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Original Research Article

Platelet count and Platelet Indices in Neonatal Sepsis in Tertiary Care Hospital

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Abstract:

Background: Early recognition of neonatal sepsis is challenging; readily available hematologic markers may improve bedside diagnosis.

Aim: To evaluate platelet, count and platelet indices mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) as diagnostic markers of neonatal sepsis in a tertiary care hospital.

Methods: Prospective case–control study of 80 neonates (40 sepsis cases; 40 controls). Demographics, sepsis screens, blood cultures, and platelet parameters were recorded. Group comparisons used *t*/Mann–Whitney U and Chi-square tests; diagnostic performance was assessed with ROC analysis.

Results: Baseline characteristics were comparable between groups. Septic neonates had lower platelet count (134.6 ± 72.4 vs 225.8 ± 64.2×10⁹/L; $p<0.001$) and PCT (0.12 ± 0.04 vs 0.19 ± 0.05%; $p<0.001$), with higher MPV (11.2 ± 1.8 vs 9.1 ± 1.2 fL; $p<0.001$) and PDW (16.5 ± 2.3 vs 12.8 ± 1.9%; $p<0.001$). Thrombocytopenia was more frequent and severe in sepsis (moderate–severe in 32.5% vs 5% of controls). ROC analysis showed good discrimination for platelet count (cut-off <150×10⁹/L; sensitivity 72.5%, specificity 80%; AUC 0.82) and PCT (cut-off <0.15%; sensitivity 75%, specificity 77.5%; AUC 0.81); MPV (AUC 0.80) and PDW (AUC 0.78) also performed well.

Conclusion: A characteristic platelet signature—low platelet count/PCT with elevated MPV/PDW—distinguishes septic from non-septic neonates and provides inexpensive, rapid adjuncts for early sepsis screening in NICUs while awaiting culture confirmation.

Keywords: Neonatal sepsis; Platelet count; Mean platelet volume (MPV); Platelet distribution width (PDW); Plateletcrit (PCT); Thrombocytopenia; ROC curve; Tertiary care hospital.

Introduction

Neonatal sepsis remains a major cause of morbidity and mortality worldwide, particularly in developing countries where healthcare resources are limited. It is estimated that nearly 1.6 million neonatal deaths occur annually due to infections, accounting for about one-third of all neonatal deaths globally [1]. Early diagnosis and prompt treatment are crucial, yet clinical features of sepsis in neonates are often nonspecific, leading to diagnostic challenges [2]

Hematological parameters have long been used as supportive tools in the evaluation of neonatal sepsis. Among them, platelet count and platelet indices such as mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) have attracted significant interest as potential biomarkers [3]. Thrombocytopenia is frequently observed in septic neonates and is associated with increased severity of illness and poorer outcomes [4] Furthermore, alterations in platelet indices reflect changes in platelet production and activation, which may provide valuable insights into the pathophysiology of neonatal sepsis [5].

Platelets play an active role not only in hemostasis but also in immune regulation and inflammation. During sepsis, platelet activation, aggregation, and interaction with endothelial cells contribute to microvascular dysfunction and organ damage [6] Studies have shown that a low platelet count combined with deranged indices such as high MPV and PDW may serve as early predictors of neonatal sepsis [7,8]. Compared with traditional markers such as C-reactive protein (CRP) and blood culture, platelet indices are inexpensive, widely available, and can be quickly obtained from routine hematology analyzers, making them particularly useful in resource-limited settings [9].

Despite growing evidence, the utility of platelet indices as diagnostic and prognostic tools in neonatal sepsis remains underexplored in many tertiary care hospitals. Therefore, this study aims to assess the role of platelet count and platelet indices in neonates with suspected sepsis and to evaluate their potential as early and cost-effective diagnostic markers.

Materials and Method

This was a prospective observational study conducted in the Department of Paediatrics and Neonatology at a tertiary care teaching hospital. The study was carried out over a period of one year.

