

# Platelet Count and its Indices: Early Marker of Neonatal Sepsis

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**Abstract:** Introduction: Neonatal sepsis is one of the major factors contributing to the high perinatal and neonatal mortality and morbidity amongst newborns and is a global health challenge. Prompt treatment can decrease the mortality rate. <sup>(1, 2)</sup> Aims and objectives: The aim of the study was to evaluate the platelet count and platelet indices in cases of neonatal sepsis. Secondary objective is to correlate platelet count and platelet indices with clinical features and other markers of sepsis like blood culture and C - reactive proteins. Materials and Methods: The prospective study lasted two years from July 2020 to August 2022, at a tertiary care hospital where platelet count and its indices were evaluated along with the clinical features of neonates for early diagnosis of neonatal sepsis. Results: A total of 117 cases of neonatal sepsis with male preponderance in the age group of 1 - 2 days were obtained. The preterm neonates delivering by caesarian section were more at risk for septicemia. Thrombocytopenia was observed in 78 cases. Increased platelet parameters like mean platelet volume and platelet distribution width were observed in the study.

**Keywords:** Thrombocytopenia, Neonatal sepsis, Platelet indices in neonatal sepsis, Organisms in neonatal sepsis, C - reactive protein in neonatal sepsis.

## 1. Introduction

Neonatal sepsis is defined as a clinical syndrome of bacteremia with systemic signs and symptoms of infection in first 4 weeks of life. <sup>(1, 2)</sup>

Neonatal septicemia is one of the major factors contributing to the high perinatal and neonatal mortality and morbidity amongst newborns and is a global health challenge. <sup>(1, 3)</sup>

Neonatal sepsis is mostly caused by bacteria, most common are Escherichia coli (Ecoli), Listeria and some strains of Group B streptococcus. <sup>(4)</sup>

Sophisticated biomarkers help in early diagnosis of neonatal sepsis and hence better management of the neonate reducing the mortality and morbidity of the patient. <sup>(5, 6)</sup> Correlation of these biomarkers with specific clinical features, signs and symptoms aid in better prognosis for the patient.

Complete blood count and platelet parameters are reasonably available tests for early diagnosis of neonatal sepsis. <sup>(7)</sup>

A major diagnostic challenge in neonatology is early, accurate and rapid diagnosis of neonatal sepsis.

The present study was undertaken to evaluate platelet count and platelet indices and to find out their role as early indicator and prognostic marker in neonatal sepsis.

## 2. Materials and Methods

The present study was a two years prospective study carried out in the department of pathology of tertiary care hospital. Our study includes study of neonates having clinical

suspicion of sepsis admitted in NICU during the period from July 2020 to August 2022

A written informed consent was taken from the parents of neonates included in the study.

### Inclusion Criteria

All neonates presenting with neonatal sepsis.

### Exclusion Criteria

- 1) Neonates with bleeding disorder in family
- 2) Neonates with exchange transfusion and maternal immune thrombocytopenic purpura.

### 2.1 Methodology

In Pathology department, the blood sample was processed within half an hour. The blood samples was analyzed for routine hematological parameters viz hemoglobin, haematocrit, red cell indices, total WBC count, differential count, platelet count and its indices. (MPV & PDW)

The platelet parameters were compared with the clinical features and if already available blood culture reports and C - reactive protein.

These investigations were performed on Automated Haematology analyser Nihon Kohden Mek - 9100.

For every sample, a peripheral smear was made and blood film was stained with Leishman's stain.

The peripheral smears were also examined for morphological changes in WBC associated with infection.

The platelet count was verified on the smear.

### 3. Observation and Results

A total of 117 cases were obtained within a period of two year from August 2020 to July 2022 which was hospital based prospective study.

All the patients with clinically suspected neonatal sepsis were included in this study.

Youngest patient was 1 day old and oldest patient was 28 days old in the present study.

**Table 1:** Age distribution among neonates having sepsis

Gestational Age (days)	No. of cases	Percent
1 - 2	55	47.01
3 - 4	19	16.24
5 - 7	17	14.53
> 7	26	22.22
Total	117	100

There were 71 (60.68%) males and 46 (39.32%) females with male preponderance and

Male: Female ratio of 1.5: 1.

80 cases (68.37%) were small for gestational age and 37 (31.63%) were average for gestational age.

64 neonates (54.70%) were preterm and 53 (45.30%) of neonates were term babies.

Among the total number of cases with sepsis, 75 cases (64.10%) had out of institute delivery and 42 cases (35.89%) had institutional delivery.

