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RESEARCH ARTICLE

A CORRELATION STUDY OF C-REACTIVE PROTEIN AND PLATELETS IN NEONATAL SEPSIS

Valinjkar, S., Malwatkar, K., Aleem, A., Nayak, P., Kore, Y. and Redkar, D.

Department of Paediatrics , Vedantaa Institute of Medical Sciences , Palghar, Maharashtra, India

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**Corresponding author:*
Valinjkar

ABSTRACT

Neonatal sepsis is a life-threatening condition and a leading cause of neonatal morbidity and mortality, particularly in low- and middle-income countries. Early diagnosis is difficult due to nonspecific clinical features. Biomarkers such as C-reactive protein (CRP), total leukocyte count (TLC), and platelet count are commonly used to support diagnosis, but their relative diagnostic utility requires further evaluation. A study was conducted for the correlation between C-reactive protein and platelet count in neonatal sepsis and to assess the diagnostic accuracy of CRP, TLC, and platelet count. This prospective observational study was conducted over 18 months in a tertiary care neonatal intensive care unit. A total of 150 neonates with clinical features suggestive of sepsis and supportive laboratory evidence were included. Neonates with congenital anomalies or non-sepsis-related thrombocytopenia were excluded. Blood culture–proven sepsis was identified in 120 neonates (80%), with Gram-negative organisms predominating (74.17%), particularly Klebsiella spp. CRP was positive in 135 neonates (90%) and showed high sensitivity (95.83%) but low specificity (33.33%) for sepsis (AUC 0.87). Thrombocytopenia was observed in 76.67% of neonates and demonstrated the highest diagnostic accuracy (AUC 0.98), while TLC showed balanced sensitivity (75%) and specificity (66.67%) with an AUC of 0.92. Platelet count emerged as the most reliable single predictor of neonatal sepsis, while CRP served as a highly sensitive screening marker. A combined biomarker approach using CRP, TLC, and platelet count may significantly improve early diagnosis and management of neonatal sepsis.

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INTRODUCTION

Neonatal sepsis is a leading cause of morbidity and mortality worldwide, especially in low- and middle-income countries (LMICs), where poor perinatal care, infection control, and diagnostics contribute to high rates. It causes about 203,000 deaths yearly, with 1.3 million cases globally, hitting preterm and low birth weight neonates hardest (mortality 17–25% in resource-limited settings). Despite neonatal ICU advances, its nonspecific symptoms and rapid progression remain challenging. Defined as a systemic inflammatory response to infection in the first 28 days of life, neonatal sepsis includes septicemia, pneumonia, meningitis, and other invasive infections. It splits into early-onset sepsis (EOS, within 72 hours, often from maternal transmission) and late-onset sepsis (LOS, after 72 hours, usually nosocomial or community-acquired). Diagnosis is tough due to immature immunity and overlapping symptoms like temperature instability, respiratory distress, poor feeding, lethargy, and hypotonia, mimicking non-infectious issues. Blood culture is the gold standard but limited by low sensitivity, delays, and false negatives. No single biomarker suffices; clinicians use clinical judgment plus markers like leukocyte/neutrophil/platelet counts, CRP, procalcitonin, cytokines, and chemokines. CRP, an acute-phase reactant rising 6–12 hours post-infection via IL-6, monitors progression and antibiotic response but lags as an early detector. Thrombocytopenia in sepsis signals severity via platelet consumption, impaired production, and immune destruction—often earlier than CRP. Combining CRP (inflammation) and platelets (hemostasis/disease severity) may improve diagnosis and prognosis. This study evaluates their correlation in neonates with suspected sepsis to enhance early detection and management in resource-limited settings using these accessible markers

MATERIALS AND METHODS

Study Design and Setting: This was a hospital-based observational correlation study conducted in the Department of Pediatrics and Neonatology at a tertiary care teaching hospital. The study was carried out over a defined study period and included neonates admitted to the neonatal intensive care unit (NICU) with clinical suspicion of sepsis. Ethical clearance was obtained from the Institutional Ethics Committee prior to initiation of the study, and informed consent was obtained from parents or legal guardians of all enrolled neonates.

Study Population: All neonates aged 0–28 days admitted to the NICU with clinical features suggestive of sepsis were

considered eligible for inclusion. Neonatal sepsis was suspected based on the presence of clinical signs such as temperature instability, respiratory distress, poor feeding, lethargy, hypotonia, apnea, or hemodynamic instability, with or without maternal risk factors.