All neonates admitted to the Neonatal Intensive Care Unit (NICU) and suspected of sepsis based on clinical features and risk factors were included.

Inclusion Criteria

- Neonates (0–28 days of life) admitted with clinical suspicion of sepsis (e.g., poor feeding, lethargy, respiratory distress, temperature instability, seizures, or abdominal distension).
- Neonates with at least one sepsis screen marker positive (such as elevated CRP, abnormal total leukocyte count, or positive micro-ESR).

Exclusion Criteria

- Neonates with congenital anomalies, perinatal asphyxia, or birth trauma.
- Neonates with maternal history of immune thrombocytopenia, preeclampsia, or other hematological disorders.
- Babies who had received platelet transfusions prior to blood sampling.

A total of 80(Cases and Control) neonates fulfilling the inclusion and exclusion criteria were enrolled. The study protocol was approved by the Institutional Ethics Committee. Written informed consent was obtained from the parents or legal guardians before enrolment.

Method

For each neonate, demographic details (age, sex, gestational age, birth weight), perinatal risk factors (PROM, maternal fever, chorioamnionitis), and clinical features suggestive of sepsis were recorded in a predesigned proforma.

Laboratory Investigations

- **Blood Culture**: 1–2 mL of venous blood was collected aseptically before initiation of antibiotics and sent for culture and sensitivity (reference standard for diagnosis of sepsis).
- **Sepsis Screen**: CRP, total leukocyte count, immature to total neutrophil ratio (I/T ratio), and micro-ESR were performed.
- **Platelet Parameters**:
  - Platelet count (×10⁹/L)
  - Mean Platelet Volume (MPV, fL)
  - Platelet Distribution Width (PDW, %)
  - Plateletcrit (PCT, %)
  - These were measured using an automated hematology analyzer

Definitions

- Neonatal Sepsis: Defined as either culture-positive sepsis or clinical sepsis with positive sepsis screen.
- Thrombocytopenia: Platelet count <150 × 10⁹/L.
- Severe Thrombocytopenia: Platelet count <50 × 10⁹/L.

Statistical Analysis: All data were entered into Microsoft Excel 2016 and subsequently analyzed using SPSS version 25.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics were applied to summarize the baseline characteristics of the study population. Continuous variables, including platelet count, mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT), were expressed either as mean ± standard deviation (SD) or as median with interquartile range, depending on the distribution of data. Categorical variables were presented as frequencies and percentages. For comparison between groups, such as sepsis versus non-sepsis and survivors versus non-survivors, independent t-test or Mann–Whitney U test was employed for continuous variables, while the Chi-square test was used for categorical variables. A p value of less than 0.05 was considered statistically significant.

Observation and Results

Table 1: Baseline Demographic Characteristics of Study Population (n = 80)

Parameter	Cases (n=40)	Controls (n=40)	p-value
Mean Age (days)	7.2 ± 4.3	6.8 ± 3.9	0.62
Male : Female ratio	22:18	21:19	0.81
Mean Birth Weight (kg)	2.48 ± 0.52	2.61 ± 0.48	0.29
Preterm (%)	12 (30%)	9 (22.5%)	0.45

The baseline demographic profile of the study population, which included 40 neonates with sepsis and 40 without sepsis, showed no significant differences between the two groups The mean age of

neonates was comparable, with 7.2 ± 4.3 days in the sepsis group and 6.8 ± 3.9 days in the control group (p = 0.62). The male-to-female ratio was also similar, being 22:18 among cases and 21:19 among controls (p = 0.81). Likewise, the mean birth weight did not differ significantly, recorded as 2.48 ± 0.52 kg in cases versus 2.61 ± 0.48 kg in controls (p = 0.29). Preterm neonates constituted 30% of the sepsis group compared to 22.5% in the control group (p = 0.45). These findings suggest that the groups were demographically well-matched, minimizing baseline confounding.