Caesarean section delivery was present in 82 cases (70.08%) and 35 cases (29.91%) had vaginal delivery.

**Table 2:** Distribution of Maternal Complication among Neonates with sepsis

Maternal Complication	No. of cases	Percent
Premature Rupture of Membranes	49	41.80
Meconium stained liquor	29	24.7
Prolonged Labour	23	20
Maternal Fever	09	7.6
Nil	07	5.9
Total	117	100

Premature rupture of membranes i. e 49 cases (41.8%) was the commonest maternal complication and Fever 9 cases (7.6%) was the least common complication.

Blood culture was positive in 25 cases (21.36%).

**Table 3:** Isolated organism in blood culture positive cases of neonatal sepsis

Organisms Isolated (n=25)	No of Cases	%
Klebseilla pneumonia	15	60
E. coli	07	28
Coagulase negative staphylococcus	03	12
Total	25	100

The commonest organism isolated amongst blood culture positive cases of clinically suspected cases of neonatal sepsis was klebsiella pneumonia 15 cases (60%) followed by Ecoli 7 cases (28%).55 cases (47.01%) showed early onset sepsis while late onset sepsis was seen in 62 cases (52.9%)

CRP levels were raised in 106 cases (90%) and normal in 11 cases (10%).

The most common clinical presentation among neonates having sepsis was respiratory distress with 106 cases (90.59 %) followed by fever which were 6 cases (5.12%) and shock 5 cases (4.27%).

#### Hematological parameters in clinically diagnosed cases of neonatal sepsis

**Table 4:** Distribution of cases on the basis of Hemoglobin levels among neonates with sepsis

Hemoglobin level (N. value - 14 - 20g/dl)			Hematocrit (42% - 60%)		
Hb (gm/dl)	No of cases	%	HCT (%)	No of cases	%
7.2 - 10	05	4.27	21.6 - 30	05	4.27
10.1 - 13.0	05	4.27	30.3 - 39	05	4.27
13.1 - 20	107	91.45%	39.3 - 60	107	91.45
Total	117	100	Total	117	100

Maximum number of patients i. e 57 cases (48.7%) had TLC within normal limits, followed by 50 cases (42.7%) had leucopenia and minimum were 10 (8.5%) had leucocytosis.

**Table 5:** Differential WBC count pattern among neonates with sepsis

Differential count pattern	Leucopenia	Normal WBC count	Leucocytosis
Neutrophilia	12/50 (24%)	12/57 (21.05%)	8/10 (80%)
Lymphocytosis	34/50 (68%)	35/57 (61.40%)	1/10 (10%)
Within Normal Limits	04/50 (8%)	10/57 (17.54. %)	1/10 (10%)

Majority of the cases i. e 78 (66.66%) had thrombocytopenia and the rest of the cases i. e 39 (33.34%) had platelet count within normal limits.

**Table 6:** Distribution of cases on the basis of Grades of thrombocytopenia in clinically suspected cases of neonatal sepsis

Grade of Thrombocytopenia	No of cases	%
Mild (1, 00, 000 - 150000) cells/mm3	22	28.2
Moderate (50, 000 - 99000) cells/mm3	40	51.28
Severe (<50, 000) cells/mm3	16	20.5
Total	78	100

80 cases (68.37%) had mean platelet volume more than 10.1 while 37 cases (31.62%) had mean platelet volume less than 10.1 while 86 cases (73.50%) had platelet distribution width more than 19.1 and 31 cases (26.5%) had platelet distribution width had less than 19.1.

#### Abnormal peripheral smear findings in clinically positive blood culture

Immature polymorphonuclear leucocyte (band form) were seen in 21 (84%) blood culture positive neonatal sepsis cases out of 25 cases. Among blood culture positive neonates, toxic granulation was present in 6 cases (24%), cytoplasmic vacuolization in 8 cases (32%) and both findings were found in 5 cases (20%).

#### 4. Discussion

The most prevalent age group in the study was 1 - 2 days (47.01%) with a male preponderance of 1.5: 1. Several other studies had similar finding with same age group. There were 68.37% cases who were small for gestational age and 54.7% were preterm. Similar findings were found in other studies. <sup>(8, 9, 10, 11, 12, 13)</sup>

64.10% cases had institutional delivery in the present study.

Out of the 117 cases, 70.08% cases had caesarian section delivery which showed similarity with Adatara and Noah. <sup>(14, 15)</sup> 41.8% cases presented with premature rupture of membranes.

