ORIGINAL RESEARCH PAPER

Microbiology

A STUDY ON C-REACTIVE PROTEIN (CRP) IN EARLY DIAGNOSIS OF NEONATAL SEPSIS IN A RURAL TERTIARY CARE CENTRE

KEY WORDS: Neonatal sepsis, C-reactive protein.

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ABSTRACT

Background: Neonatal sepsis remains a major contributor to neonatal morbidity and mortality, especially in developing regions. Timely diagnosis is crucial yet complicated by nonspecific symptoms and delayed blood culture results **Objectives:** To evaluate the diagnostic accuracy of CRP in the early identification of neonatal sepsis and to assess its correlation with blood culture results and hematological parameters. **Methods:** This prospective observational study, conducted over 12 months, evaluated the diagnostic accuracy of C-reactive protein (CRP) in 189 neonates at risk of sepsis. CRP levels, measured by quantitative and semi-quantitative latex agglutination methods, were considered positive at ≥6 mg/L. **Results:** This 12-month study assessed CRP's diagnostic value in 189 neonates at risk of sepsis. CRP ≥6 mg/L showed 89.7% sensitivity, 78.4% specificity, 77.2% PPV, and 90.3% NPV. Elevated CRP correlated with abnormal haematological indices. Serial CRP monitoring in 52 neonates effectively reflected clinical response to treatment. **Conclusion:** CRP is a useful and affordable tool for early diagnosis and monitoring of neonatal sepsis, particularly in resource-limited settings, but should be used alongside clinical assessment and blood culture, not as a substitute.

INTRODUCTION

Neonatal sepsis, a systemic infection within the first 28 days of life, poses a major challenge in neonatal intensive care units, especially in developing countries. It is a leading cause of neonatal mortality globally, following prematurity and birth-related complications, as recognized by the World Health Organization (WHO)[1,2]. In India, the neonatal mortality rate stands at 25.3 per 1000 live births, with sepsis contributing significantly to these deaths[3]. Sepsis is classified as early-onset (EOS) if occurring within 72 hours of birth—typically from maternal transmission—or late-onset (LOS) if after 72 hours, often due to environmental or hospital-acquired infections[4].

Timely diagnosis of neonatal sepsis is challenging due to its nonspecific symptoms, including lethargy, temperature instability, and respiratory distress[4,5]. Although blood culture is the diagnostic gold standard, it has limitations such as delayed results and reduced sensitivity with prior antibiotic exposure[6]. This makes early and reliable biomarkers essential, particularly in resource-limited settings. C-reactive protein (CRP), an acute-phase reactant produced in response to interleukin-6, rises early during infection and declines with recovery, offering both diagnostic and monitoring utility[7,8]. The present study aims to assess the diagnostic accuracy of CRP in early detection of neonatal sepsis and its correlation with blood culture and haematological markers.

Objectives

To evaluate the diagnostic accuracy of CRP in the early identification of neonatal sepsis and to assess its correlation with blood culture results and hematological parameters.

MATERIALS AND METHODS

This prospective observational study was conducted over 12 months (June 2023 to June 2024) in the Neonatal ICU. A total of 189 neonates at risk for sepsis, delivered at the institute and meeting the inclusion criteria (age <28 days), were enrolled. Neonates aged >28 days or with non-specific symptoms were excluded. Institutional ethical clearance was obtained. Detailed clinical data, including age, sex, duration of illness, and presenting symptoms, were collected. Blood (2 mL) was drawn aseptically before initiating antibiotics and sent to the microbiology lab. Serum was separated via centrifugation at 2500–3000 RPM. Initial CRP testing was done using a qualitative latex agglutination test. CRP-positive samples were further analysed using semi-quantitative latex agglutination. A CRP level ≥6 mg/L was considered positive, based on previous research[12]. Blood cultures were performed using standard microbiological techniques[10], and CBC was conducted to assess white cell count, neutrophils, and platelets.

In a subgroup of 52 neonates, serial CRP testing was repeated every 48–72 hours to monitor treatment response alongside clinical status. Data analysis was performed using SPSS software. Diagnostic accuracy of CRP was evaluated using sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), with significance set at $p<0.05$.

