Original Article

Role of Platelet Indices as a Diagnostic Marker of Neonatal Sepsis: A Case-Control Study in a Tertiary Railway Hospital of Eastern India

Asif Rafik Bagwan[1], Chaitali Patra[2], Rina Mukherjee[3]

[1]Post Graduate Trainee, Department of Paediatrics, B R Singh Hospital and Center for Medical Education and Research, Eastern Railway, Sealdah, Kolkata, West Bengal, India. [2]Senior Divisional Medical Officer, Department of Paediatrics, B R Singh Hospital and Center for Medical Education and Research, Eastern Railway, Sealdah, Kolkata, West Bengal, India. [3]Additional Chief Health Director and Head of the Department of Pathology, B R Singh Hospital and Center For Medical Education and Research, Eastern Railway, Sealdah, Kolkata, West Bengal, India

Abstract

Background: Neonatal sepsis continues to be a major contributor to morbidity and mortality in almost all parts of the world in both low and middle-income nations. The non-specific clinical presentation and constraints of the traditional diagnostics make it hard to detect the disease at earlier stages. Platelet indices have emerged as potential biomarkers of early sepsis. **Material and Methods:** The proposed study is a prospective case-control study to be conducted at the Department of Pediatrics, B. R. Singh Hospital, and the Centre of Medical Education and Research, Kolkata, between January and December 2024. One hundred and twenty-two term neonates (122) were enrolled, including 61 who developed culture-proven sepsis and 61 controls who did not. Platelet indices and total platelet count (TPC), mean platelet volume (MPV), and platelet distribution width (PDW), and the proportions of MPV to total platelet count TPC (MPV/TPC ratio) were evaluated. The receiver operating characteristic (ROC) curve analysis was used to evaluate diagnostic performance. **Results:** Septic neonates demonstrated significantly lower TPC (1.40 ± 0.43 vs. 2.55 ± 0.54 lakhs/mm³; $p < 0.001$), higher MPV (10.45 ± 1.63 vs. 9.11 ± 0.90 fL; $p < 0.001$), elevated PDW (19.80 ± 1.42 vs. 17.96 ± 1.45%; $p < 0.001$), and increased MPV/TPC ratio (8.12 ± 2.47 vs. 3.78 ± 1.04; $p < 0.001$) compared to controls. The MPV/TPC ratio exhibited the highest diagnostic accuracy (AUC = 0.961) with 80.3% sensitivity and 96.7% specificity at a cut-off of ≥5.84. **Conclusion:** Platelet indices, especially MPV/TPC ratio, have good diagnostic capabilities for neonatal sepsis and could be considered useful supplementary procedures to the traditional screening techniques, where limited resources are available.

Keywords: Neonatal sepsis, Neonatal sepsis platelet indices, platelet distribution width, platelet indices, platelet distribution width, platelet high-resolution computed tomography, platelet indices, platelet mean platelet volume, platelet indices, platelet high-resolution computed tomography, platelet mean platelet volume, platelet indices.

Received: 12 January 2026 **Revised: 30 January 2026** **Accepted: 12 February 2026** **Published: 03 March 2026**

Introduction

Neonatal sepsis is a potentially fatal systemic inflammatory disease that develops when microbes enter the bloodstream during the first 28 days of life.[1] It is the second leading cause of neonatal death in the world because it causes 15 percent of all neonatal deaths.[2] Neonatal sepsis has been estimated to be 2,202 per 100,000 live births worldwide, with the highest burden experienced in the low- and middle-income countries, where 99 per cent of neonatal mortality is seen.[3] The incidence of neonatal sepsis cases is higher in India as it has the highest absolute cases of the condition in the world, whereas the case fatality is 25 to 65 percent.[4]

Neonatal sepsis is a condition that is difficult to diagnose because of its non-specific presentation, lethargy, poor feeding, temperature variation, respiratory distress, and hemodynamic instability are just some of the manifestations.[5] Blood culture, which is the gold standard for diagnosis, has numerous limitations, including a long turnaround time of 48-72 hours, low sensitivity due to intermittent bacteremia, and the risk of contamination.[6] Traditional sepsis screening markers such as C-reactive protein, procalcitonin, and total leukocyte count exhibit varying sensitivity and specificity and are usually insufficient to support timely patient clinical decision-making.[7]

Platelets have important non-hemostatic functions, as they are significant agents of inflammation and are involved in immune responses.[8] In sepsis, platelets respond to interactions with the pathogen and immune cells, releasing inflammatory mediators and contributing to microvascular thrombosis.[9] Thrombocytopenia caused by sepsis occurs through various mechanisms, including increased platelet consumption, bone marrow inhibition, and sequestration.[10] Recent research has shown changes in platelet indices (mean platelet volume [MPV] and platelet distribution width [PDW]).[11,12] in septic neonates.

