclusion: The specificity and sensitivity of CRP against blood culture strengthen the use of this acute phase protein in the diagnosis of neonatal sepsis. Our study concludes that serum CRP is simple method for diagnosis of neonatal sepsis in resource limited settings.

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Introduction

Neonatal Sepsis is Systemic blood stream infection of neonates during the first 30 days of life. Neonatal sepsis may have an early onset (zero to three days) or a late onset (four days to 28days). Onset of sepsis is more rapid in premature neonates. It is one of the most common causes of morbidity and mortality in newborns. [1] In India accounts for 17,000 neonatal sepsis cases / 1,00,000 live births [2]. Clinical signs of sepsis are poor reflexes, lethargy, respiratory distress, bradycardia, apnea, fever, convulsions, abdominal distention and bleeding. Blood culture is a standard test for naming the causative agent of sepsis [3]. The culture reports would be positive in only 25 % to 45% of cases, results in less importance

following antenatal antibiotic exposure [4]. Delay in culture reports leads to inappropriate usage of antibiotics among the neonates suspected of sepsis. On the other hand, early diagnosis is the key to prevents neonatal mortality due to sepsis. Culture independent test such as serological test or detection of sepsis biomarker is used for better clinical outcome to avoid the emergence of antibiotic resistance [5]. CRP, PCT, IL-6, IL-8, IFN-g and TNF-α are the predominant biomarkers known for diagnosing neonatal sepsis. [6].

C-reactive protein is an important inflammatory biomarker of neonatal sepsis in association with blood culture that aids in the timely diagnosis of neonatal septicaemia and to guide the antibiotic treatment. CRP are widely employed in routine clinical practice by clinicians. On combining biomarkers with clinical assessment increases the possibility to confirm the diagnosis [7]. This study is undertaken to know the diagnostic value of CRP levels, and its correlation with blood culture is used in the management of neonatal sepsis.

Aim: To study, the correlation between high C-reactive protein (CRP) level and positive blood culture in suspected cases of neonatal septicemia Patients.

Materials and Methods

This is descriptive, prospective and laboratory-based study was conducted in department of Microbiology from Feburary 2024 to July 2024 in NMCH Jamuhar Sasaram. Total 108 blood samples were taken from Clinically suspected patients of neonatal septicemia from NICU, and blood culture were processed by BACT/ALERT 3D automated Blood culture instrument and Isolates were identified by morphological, cultural charecterstics and biochemical reactions. Qualitative and quantitative assessment of CRP were done by Latex agglutination test and STANDARD F CRP (SD BIOSENSOR). The cut off value of CRP level are 10mg/dl.

2.5ml of blood were collected from suspected cases of neonates and transported to Microbiology lab and 0.5ml was used for the measurement of CRP. 2ml was inoculated into the BACT/ALERT 3D automated Blood culture bottles.

Inclusion Criteria: All newborns who were diagnosed with septicaemia with a positive blood culture and CRP level to validate and confirm the diagnosis and Those neonates who were also diagnosed with septicaemia with a negative blood culture and CRP levels. The diagnosis of neonatal sepsis was based on any of three of the risk factors and clinical signs of bacterial infections.

- Birth weight < 2.5 kgs
- Gestational age < 37 weeks
- Foul-smelling / meconium-stained vaginal discharge
- Presence of maternal fever within two weeks before delivery
- Suspected chorioamnionitis
- Rupture of membranes >18 hours
- Prolonged labour
- Perinatal asphyxia (Apgar score < 4 at 1 minute)
- Clinical signs of sepsis – poor reflexes, lethargy, respiratory distress, bradycardia, apnea, fever, convulsions, abdominal distention, bleeding.

Exclusion Criteria: Neonates who had received antibiotics before collection of blood samples. Having surgical problems, chromosomal or congenital anomalies and Neonates referred in from other health care setups.were excluded from the study.

We analyse the data, Sensitivity, Specificity, Positive predictive value, Negative predictive value was used to determine the validity, reliability of CRP and blood culture as the gold standard. Summaries of measures were presented as tables, figures, and percentages.

Results

A total of 108 blood sample of suspected neonatal septicaemia cases are analyzed. Majority of neonates were having early onset sepsis (54.27%) as compared to late onset sepsis (45.73%). Out of 108 suspected cases 28 (26%) cases were blood culture positive. Among these culture positive isolates 16 (57.1%) are gram negative bacilli such as Escherichia coli 6 (21.4%) Klebsiella pneumonia 04 (14.3%) and Citrobacter koseri 6 (21.4%), isolates of candida spp. are 02 (7.1 %) and gram-positive cocci aare isolatedin 10 cases with 35.6% such as Staphylococcus aureus 07 (24.6%) and Enterococcus spp. 3 (10.7%).