21.36% cases were blood culture positive with 60% cases positive for klebsiella pneumonia. Similarity was found in other studies. <sup>(16, 17)</sup>

The C - reactive protein was raised in 90% of blood culture positive cases.

52.99% cases had early onset of sepsis with respiratory distress being the common presenting feature having similarity with Stoll. <sup>(18)</sup>

Hemoglobin levels were within 13.1 - 20 g/dl present in 91.45% cases. Leucopenia was present in 42.7% cases having similarity with Adane. <sup>(19)</sup>

Other peripheral smear abnormalities in clinically diagnosed cases of neonatal sepsis were total polymorphonuclear leucocyte count (band form) and morphological changes in polymorphonuclear leucocytes which included toxic granulation and vacuolation.

Thrombocytopenia was observed in 78 cases (66.66%), of which 40 cases (51.28%) had moderate thrombocytopenia, 16 cases (20.5%) and 22 cases (28.2%) had severe and mild thrombocytopenia which were similarly found in Arabdin. <sup>(20)</sup>

73.5% cases revealed increased PDW and 86% cases revealed increased MPV values. Similar observation was found by Choudhary. <sup>(21)</sup>

#### 5. Conclusion

Clinical presentation in neonatal sepsis is not specific as it can mimic other clinical conditions. So other parameters need to be evaluated for early diagnosis of the condition.

Platelet count and its indices can be analyzed for better prognosis of the sepsis amongst neonates. it is an economical modality of investigation.

Neonatal sepsis is associated with low birth weight, premaurity and caesarian deliveries

Anemia, leucopenia and leucocytosis are unreliable predictors of neonatal sepsis as these parameters can change in the first few hours to days of life.

Clinical correlation with the platelet count, its indices and hematology parameters can minimize the mortality and morbidity in neonatal sepsis by early diagnosis.

#### Consent

As per international standard or university standard, patients written consent has been collected and preserved by the author (s).

#### Ethical Approval

As per international standard or university standard written ethical approval has been collected and preserved by the author (s).

#### Competing interests

Authors have declared that no competing interests exist.

#### References

- [1] Chandna A, Rao N, Srinivas M, Shyamala S. Rapid diagnostic tests in neonatal septicemia. *Indian J Pediatr* 1988; 55 (6): 947 - 953.
- [2] Tewabe, T., Mohammed, S., Tilahun, Y. et al. Clinical outcome and risk factors of neonatal sepsis among neonates in Felege Hiwot referral Hospital, Bahir Dar, Amhara Regional State, North West Ethiopia 2016: a retrospective chart review. *BMC Res Notes* 10, 265 (2017). <https://doi.org/10.1186/s13104-017-2573-1>
- [3] Alonso Zea - Vera, Theresa J. Ochoa, Challenges in the diagnosis and management of neonatal sepsis, *Journal of Trop Pediatrics*, 2015 61 (1), 1–13, <https://doi.org/10.1093/tropej/fmu079>.
- [4] Darmstadt GL, Saha SK, Choi Y, El Arifeen S, Ahmed NU, et al; Bangladesh Projahnmo - 2 (Mirzapur) Study Group. Population - based incidence and etiology of community - acquired neonatal bacteremia in Mirzapur, Bangladesh: an observational study. *J Infect Dis.* 2009 15; (6): 906 - 15. doi: 10.1086/605473. PMID: 19671016; PMCID: PMC2841956.
- [5] Celik IH, Hanna M, Canpolat FE, Mohan Pammi. Diagnosis of neonatal sepsis: the past, present and future. *Pediatr Res.* 2022; 91 (2): 337 - 350. doi: 10.1038/s41390 - 021 - 01696 - z. Epub 2021 Nov 2. PMID: 34728808; PMCID: PMC8818018.
- [6] Commins SP, Borish L, Steinke JW. Immunologic messenger molecules: cytokines, interferons, and chemokines. *J Allergy Clin Immunol.* 2010; 125 (2 Suppl 2): S53 - 72. doi: 10.1016/j. jaci.2009.07.008. Epub 2009, 24. PMID: 19932918.
- [7] Dey, Dipika & Sultana, Razia & Ahmed, Wazir & Chowdhury, Mahmood & Akter, Farhana & Dasgupta, Srabony. (2020). Role of Hematological Score in Early Diagnosis of Neonatal Sepsis. *Chattagram Maa - O - Shishu Hospital Medical College Journal.* 18.45 - 48.10.3329/cmshmcj. v18i2.47776.
- [8] Makkar M, Gupta C, Pathak R, Garg S, Mahajan NC. Performance evaluation of hematologic scoring system in early diagnosis of neonatal sepsis. *J Clin Neonatol.* 2013; 2 (1): 25 - 9. doi: 10.4103/2249 - 4847.109243. PMID: 24027741; PMCID: PMC3761960.