Address for correspondence: Dr. Asif Rafik Bagwan, Post Graduate Trainee, Department of Paediatrics, B R Singh Hospital and Center for Medical Education and Research, Eastern Railway, Sealdah, Kolkata, West Bengal, India
E-mail: dr.asifbagwan@gmail.com

DOI:
10.21276/amit.2026.v13.i1.399

How to cite this article: Bagwan AR, Patra C, Mukherjee R. Role of Platelet Indices as a Diagnostic Marker of Neonatal Sepsis: A Case-Control Study in a Tertiary Railway Hospital of Eastern India. Acta Med Int. 2026;13(1):588-591.

MPV is a measure of platelet size and activation status; a high MPV value indicates greater platelet turnover and the release of more and larger platelets active in the bone marrow.[13] PDW measures platelet anisocytosis and increases with heterogeneous platelet populations during inflammatory states.[14] The MPV/TPC ratio has been proposed as a composite marker with enhanced diagnostic performance compared to individual parameters.[15]

Despite promising preliminary evidence, studies evaluating platelet indices in neonatal sepsis from the eastern region of India remain limited. Therefore, this study aimed to evaluate the diagnostic utility of platelet indices as potential markers for neonatal sepsis in term neonates admitted to a tertiary care hospital.

Materials and Methods

Study Design and Setting: This prospective case-control study was conducted at the Department of Pediatrics, B. R. Singh Hospital and Centre for Medical Education and Research, Kolkata, a tertiary railway hospital in Eastern India, from January 2024 to December 2024.

Ethical Considerations: The Institutional Ethics Committee approved the study protocol. Written informed consent was obtained from parents/guardians of all participating neonates after explaining the study purpose in the local vernacular language.

Sample Size: The sample size was calculated using the formula for comparing two proportions. Based on previous literature reporting MPV >10.8 fL in 58.6% of septic neonates versus 33.3% of controls, with 95% confidence level and 80% power, the minimum sample size was estimated at 61 per group, totaling 122 participants.

Participants

Inclusion Criteria:

- **Cases:** Term neonates (≥37 weeks of gestation) up to 28 days of life with clinical features of sepsis and positive blood culture
- **Controls:** Term neonates admitted for non-infectious conditions without sepsis features

Exclusion Criteria:

- Neonates with chromosomal abnormalities, syndromic conditions, or hydrops fetalis
- Hypoxic-ischemic encephalopathy or intrauterine growth restriction
- Congenital or acquired thrombocytopenia
- Maternal conditions affecting platelet counts (ITP, gestational hypertension, TORCH infections)
- Prior platelet transfusion
- Culture-negative suspected sepsis cases

Data Collection: Proforma: The data on demographic characteristics, maternal risk factors, and clinical presentations were recorded using a structured proforma. Presence of fever (greater than 38.0 C) and hypothermia (less than 36.5 C), lethargy and poor feeding, respiratory distress, convulsions, vomiting, jaundice, or abdominal distension were also used to diagnose clinical sepsis.

Laboratory Investigations: Aseptically, peripheral venous blood samples (1.5-2 mL) were put in EDTA tubes. The full blood count, including TPC, MPV, and PDW, was analyzed on the Sysmex Automated Hematology Analyzer (System XN1000). Standard microbiological methods were used to obtain blood cultures from all suspected sepsis cases.

Statistical Analysis: SPSS version 16.0 was used to analyse the data. The continuous variables have been provided as mean and standard deviation, and analyzed through the Mann-Whitney U test. Frequencies and percentages were used to express categorical variables, and comparisons were performed using the chi-square or Fisher's exact test. Diagnostic performance has been assessed using ROC curve analysis and the determination of the area under the curve (AUC), sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV). The level of statistical significance was established at $p < 0.05$.

Results

Demographic and Birth Characteristics: One hundred and twenty-two neonates were recruited, including 61 cases and 61 controls. There were also similarities in the mean age at admission (3.84 ± 2.54 vs. 3.97 ± 1.91 days; p = 0.747). There was no difference in gender distribution (males: 47.5 versus 39.3; p= 0.361). Cases had significantly lower mean birth weight than controls (2.73 ± 60 vs. 2.96 ± 56 kg; p = 0.029) [Table 1].