RESULTS

In this study of 189 neonates with suspected sepsis, 68 cases (35.9%) were blood culture positive, while 79 (41.8%) had elevated CRP levels (≥6 mg/L). Among culture-positive neonates, 89.7% also showed raised CRP, and among CRP-negative cases, 93.6% were culture negative, indicating a strong correlation ($p < 0.001$). Hematological abnormalities among CRP-positive neonates included leucocytosis in 42%, neutrophilia in 58%, and thrombocytopenia in 36%, further supporting the diagnosis. Serial CRP monitoring in a subset showed a decline in CRP within 48–72 hours in clinically improving neonates, reinforcing its role in therapeutic monitoring, as also reported by Mehar et al. (2020) and Khashabi et al. (2004). Thus, CRP, in conjunction with hematological markers and blood culture, proved effective for early diagnosis and monitoring of neonatal sepsis. Data analysis based on sex, age, CRP levels, blood cultures, and hematologic parameters is presented in the following tables.

Table 1. Demographic Profile (n=189)

Sex	Number of Cases	Percentage (%)
Male	112	59.3%
Female	77	40.7%
Total	189	100%

Table 2: Age Wise Distribuition of Sample Taken

Age group (sepsis type)	Number	Percentage
Early onset sepsis(≤72 hrs)	119	62.9%
Late onset sepsis(> 72 hrs)	70	37.1%
Total	189	100%

Table 3: Correlation Between Elevated CRP Levels and Positive Blood Cultures

Category	Number of Neonates (n = 189)	Percentage (%)
Blood Culture Positive	68	35.9%
Elevated CRP (≥6 mg/L)	79	41.8%
Both Blood Culture Positive and Elevated CRP	61	89.7%
CRP Negative	110	58.2%
Both CRP Negative and Blood Culture Negative	103	93.6%

This table highlights the correlation between elevated CRP levels and positive blood cultures in neonates suspected of sepsis. Elevated CRP levels were observed in 41.8% of the neonates, and among those with positive blood cultures, 89.7% also had elevated CRP levels. Conversely, among the neonates with negative CRP levels, 93.6% had negative blood cultures, suggesting a strong negative predictive value for CRP in ruling out neonatal sepsis.

Table No.4 Diagnostic Performance of CPR

Diagnostic Parameter	Value (%)
Sensitivity	89.7%
Specificity	78.4%
Positive Predictive Value (PPV)	77.2%
Negative Predictive Value (NPV)	90.3%

The diagnostic evaluation showed that CRP had a sensitivity of 89.7%, specificity of 78.4%, PPV of 77.2%, and NPV of 90.3%, making it a reliable tool, especially for ruling out neonatal sepsis. In a subset of 52 neonates, serial CRP monitoring showed a decline in levels within 48–72 hours in clinically improving cases. Persistently elevated CRP indicated complicated or unresponsive sepsis. These results highlight the value of CRP in both early diagnosis and monitoring treatment response[11].

DISCUSSION

This study confirms the diagnostic reliability of CRP as a sensitive and practical tool in early detection of neonatal sepsis. The high sensitivity (89.7%) suggests that CRP is effective in detecting most true-positive sepsis cases, aligning with findings from Gupta et al. (2020), Monga et al. (2018), and Bunduki & Adu-Sarkodie (2016)[13].

While the specificity (78.4%) is slightly lower, indicating the possibility of false positives due to non-infectious inflammatory conditions, CRP remains valuable when combined with clinical findings and other laboratory parameters. Shirazi et al. (2010) and Gugnani et al. (2019) reported similar CRP performance metrics, supporting its utility in early screening.

One major advantage of CRP is its stability despite prior antibiotic exposure, unlike blood cultures which may be falsely negative. Additionally, serial CRP testing provides insight into treatment response. As shown by Mehar et al. (2020) and Sah et al. (2020), a declining CRP trend supports discontinuation of antibiotics, potentially reducing the risk of antibiotic resistance and adverse effects from prolonged therapy.

Our findings also reinforce the utility of combining CRP with CBC-derived haematological indices, which enhances diagnostic accuracy. Studies by Ahire et al. (2022) and Shirazi et al. (2010) found that abnormal CBC parameters like neutrophilia and thrombocytopenia increase the diagnostic yield when CRP is concurrently elevated.Despite CRP's advantages, it does not identify the specific pathogen and cannot fully replace culture-based diagnostics. However, in low-resource settings, CRP testing — especially the qualitative bedside form — remains an invaluable adjunct to clinical judgment.

CONCLUSION

The study underscores the significant role of CRP as a reliable and cost-effective biomarker for the early diagnosis of neonatal sepsis, especially in settings where rapid access to blood culture is limited. With a sensitivity of 89.7% and NPV of over 90%, CRP can safely guide early antibiotic initiation and, through serial measurement, help determine treatment duration. While it cannot replace blood cultures for pathogen identification, CRP provides crucial early support to clinicians in initiating and tailoring therapy. The combination of CRP with clinical signs and haematological indices enhances diagnostic confidence and promotes rational use of CRP in early diagnosis of neonatal septicaemia.

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