- [9] Salama, K., Gad, A. & El Tatawy, S. Sepsis profile and outcome of preterm neonates admitted to neonatal intensive care unit of Cairo University Hospital. *Egypt Pediatric Association Gaz* 69, 8 (2021). <https://doi.org/10.1186/s43054-021-00055-1>.
- [10] Mohamed SH, Binni RR, Yousef BA. Management of early onset sepsis in a teaching hospital: A descriptive retrospective study. *J Acute Dis* 2020; 9: 78 - 82.
- [11] Majumdar A, Biswas S, Jana A. Platelet indices as an earlier and economical marker of neonatal sepsis. *Iraqi J Hematol* 2021; 10: 108 - 11
- [12] Jajoo M, Kapoor K, Garg LK, Manchanda V, Mittal SK. To study the incidence and risk factors of early onset neonatal sepsis in an out born neonatal intensive care unit of India. *J Clin Neonatol* 2015; 4: 91 - 5.
- [13] Khinchi, Y., Kumar, A., & Yadav, S. (2010). Profile of Neonatal sepsis. *Journal of College of Medical Sciences - Nepal*, 6 (2), 1-6. <https://doi.org/10.3126/jcmsn.v6i2.3609>
- [14] Peter Adatara, 1Agani Afaya, 1Solomon Mohammed Salia, 1Richard Adongo Afaya, 2Kennedy Diema Konlan, 1Eric Agyabeng - Fandoh, 1Ethel Agbinku, 1Esther Aku Ayandayo, 1and Irene Gifty Boahene1Volume 2019 | Article ID 9369051 | <https://doi.org/10.1155/2019/9369051>
- [15] Noah FN, Doya LJ, Jouni O (2022) Perinatal Risk Factors and Early Onset of Neonatal Sepsis. *Int J Pediatr Res* 8: 088. [doi.org/10.23937/2469-5769/1510088](https://doi.org/10.23937/2469-5769/1510088).
- [16] Supreetha MS et al. Evaluation of neonatal septicaemia using hematological parameters. *International Journal of Recent Scientific Research Vol.6, Issue, 2, pp.2775 - 2778, February, 2015 DOI: 10.21276/APALM.2894Annals of Pathology and Laboratory Medicine* 2020, 7, (10).
- [17] Pokhrel B, Koirala T, Shah G, Joshi S, Baral P. Bacteriological profile and antibiotic susceptibility of neonatal sepsis in neonatal intensive care unit of a tertiary hospital in Nepal. *BMC Pedi.*2018, 27; 18 (1): 208. [doi: 10.1186/s12887-018-1176-x](https://doi.org/10.1186/s12887-018-1176-x). PMID: 29950162; PMCID: PMC6020420.
- [18] Stoll BJ, Puopolo KM, Hansen NI, et al. Early - Onset Neonatal Sepsis 2015 to 2017, the Rise of *Escherichia coli*, and the Need for Novel Prevention Strategies. *JAMA Pediatr.*2020; 174 (7): e200593. [doi: 10.1001/jamapediatrics.2020.0593](https://doi.org/10.1001/jamapediatrics.2020.0593)
- [19] Adane T, Worku M, Tigabu A, Aynalem M. Hematological Abnormalities in Culture Positive Neonatal Sepsis. *Pediatric Health Med Ther.*2022, 7; 13: 217 - 225. [doi: 10.2147/PHMT.S361188](https://doi.org/10.2147/PHMT.S361188). PMID: 35698626; PMCID: PMC9188337.
- [20] Arabdin M, Khan A, Zia S, et al. Frequency and Severity of Thrombocytopenia in Neonatal Sepsis. *Cureus* 2022, 14 (2): e22665. [doi: 10.7759/cureus.22665](https://doi.org/10.7759/cureus.22665).
- [21] CHOUDHARY, Ratana Ram et al. Evaluation of platelet and its indices as a marker of neonatalsepsis: a prospective case control study. *International Journal of Contemporary Pediatrics, [S. l. ], v.5, n.5, p.1898 - 1903.2018.*