Inclusion Criteria

- Neonates (≤28 days of life) with clinical suspicion of sepsis
- Both early-onset sepsis (≤72 hours of life) and late-onset sepsis (>72 hours of life)
- Neonates of either gender and all gestational ages

Exclusion Criteria

- Neonates with major congenital anomalies
- Neonates with known chromosomal abnormalities
- Neonates with severe perinatal asphyxia without evidence of infection
- Neonates who had received platelet transfusions prior to sample collection

Sample Size: The sample size was calculated based on the expected prevalence of neonatal sepsis and the anticipated correlation between C-reactive protein levels and platelet counts, as reported in previous studies. All eligible neonates meeting the inclusion criteria during the study period were enrolled to achieve adequate statistical power.

Clinical Evaluation: A detailed maternal and neonatal history was recorded for each participant. Maternal factors such as parity, mode of delivery, prolonged rupture of membranes, intrapartum fever, and antenatal infections were documented. Neonatal parameters including gestational age, birth weight, gender, APGAR scores, age at onset of symptoms, and clinical signs at presentation were systematically recorded. Neonates were categorized into early-onset sepsis (EOS) and late-onset sepsis (LOS) based on the timing of symptom onset.

Laboratory Investigations: Blood samples were collected from all enrolled neonates at the time of clinical suspicion of sepsis, prior to initiation of antibiotic therapy wherever possible. The following laboratory investigations were performed:

C-Reactive Protein (CRP): Serum C-reactive protein levels were measured using a standardized quantitative assay. A CRP value above the established laboratory reference range was considered positive and indicative of systemic inflammation. Serial CRP measurements were performed in selected cases to monitor disease progression and response to therapy.

Platelet Count: Platelet counts were obtained as part of a complete blood count using an automated hematology analyzer. Thrombocytopenia was defined as a platelet count less than 150,000/μL and was further categorized into mild, moderate, or severe based on standard definitions.

Other Investigations: Additional investigations included total leukocyte count, blood culture, and other relevant tests as clinically indicated. Blood cultures were processed using standard microbiological techniques, and organisms were identified along with antibiotic sensitivity patterns.

Outcome Measures: The primary outcome measure was the correlation between serum CRP levels and platelet counts in neonates with suspected sepsis. Secondary outcomes included:

- Association of CRP positivity with culture-proven sepsis
- Association of thrombocytopenia with sepsis severity
- Diagnostic performance of CRP and platelet count in predicting neonatal sepsis
- Clinical outcome in terms of survival or mortality

Statistical Analysis: Data were entered into a standardized proforma and analyzed using appropriate statistical software. Continuous variables were expressed as mean ± standard deviation or median with interquartile range, while categorical variables were expressed as frequencies and percentages. The association between CRP levels and platelet counts was assessed using correlation analysis. The diagnostic performance of CRP and platelet count was evaluated using sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and receiver operating characteristic (ROC) curve analysis. Logistic regression analysis was performed to assess the predictive value of CRP and platelet count for neonatal sepsis. A p-value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Baseline Characteristics of the Study Population: A total of neonates with clinical suspicion of sepsis admitted to the NICU during the study period were included in the analysis. Both early-onset sepsis (EOS) and late-onset sepsis (LOS) cases were represented.

Table. 1. Distribution according to CRP positive neonates

CRP	Frequency	Percentage
POSITIVE	135	90.00%
NEGATIVE	15	10.00%
TOTAL	150	100.00%

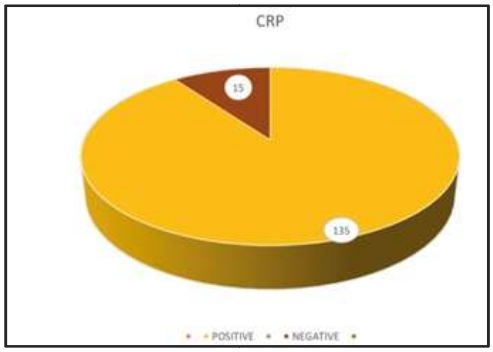

Fig. 1. Distribution according to CRP positive neonate

The majority of neonates presented within the early neonatal period, with EOS constituting a larger proportion of cases compared to LOS, consistent with observations reported from other tertiary care centers in low- and middle-income countries. Male neonates outnumbered females, demonstrating a male preponderance in neonatal sepsis. This finding is in agreement with multiple epidemiological studies that report increased susceptibility to sepsis among male neonates, possibly related to immunological and hormonal differences influencing neonatal immune responses.

