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Original Research Article

Study of Haematological and Biochemical Parameters in Cases of Neonatal Sepsis at Tertiary Care Centre

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Conflict of interest: Nil

Abstract

Introduction: Neonatal sepsis is a bacterial bloodstream infection with positive blood culture in first four weeks of life. Early diagnosis of neonatal sepsis helps clinician to treat in time and thereby reduces complications and mortality. Early diagnosis in neonatal sepsis is difficult merely on clinical suspicion. Blood culture is the gold standard for diagnosis but it takes 48-72 hrs. Therefore, haematological and biochemical parameters play an important part in early diagnosis and management strategies in neonatal sepsis.

Material & Methods: This study included 80 neonates with sepsis confirmed by blood culture positivity over a period of 12 months (Oct. 2024 - Sept. 2025). In this study we evaluate various haematological parameters-Total leukocyte count (TLC), Absolute neutrophil count (ANC), Immature to total neutrophil ratio (I/T ratio), Immature to mature neutrophil ratio, Platelet count, Red cell distribution width (RDW) and biochemical parameters-CRP from blood samples which were collected prior to initiation of treatment.

Result: Out of 80 neonatal sepsis cases (confirmed by blood culture) 36(45%) shows leukocytosis 16(20%) shows leukopenia; 22(27%) shows neutrophilia; 33(41%) shows neutropenia; 32(40%) shows high Immature to total neutrophil ratio (I/T ratio); 26(32%) shows high Immature to mature neutrophil ratio; 42(52%) shows low Platelet count; 74(92%) shows high Red cell distribution width (RDW) and 77(96%) shows raised CRP levels.

Conclusion: The haematological and biochemical parameters studied in this study are cost effective, less time consuming and easy to perform. Understanding these dynamics can enhance diagnosis and treatment, highlighting the need for personalized approaches in neonatal sepsis management.

Keywords: Neonatal Sepsis, Haematological Parameters, Biochemical Parameters, Early Diagnosis.

Introduction:

Neonatal sepsis is a bacterial bloodstream infection in first four weeks of life leading to severe clinical manifestations frequently associated with death or irreversible long-term deficits.[1] The reported incidence of neonatal sepsis ranges from one to five cases per 1000 live births.

The overall mortality rate is up to 24.4%, but it can be as high as 54% in infants born between 22 and 24 weeks of pregnancy and 30% in those born between 25 and 28 weeks.[2]

Early diagnosis of neonatal sepsis helps clinician to treat in time and thereby reduces complications and mortality but early diagnosis in neonatal sepsis is difficult merely on clinical suspicion. [3]

While blood culture is the gold standard for diagnosis but it takes 48-72 hrs. Therefore, haematological and biochemical parameters play an important part in early diagnosis and management strategies in neonatal sepsis which can help to reduce the burden of death or irreversible long-term deficits.

Aim & Objective: To study various haematological and biochemical parameters in confirmed cases of neonatal sepsis:

a) Total leukocyte count (TLC)
b) Absolute neutrophil count (ANC)
c) Immature to total neutrophil count ratio (I/T ratio)
d) Immature to mature neutrophil count ratio (I/M ratio)
e) Platelet count (PC)
f) Red cell distribution width (RDW)
g) C-reactive protein (CRP)

Material & Method

This retrospective data analysis study was conducted in tertiary care teaching hospital in Surendranagar, Gujarat, India over a time period of 12 months. (1st October 2024 to 30 September 2025).

Total of 80 neonates (aged 0-28 days) of both genders with sepsis confirmed by blood culture were included.

Culture positivity data was taken from department of microbiology with written consent and haematological and biochemical data was taken from laboratory records of pathology department.

Result

Gender distribution: This study showed a male preponderance with the male: female ratio of 1.5:1.