Table 2: Platelet Count and Platelet Indices in Cases and Controls

Parameter	Cases (n=40)	Controls (n=40)	p-value
Platelet Count (×10⁹/L)	134.6 ± 72.4	225.8 ± 64.2	<0.001*
MPV (fL)	11.2 ± 1.8	9.1 ± 1.2	<0.001*
PDW (%)	16.5 ± 2.3	12.8 ± 1.9	<0.001*
PCT (%)	0.12 ± 0.04	0.19 ± 0.05	<0.001*

Marked differences were noted in platelet parameters between septic and non-septic neonates. The mean platelet count was significantly reduced in the sepsis group (134.6 ± 72.4 ×10⁹/L) compared to controls (225.8 ± 64.2 ×10⁹/L, p < 0.001). In contrast, platelet indices such as mean platelet volume (MPV) and platelet distribution width (PDW) were significantly higher in septic neonates, indicating platelet activation and anisocytosis. The MPV was 11.2 ± 1.8 fL in cases compared to 9.1 ± 1.2 fL in controls (p < 0.001), while PDW was 16.5 ± 2.3% in cases versus 12.8 ± 1.9% in controls (p < 0.001). Plateletcrit (PCT) was found to be significantly lower in neonates with sepsis (0.12 ± 0.04%) as compared to controls (0.19 ± 0.05%, p < 0.001). Collectively, these findings highlight a pattern of thrombocytopenia with increased platelet size heterogeneity and reduced platelet mass in septic neonates.

Table 3: Distribution of Thrombocytopenia in Study Groups

Platelet Count Category	Cases (n=40)	Controls (n=40)
Normal (>150 ×10⁹/L)	18 (45%)	34 (85%)
Mild (100–150 ×10⁹/L)	9 (22.5%)	4 (10%)
Moderate (50–100 ×10⁹/L)	7 (17.5%)	2 (5%)
Severe (<50 ×10⁹/L)	6 (15%)	0 (0%)

The distribution of thrombocytopenia across the study groups reinforced the association between sepsis and low platelet counts. In the control group, the majority of neonates (85%) had normal platelet counts (>150 ×10⁹/L), while only 45% of septic neonates maintained normal counts. Mild thrombocytopenia (100–150 ×10⁹/L) was seen in 22.5% of septic neonates compared to 10% of controls. Moderate thrombocytopenia (50–100 ×10⁹/L) was present in 17.5% of septic cases versus 5% of controls. Importantly, severe thrombocytopenia (<50 ×10⁹/L) was observed exclusively in the sepsis group (15%), with no such cases among controls. This distribution suggests that the severity of thrombocytopenia correlates strongly with sepsis in neonates.

Table 4: ROC Curve Analysis of Platelet Indices for Diagnosis of Sepsis

Parameter	Cut-off Value	Sensitivity (%)	Specificity (%)	AUC
Platelet Count	<150 ×10⁹/L	72.5	80	0.82
MPV	>10.5 fL	77.5	72.5	0.8
PDW	>15 %	70	75	0.78
PCT	<0.15 %	75	77.5	0.81

Receiver Operating Characteristic (ROC) curve analysis was performed to evaluate the diagnostic utility of platelet indices in neonatal sepsis. Platelet count <150 ×10⁹/L demonstrated good diagnostic performance with a sensitivity of 72.5%, specificity of 80%, and an AUC of 0.82. MPV >10.5 fL showed sensitivity of 77.5% and specificity of 72.5%, with an AUC of 0.80. PDW >15% yielded 70% sensitivity and 75% specificity (AUC = 0.78). PCT <0.15% had 75% sensitivity, 77.5% specificity, and an AUC of 0.81. Among all indices, platelet count and PCT were the most reliable markers, followed closely by MPV and PDW, suggesting that these parameters could serve as cost-effective and rapid diagnostic tools for neonatal sepsis.