Table 2. Distribution according to sepsis on blood culture

sepsis on blood culture	Frequency	Percentage
present	120	**80.00%**
absent	30	**20.00%**
Total	150	**100.00%**

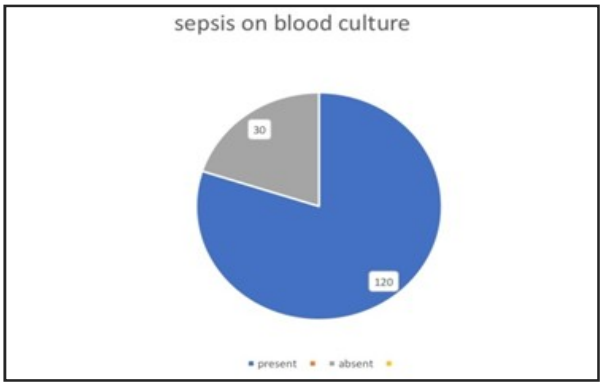

Fig. 2. Distribution according to sepsis on blood culture

Table 3. Distribution according Platelet counts and sepsis

PLATLET COUNT	SEPSIS		TOTAL	P VALUE
	PRESENT	**ABSENT**		
<1.5 Lakh /Mm^3	84	27	115	**<0.04 HIGHLY SIGNIFICANT**
>1.5 Lakh /Mm^3	36	3	35	
TOTAL	120	30	150	

Table 4. Association between CRP and sepsis

CRP	SEPSIS		TOTAL	P VALUE
	PRESENT	ABSENT		
POSITIVE	115	20	135	**<0.0001 HIGHLY SIGNIFICANT**
NEGATIVE	5	10	15	
TOTAL	120	30	150	

Most neonates were born to primiparous mothers, and a higher incidence of sepsis was observed among neonates delivered by cesarean section, which may be attributed to increased exposure to hospital environments and invasive procedures. Preterm and low birth weight neonates constituted a significant proportion of the study population. These neonates are known to be at increased risk for sepsis due to immature immune systems, compromised skin and mucosal barriers, and the frequent requirement for invasive interventions such as intravenous lines and mechanical ventilation.

Microbiological Profile: Blood cultures were positive in a subset of neonates with suspected sepsis. Culture-positive sepsis accounted for a larger proportion compared to culture-negative cases, highlighting the limitations of blood culture sensitivity in neonates. Among the culture-positive isolates, Gram-negative organisms predominated. Klebsiella pneumoniae and Escherichia coli were the most frequently isolated pathogens, followed by Staphylococcus aureus and coagulase-negative Staphylococci.

This bacteriological profile is consistent with reports from Indian and other LMIC settings, where Gram-negative organisms are the leading cause of neonatal sepsis. The predominance of Gram-negative pathogens underscores the importance of strict infection control measures and judicious antibiotic use, given the rising prevalence of multidrug-resistant organisms in NICUs.

C-Reactive Protein and Neonatal Sepsis: A significant proportion of neonates with clinically suspected sepsis demonstrated elevated CRP levels. CRP positivity was significantly associated with culture-proven sepsis, supporting its role as a reliable marker of systemic inflammation in neonatal infections. Neonates with positive blood cultures had higher mean CRP values compared to culture-negative cases.

The diagnostic performance of CRP in predicting neonatal sepsis was evaluated using sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). CRP showed good sensitivity and moderate specificity, making it a useful screening tool for neonatal sepsis. Receiver operating characteristic (ROC) curve analysis further demonstrated acceptable discriminatory ability of CRP in differentiating septic from non-septic neonates. These findings are consistent with previous studies that have highlighted CRP as a valuable adjunct in the diagnosis of neonatal sepsis, particularly when used in serial measurements. Although CRP is a relatively late marker, its strength lies in monitoring disease progression and guiding the duration of antibiotic therapy. A declining CRP trend was associated with favorable clinical outcomes, whereas persistently elevated or rising CRP levels were observed in neonates with severe disease or poor outcomes.