Table 1: Gender wise distribution of neonatal sepsis cases

Gender	No. of cases (%)
Male	48(60%)
Female	32(40%)

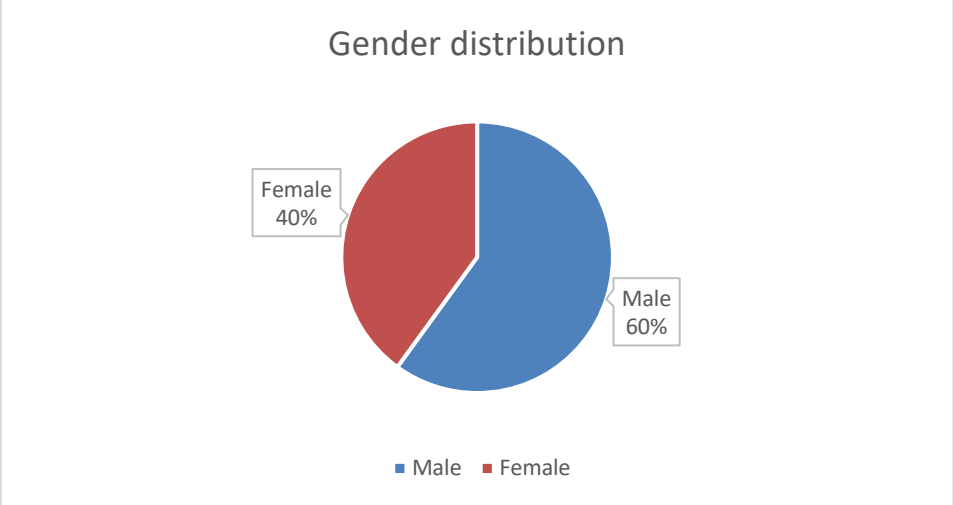

Figure 1: Gender wise distribution of neonatal sepsis cases

Age distribution: Majority of neonates are of age group less than 7 days (86%), followed by age group of 7-14 days (8%) and 15-28 days (5%).

Table 2: Age wise distribution of neonatal sepsis cases

Age (Days)	Frequency(N)	Percentage (%)
<7	69	86%
7-14	6	8%
15-28	5	5%

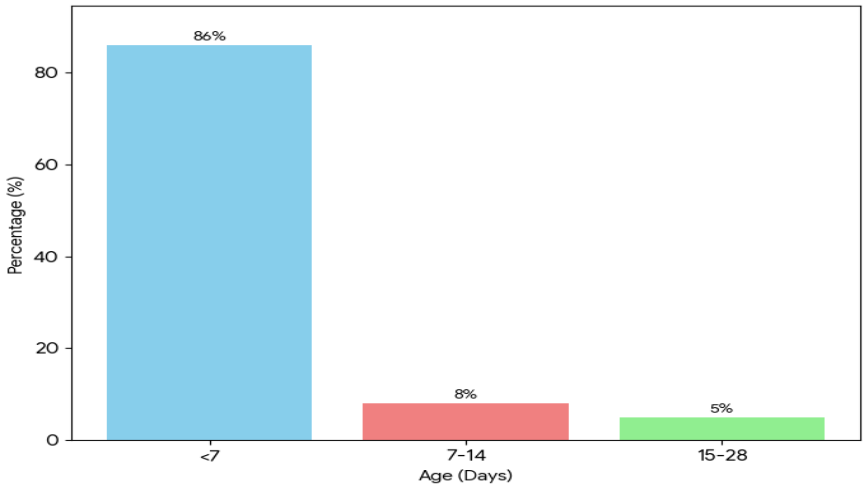

Figure 2: Age wise distribution of neonatal sepsis cases

Table 3: Total Leukocyte Count (N=80)

Total Leukocyte Count	No. of cases (%)
Leukocytosis (>15000/cumm)	36(45%)
Leukopenia (<5000/cumm)	16(20%)
Normal (5000/cumm-15000/cumm)	28(35%)