Discussion

In this prospective case–control cohort of 80 neonates, septic cases demonstrated significantly lower platelet counts and plateletcrit (PCT), and higher mean platelet volume (MPV) and platelet distribution width (PDW) than controls.

Thrombocytopenia was more frequent and more severe among cases, including a 15% rate of severe thrombocytopenia (<50×10⁹/L) seen exclusively in the sepsis group. Diagnostic performance by ROC analysis was best for platelet count (AUC 0.82) and PCT (AUC 0.81), with MPV and PDW also performing well (AUC 0.80 and 0.78, respectively).

These findings align with the biological role of platelets as immune effectors: during sepsis, accelerated consumption/activation and marrow stress yield lower circulating counts, larger/younger platelets (↑MPV), and greater size heterogeneity (↑PDW), while the integrated platelet mass (PCT) falls. This pathophysiologic pattern has been consistently reported in neonatal and pediatric sepsis cohorts. Oncel et al. found MPV significantly higher in both culture-proven and clinical neonatal sepsis versus matched controls, supporting MPV as a readily available early marker [10]. Guida et al. earlier demonstrated that thrombocytopenia is common in septic very-low-birth-weight neonates and may vary with organism class, underscoring the robustness of platelet responses in neonatal sepsis [11].

Our thrombocytopenia distribution—normal counts in 45% of cases vs 85% of controls, with moderate–severe thrombocytopenia concentrated in sepsis—mirrors contemporary series. Arabdin et al. reported high frequencies and greater severity of thrombocytopenia among septic neonates, further linking low counts to adverse outcomes [12]. Similar observations are echoed in other neonatal cohorts and reviews.[13]

Regarding indices, our data showing ↑MPV and ↑PDW with ↓PCT in cases vs controls are consistent with the literature. Reviews synthesize that MPV, PDW, and PCT are inexpensive, fast, and widely available adjuncts for early sepsis evaluation in neonates [14]. Multiple primary studies corroborate elevated MPV as an early discriminator; some also report clinically useful cut-offs around 10–10.5 fL, with sensitivities/specificities in the 70–85% range—values comparable to our ROC metrics [15,16]. Recent hospital-based studies and pediatric sepsis analyses similarly highlight PDW and PCT as complementary markers, with ROC areas broadly in the 0.70–0.82 range, again in line with our AUCs (MPV 0.80, PDW 0.78, PCT 0.81) [17,18,19].

Clinical implications. Platelet indices, obtained from the same CBC draw with no added cost or turnaround, can augment early diagnostic suspicion in settings where cultures are delayed and CRP/other biomarkers may lag. Our results suggest that a composite approach—low platelet count or PCT together with elevated MPV/PDW—could improve bedside decision-making pending culture confirmation, particularly in resource-limited NICUs.

This resonates with broader pediatric sepsis literature where platelet parameters contribute to both diagnostic and prognostic stratification [20].

Strengths and limitations. Strengths include a well-matched control group and simultaneous appraisal of count plus indices with ROC benchmarking.

Limitations include single-center design, modest sample size, and lack of organism-specific analyses; platelet parameters can be influenced by gestational age, perinatal conditions, and analytical variability across hematology analyzers. Future multicenter studies should validate standardized cut-offs and explore dynamic changes (delta-MPV/PDW/PCT) relative to timing of sepsis and therapy response, alongside integration with other CBC-derived ratios (e.g., NLR/PLR) that show promise in late-onset neonatal sepsis [21].

Conclusion

In this cohort of 80 neonates, septic cases exhibited significantly lower platelet count and plateletcrit with higher MPV and PDW compared to controls, and thrombocytopenia especially moderate to severe was concentrated in the sepsis group. ROC analysis showed platelet count and PCT provided the best discrimination (AUC ≈0.82 and 0.81), with MPV and PDW also performing well. These findings support incorporating routine platelet indices as rapid, low-cost adjuncts to early sepsis screening in NICUs, enhancing bedside suspicion while awaiting culture confirmation.

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