Table 1: Demographic and Birth Characteristics of Study Participants

Characteristic	Cases (n=61)	Controls (n=61)	p-value
Mean age (days)	3.84 ± 2.54	3.97 ± 1.91	0.747
Male gender, n (%)	29 (47.5)	24 (39.3)	0.361
Mean birth weight (kg)	2.73 ± 0.60	2.96 ± 0.56	0.029*
Low birth weight, n (%)	22 (36.1)	15 (24.6)	0.168
Inborn delivery, n (%)	46 (75.4)	45 (73.8)	0.835

*Statistically significant ($p < 0.05$)

Maternal Risk Factors: There were significant maternal risk factors that were correlated with neonatal sepsis, which consisted of premature rupture of membranes (45.9% vs. 19.7; p = 0.002), foul-smelling liquor (34.4% vs. 3.3; p = 0.001), maternal fever (27.9% vs. 18.0; p = 0.023), chorioamnionitis (29.5% vs. 3.3; p =

Platelet Indices: Platelet indices were significantly different between septic infants and controls. Thrombocytopenia (TPC < 1.5 lakhs/mm3) was found in 39.3 percent of the cases, compared with 6.6 percent of the controls (p < 0.001). There were statistically significant discrepancies in all platelet parameters across groups [Table 2].

Table 2: Comparison of Platelet Indices Between Cases and Controls

Parameter	Cases (n=61)	Controls (n=61)	p-value
TPC (lakhs/mm³)	1.40 ± 0.43	2.55 ± 0.54	<0.001*
TPC <1.5 lakhs/mm³, n (%)	24 (39.3)	4 (6.6)	<0.001*
MPV (fL)	10.45 ± 1.63	9.11 ± 0.90	<0.001*
PDW (%)	19.80 ± 1.42	17.96 ± 1.45	<0.001*
MPV/TPC ratio	8.12 ± 2.47	3.78 ± 1.04	<0.001*

*Statistically significant ($p < 0.05$); TPC: Total platelet count; MPV: Mean platelet volume; PDW: Platelet distribution width

Diagnostic Performance: The examination of all ROC curves indicated that the platelet index has good diagnostic performance. The AUC was highest for the MPV/TPC ratio (0.961), followed by TPC (0.914), PDW (0.818), and MPV (0.734). At a cut-off value of 5.84 or higher, the MPV/TPC yielded sensitivity of 80.3%, specificity of 96.7%, and diagnostic accuracy of 88.5% [Table 3].

Table 3: Diagnostic Performance of Platelet Indices for Neonatal Sepsis

Parameter	AUC (95% CI)	Cut-off	Sensitivity (%)	Specificity (%)	PPV (%)	NPV (%)	Accuracy (%)
TPC (lakhs/mm³)	0.914 (0.862-0.967)	<1.5	82.0	98.4	84.5	98.0	90.2
MPV (fL)	0.734 (0.641-0.827)	≥9.75	67.2	75.4	73.2	69.7	71.3
PDW (%)	0.818 (0.746-0.890)	≥19.85	52.5	93.4	88.9	66.3	72.9
MPV/TPC ratio	0.961 (0.932-0.991)	≥5.84	80.3	96.7	96.1	83.1	88.5

AUC: Area under curve; PPV: Positive predictive value; NPV: Negative predictive value

Discussion

The paper tested platelet indices as variables in neonatal sepsis diagnostics and found that TPC, MPV, PDW, and the MPV/TPC ratio showed significant changes in septic newborn infants. The results confirm the use of these easily obtained parameters as supplements to the traditional diagnosis measures.

The finding of decreased birth weight in neonates with septicemia is consistent with the literature on the definition of low birth weight as the key risk factor in the infection of newborns.[16] The correlation is probably a manifestation of immunological immaturity and decreased transplacental immunoglobulin transmission in smaller infants.[17]

The maternal risk factors we found to be associated with PROM, chorioamnionitis, and maternal infections are also consistent with prior studies, which highlight the significance of intrapartum factors in the pathogenesis of early sepsis.[18] These results support the necessity of extreme maternal screening and prevention.