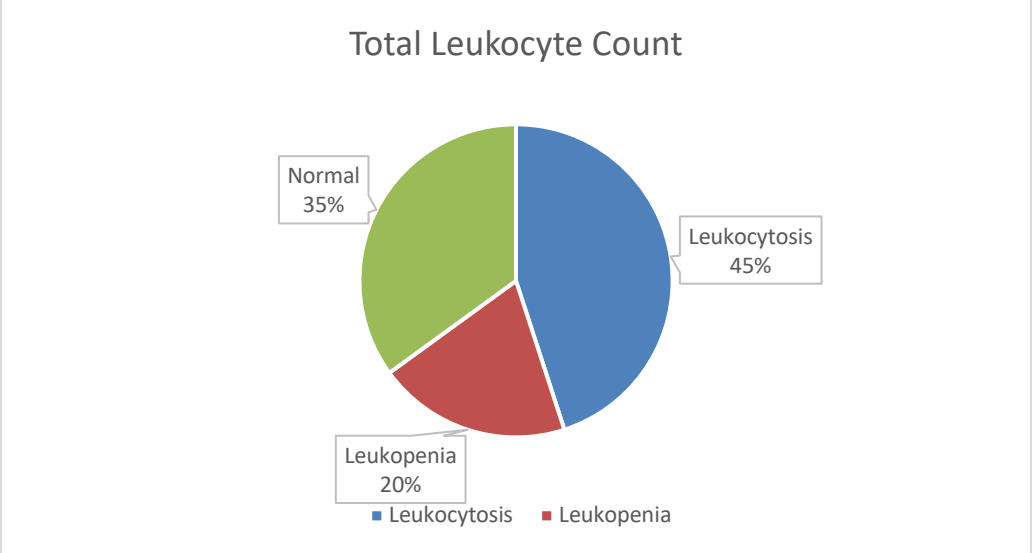

Figure 3: Total Leukocyte Count

Table 4: Absolute Neutrophil Count (N=80)

Absolute Neutrophil Count	No. of cases (%)
Neutropenia (<5000/cumm)	33(41%)
Neutrophilia (>15000/cumm)	22(27%)
Normal (5000-15000/cumm)	25(32%)

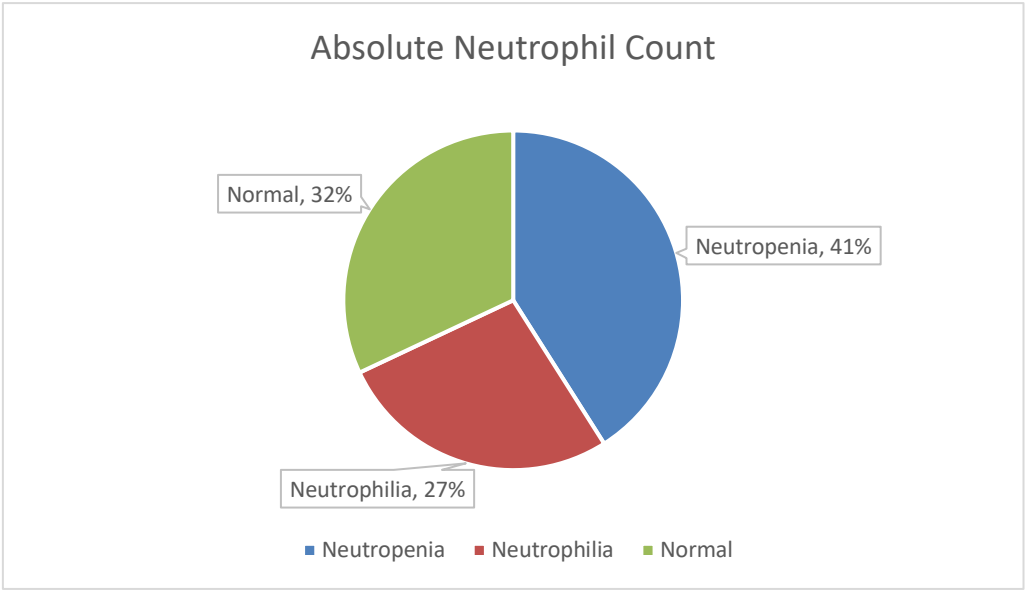

Figure 4: Absolute Neutrophil Count

Table 5: Immature to Total Neutrophil Count Ratio (N=80)

I/T ratio	No. of cases (%)
Increased (>0.2)	32(40%)
Normal (<0.2)	48(60%)