Platelet Count and Sepsis Severity: Thrombocytopenia was a common hematological abnormality observed in neonates with sepsis. A significant proportion of septic neonates exhibited platelet counts below the normal reference range. The severity of thrombocytopenia correlated with the clinical severity of sepsis, with lower platelet counts observed in neonates with culture-positive sepsis and adverse outcomes. The association between thrombocytopenia and neonatal sepsis was statistically significant. Neonates with severe thrombocytopenia demonstrated a higher risk of complications and mortality compared to those with normal or mildly reduced platelet counts. This finding reinforces the role of platelet count as an important prognostic marker in neonatal sepsis. The pathophysiological basis of thrombocytopenia in sepsis is multifactorial and includes increased platelet consumption due to endothelial activation and microthrombi formation, suppression of platelet production in the bone marrow, and immune-mediated platelet destruction. In severe cases, disseminated intravascular coagulation (DIC) may contribute to profound thrombocytopenia and increased mortality.

Correlation Between CRP and Platelet Count: A statistically significant inverse correlation was observed between serum CRP levels and platelet counts in neonates with sepsis. As CRP levels increased, platelet counts tended to decrease, reflecting the close interplay between inflammation and coagulation in the septic process. Neonates with high CRP values were more likely to exhibit thrombocytopenia, particularly in culture-positive and severe sepsis cases.

This correlation supports the hypothesis that combined assessment of inflammatory and hematological markers provides superior diagnostic and prognostic information compared to individual parameters. While CRP reflects the intensity of the systemic inflammatory response, platelet count serves as an indicator of hemostatic dysfunction and disease severity. Logistic regression analysis demonstrated that both elevated CRP and thrombocytopenia were independent predictors of neonatal sepsis. The combined use of these markers improved diagnostic accuracy and risk stratification. Neonates with both CRP positivity and thrombocytopenia had a significantly higher likelihood of confirmed sepsis and adverse outcomes.

Diagnostic Accuracy and Clinical Implications: The combined evaluation of CRP and platelet count showed improved sensitivity and specificity for the diagnosis of neonatal sepsis compared to either marker alone. ROC curve analysis revealed better predictive performance when both parameters were considered together, supporting their use as complementary biomarkers. From a clinical perspective, both CRP and platelet count are inexpensive, widely available, and easily interpretable investigations, making them particularly valuable in resource-limited settings. Their combined use can aid in early identification of high-risk neonates, guide initiation of empirical antibiotic therapy, and assist in monitoring treatment response. Early recognition of sepsis using readily available biomarkers can significantly reduce delays in treatment, minimize complications, and improve survival. Furthermore, serial monitoring of CRP and platelet count can help clinicians make informed decisions regarding antibiotic discontinuation, thereby reducing unnecessary antibiotic exposure and the risk of antimicrobial resistance.

Comparison With Previous Studies: The findings of the present study are in agreement with several previous studies that have demonstrated the diagnostic and prognostic utility of CRP and platelet count in neonatal sepsis. Similar correlations between elevated CRP levels and thrombocytopenia have been reported, emphasizing their combined role in reflecting disease severity. Studies conducted in similar settings have also reported a predominance of Gram-negative organisms and a high incidence of thrombocytopenia among septic neonates. The observed male predominance, higher risk among preterm and low birth weight neonates, and greater incidence of EOS are consistent with existing literature. While newer biomarkers such as procalcitonin and interleukins may offer earlier diagnostic potential, their limited availability and higher costs restrict their routine use in many settings. In contrast, CRP and platelet count remain practical and reliable tools for the management of neonatal sepsis.

CONCLUSION

Neonatal sepsis remains a major cause of morbidity and mortality, particularly in low- and middle-income countries where early diagnosis continues to be a challenge. The nonspecific clinical presentation and limited sensitivity of blood cultures highlight the need for reliable and accessible biomarkers. The present study demonstrates a significant inverse correlation between C-reactive protein (CRP) levels and platelet counts in neonates with suspected sepsis. Elevated CRP levels were strongly associated with culture-proven sepsis, indicating its value as a sensitive marker of systemic inflammation, while thrombocytopenia showed a significant association with disease severity and adverse outcomes, reinforcing its prognostic importance. The observed inverse relationship reflects the underlying interaction between inflammatory and coagulation pathways in neonatal sepsis. Importantly, the combined use of CRP and platelet count provided better diagnostic accuracy and risk stratification than either parameter alone. Given their low cost, wide availability, and ease of interpretation, these markers are especially valuable in resource-limited settings. Serial monitoring further enhances their utility in guiding timely initiation and rational discontinuation of antibiotic therapy. In conclusion, the integrated assessment of CRP and platelet count offers a practical, effective, and clinically meaningful approach for early diagnosis and prognostication in neonatal sepsis, with the potential to improve outcomes and support better antimicrobial stewardship.

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