Thrombocytopenia in 39.3% of septic neonates is a finding supported by numerous studies reporting rates of 38-81%.[19,20] The pathophysiology is characterized by decreased platelet consumption due to disseminated intravascular coagulation, primary inhibition of bone marrow function by proinflammatory cytokines, and platelet aggregation with pathogens.[21]

The elevated MPV in discharged neonates indicates thrombopoiesis compensation, in which platelets produce larger, more reactive platelets.[22] Meta-analysis by Wang et al. established that there was a significant increase in MPV in neonates with septicemia as compared to normal controls.[23] We report an MPV of 9.75 fL or higher as the best cut-off and 67.2 as the sensitivity, which agrees with pooled estimates from recent meta-analyses.[24]

High PDWs reflect greater heterogeneity in platelet size under inflammatory conditions and have been linked to a range of infectious and inflammatory diseases.[25] The specificity (93.4) of PDW in our study is high, indicating that it can be used rule out the diagnosis of sepsis.

The most accurate diagnostic marker, based on AUC, was the MPV/TPC ratio, with an AUC of 0.961. This composite variable represents a reduction in platelet number and an increase in platelet volume, which enhances discriminant ability.[26] The same report was replicated by Kaur et al., who reported a 96.67% specificity for the MPV/TPC ratio in the diagnosis of neonatal sepsis.[27]

Our findings have important clinical ramifications, especially in resource-constrained environments—platelet indices. The platelet indices are traditionally obtained by performing a standard complete blood count and do not require any additional cost or specialized equipment. Their prompt access is in contrast to blood culture turnaround times, which may delay timely therapy changes.

Limitations of the study include its single-center design, which did not distinguish between early- and late-onset sepsis. Moreover, gestational age associations among neonates during the term period may affect platelet parameters. It is justified to conduct multicenter research involving larger numbers of people in the future to confirm these results.

Conclusion

This paper shows that platelet indices, specifically the MPV/TPC ratio, have strong diagnostic value, with high sensitivity and specificity for neonatal sepsis. These parameters are cost-effective and readily available and could be useful as adjuncts to traditional diagnostic methods to recognize and intervene in sepsis more quickly. Incorporating platelet indices into neonatal sepsis screening guidelines would greatly enhance the quality of diagnostic systems, particularly in health facilities with limited resources, and ultimately reduce the rates of neonatal morbidity and mortality.

Financial support and sponsorship
Nil.

Conflicts of interest
There are no conflicts of interest.