In our study, out of 108 samples, 72 samples had positive results for CRP test i.e. 66.6% sample. In a total of 28 culture positive detected sample of neonatal septicemia,23 samples were CRP positive and showed significant correlation with culture positivity It indicates that sensitivity of CRP test to detect neonatal septicemia was 82.1%. In a total of the 80 culture negative sample, 31 samples were detected negative by estimation of CRP. Thus, specificity of CRP was 38.75%, which shows a relatively lower specificity rate. This study shows the sensitivity, specificity, NPV and PPV of CRP to detect neonatal septicaemia are 82.1%, 45%,86% and 32% respectively.

Table 1: Correlation of blood culture with CRP in Patients with Neonatal septicemia

Variables	Blood culture positive	Blood culture Negative	Total
CRP Positive	23	49	72
CRP Negative	05	31	36
Total	28	80	108

Table 2: Sensitivity, Specificity, NPV, and PPV of CRP with blood culture in Neonatal septicaemia patients

Tests	Sensitivity	Specificity	Negative predictive value	Positive Predictive Value
CRP	**82.1%**	**38.75%**	**86%**	**32%**

Table 3: Species wise distribution of blood cultures isolates

	Organism isolates	Frequency
Blood culture results	**No growth**	**80 (74%)**
	Citrobacter koseri	**06 (5.5%)**
	Klebsiella pneumoniae	**04(3.7%)**
	Escherichia coli	**06(5.5%)**
	Enterococcus spp.	**03(2.75)**
	Staphylococcus aureus	**07(6.4%)**
	Candida spp.	**02(1.85%)**

Table 4: Demographic Data of the Study Populations (Information like Gender, Age, Birth weight)

Demographic Details (n=100)	Number of Neonates
Gender	
Male	57.4.0% (62)
Female	42.6.0% (46)
Age	
Preterm (<37 weeks)	51.8% (56)
Term (>37 weeks)	48.2% (52)
Birth Weight	
Low birth weight	44.4% (48)
Normal birth weight	55.6% (60)

Discussion

- In our study out of 108 sample, 57.4.0% (62) male and 42.6.0% (46) female neonates. sample was received and processed. Males have been reported to be more than females to develop septicaemia as shows in our study. similar to findings of other studies reported by Mohammed Shahnawazet et al. [8] On the basis of birth weight 44.4% (48) are low birth weight and 55.6% (60) are normal birth weight. 51.8% (56) are premature baby and 48.2% (52) are mature baby, septicaemia is more common in premature baby, this study is correlated with the study done by Patel BM et al., [9] and Shah AJ et al., [10]. Out of 108 total samples 72 samples had positive results for CRP test i.e. 66.6%. In this study total 28 blood culture positive detected in 108 sample of suspected neonatal septicaemia patients, 23 samples were CRP positive. It indicates that sensitivity of CRP test to detect neonatal septicemia is 82.1%. 31 samples were detected negative by CRP results out of the 80 culture negative sample. Thus, specificity was 38.75%. In our study CRP test shows lower specificity rate.
- These results were similar to the study conducted by Gupta A et al. 2020 [11] with sensitivity of 86.7% specificity of 42%, Positive predictive Value of 45.5% and Negative Predictive value of 85% against blood culture. Mannan et al. 2010 [12] also had similar results with sensitivity of 92.86% and specificity of 36.11%, thus CRP can be viewed as having higher sensitivity rate and can be used in cases suspected of having neonatal septicaemia as it is rapid comparative to culture though chances of false negative results are high.
- Out of 108 suspected cases, 28 cases (26%) were culture positive. In the study done by Joshi et al,[13] it was found that 25% of sepsis suspected neonates were culture positive. while Shaw et al [14] and Gugnani P et al [15] reported culture positivity in 37.76% and 50.74% of the clinically septic neonates. This culture positive study is correlated with the study done by Purvi G et al [16] 2018 who reported a 31% of culture positive.
- **Conclusion:** The specificity and sensitivity of CRP against blood culture strengthen the use of this acute phase protein in the diagnosis of neonatal sepsis. The specificity and sensitivity

of CRP against blood culture strengthen the use of this acute phase protein in the diagnosis of neonatal sepsis. Our study concludes that serum CRP is simple method for diagnosis of neonatal septicemia. These tests are helpful to rule out neonatal infection and their treatment can be started by clinician as soon as possible within one hour, which is not only in tertiary care centers but also in remote area primary health care centers, unlike conventional methods that take up to seven days for blood culture for diagnosis of infection and septicemia.

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