References
1. Shane AL, Sánchez PJ, Stoll BJ. Neonatal sepsis. Lancet. 2017;390(10104):1770-1780. DOI: 10.1016/S0140-6736(17)31002-4
2. Fleischmann-Struzek C, Goldfarb DM, Schlattmann P, Schlapbach LJ, Reinhart K, Kissoon N. The global burden of paediatric and neonatal sepsis: a systematic review. Lancet Respir Med. 2018;6(3):223-230. DOI: 10.1016/S2213-2600(18)30063-8
3. Milton R, Gillespie D, Dyer C, et al. Neonatal sepsis and mortality in low-income and middle-income countries from a facility-based birth cohort: an international multisite prospective observational study. Lancet Glob Health. 2022;10(5):e661-e672. DOI: 10.1016/S2214-109X(22)00043-2
4. Fleischmann C, Reichert F, Cassini A, et al. Global incidence and mortality of neonatal sepsis: a systematic review and meta-analysis. Arch Dis Child. 2021;106(8):745-752. DOI: 10.1136/archdischild-2020-320217
5. Simonsen KA, Anderson-Berry AL, Delair SF, Davies HD. Early-onset neonatal sepsis. Clin Microbiol Rev. 2014;27(1):21-47. DOI: 10.1128/CMR.00031-13
6. Cantey JB, Baird SD. Ending the culture of culture-negative sepsis in the neonatal ICU. Pediatrics. 2017;140(4):e20170044. DOI: 10.1542/peds.2017-0044
7. Sharma D, Farahbakhsh N, Shastri S, Sharma P. Biomarkers for diagnosis of neonatal sepsis: a literature review. J MaternFetal Neonatal Med. 2018;31(12):1646-1659. DOI: 10.1080/14767058.2017.1322060
8. Semple JW, Italiano JE Jr, Freedman J. Platelets and the immune continuum. Nat Rev Immunol. 2011;11(4):264-274. DOI: 10.1038/nri2956
9. de Stoppelaar SF, van 't Veer C, van der Poll T. The role of platelets in sepsis. ThrombHaemost. 2014;112(4):666-677. DOI: 10.1160/TH14-02-0126
10. Claushuis TAM, van Vught LA, Scicluna BP, et al. Thrombocytopenia is associated with a dysregulated host response in critically ill sepsis patients. Blood. 2016;127(24):3062-3072. DOI: 10.1182/blood-2015-11-680744
11. Choudhary RR, Makwana M, Mourya HK, Dabi J, Gulati K. Evaluation of platelet and its indices as a marker of neonatal sepsis: a prospective case control study. Int J ContempPediatr. 2018;5:1898-1903. DOI: 10.18203/2349-3291.ijcp20183524
12. Panda SK, Nayak MK, Thangaraj J, Das P, Pugalia R. Platelet parameters as diagnostic markers in the early diagnosis of neonatal sepsis. J Family Med Prim Care. 2022;11(5):1748-1754. DOI: 10.4103/jfmpc.jfmpc_1421_21
13. Gasparyan AY, Ayvazyan L, Mikhailidis DP, Kitas GD. Mean platelet volume: a link between thrombosis and inflammation? Curr Pharm Des. 2011;17(1):47-58. DOI: 10.2174/138161211795049804
14. Budak YU, Polat M, Huysal K. The use of platelet indices, plateletcrit, mean platelet volume, and platelet distribution width in emergency non-traumatic abdominal surgery: a systematic review. Biochem Med (Zagreb). 2016;26(2):178-193. DOI: 10.11613/BM.2016.020
15. Gao Y, Li Y, Yu X, et al. The impact of various platelet indices as prognostic markers of septic shock. PLoS One. 2014;9(8):e103761. DOI: 10.1371/journal.pone.0103761
16. Belachew A, Tewabe T. Neonatal sepsis and its association with birth weight and gestational age among admitted neonates in Ethiopia: systematic review and meta-analysis. BMC Pediatr. 2020;20(1):55. DOI: 10.1186/s12887-020-1949-x
17. Stoll BJ, Hansen NI, Sánchez PJ, et al. Early-onset neonatal sepsis: the burden of group B streptococcal and E. coli disease persists. Pediatrics. 2011;127(5):817-826. DOI: 10.1542/peds.2010-2217
18. Moftian N, Samad Soltani T, Mirnia K, et al. Clinical risk factors for early-onset sepsis in neonates: an international Delphi study. Iran J Med Sci. 2023;48(1):57-69. DOI: 10.30476/ijms.2022.94666.2581
19. Ree IMC, Fustolo-Gunnink SF, Bekker V, Fijnvandraat KJ, Steggerda SJ, Lopriore E. Thrombocytopenia in neonatal sepsis: incidence, severity and risk factors. PLoS One. 2017;12(10):e0185581. DOI: 10.1371/journal.pone.0185581
20. Brown RE, Rimsza LM, Pastos K, et al. Effects of sepsis on neonatal thrombopoiesis. Pediatr Res. 2008;64(4):399-404. DOI: 10.1203/PDR.0b013e318181ad49
21. Satoh K, Wada T, Tampo A, et al. Practical approach to thrombocytopenia in patients with sepsis: a narrative review. Thromb J. 2024;22(1):67. DOI: 10.1186/s12959-024-00635-4
22. Guclu E, Durmaz Y, Karabay O. Effect of severe sepsis on platelet count and its indices. Afr Health Sci. 2013;13(2):333-338. DOI: 10.4314/ahs.v13i2.19
23. Wang J, Wang Z, Zhang M, Lou Z, Deng J, Li Q. Diagnostic value of mean platelet volume for neonatal sepsis: a systematic review and meta-analysis. Medicine (Baltimore). 2020;99(32):e21649. DOI: 10.1097/MD.0000000000021649
24. Milas GP, Karageorgiou V, Repasos E, Zafeiropoulou K. Mean platelet volume for the diagnosis of neonatal sepsis: a systematic review and meta-analysis. Clin Chem Lab Med. 2022;60(7):1027-1034. DOI: 10.1515/cclm-2022-0201
25. Aydemir H, Piskin N, Akduman D, et al. Platelet and mean platelet volume kinetics in adult patients with sepsis. Platelets. 2015;26(4):331-335. DOI: 10.3109/09537104.2012.701027
26. Djordjevic D, Rondovic G, Surbatovic M, et al. Neutrophil-to-lymphocyte ratio, monocyte-to-lymphocyte ratio, platelet-to-lymphocyte ratio, and mean platelet volume-to-platelet count ratio as biomarkers in critically ill and injured patients. Mediators Inflamm. 2018;2018:3758068. DOI: 10.1155/2018/3758068
27. Kaur K, Varughese PV, Singh R, Shajan N. Neonatal platelet parameters as early markers for diagnosis of neonatal sepsis. Natl Board Exam J Med Sci. 2024;2(12):1233-1244. DOI: 10.25259/NBEJMS_376_2024.