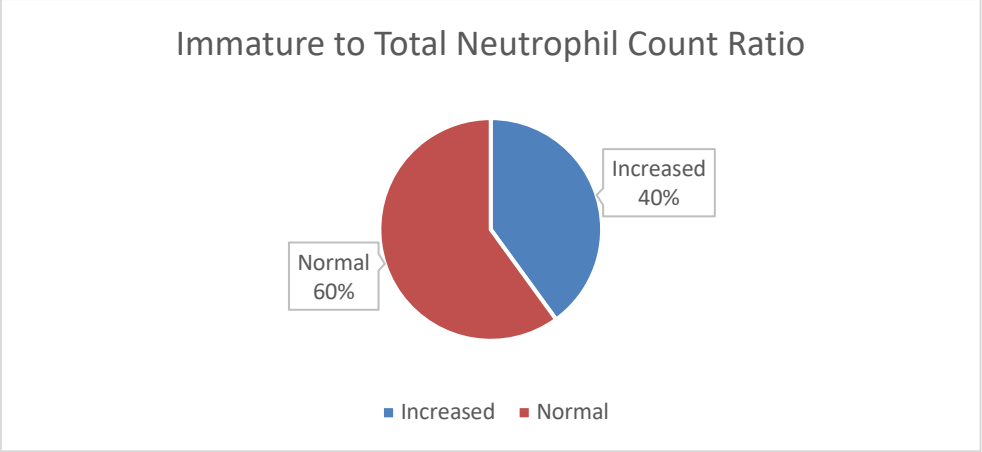

Figure 5: Immature to Total Neutrophil Count Ratio

Table 6: Immature to Mature Neutrophil Count Ratio (N=80)

I/M ratio	No. of cases (%)
Increased (>0.3)	26(32%)
Normal (<0.3)	54(68%)

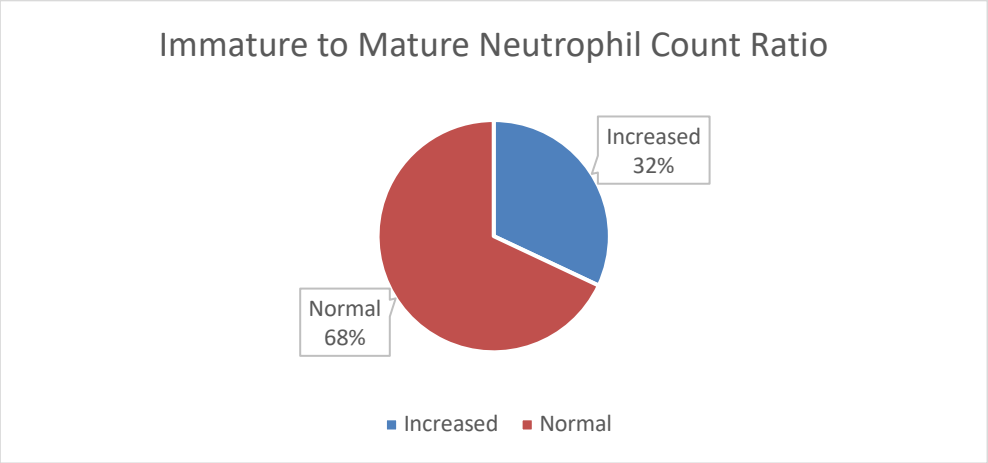

Figure 6: Immature to Mature Neutrophil Count Ratio

Table 7: Platelet Count (N=80)

Platelet Count	No. of cases (%)
Deceased (<150000/cmm)	42(52%)
Normal (>150000/cmm)	38(48%)

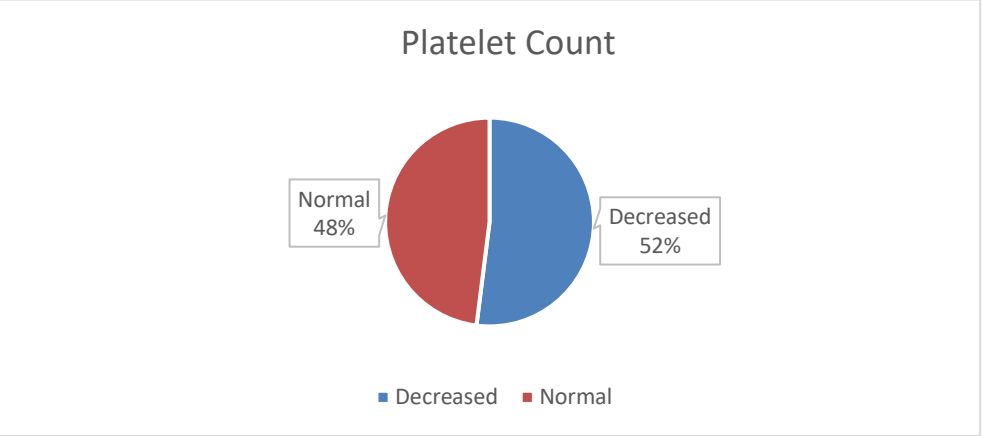

Figure 7: Platelet Count

Table 8: Red Cell Distribution Width (N=80)

Red Cell Distribution Width	No. of cases (%)
High (>15 cv %)	74(92%)
Normal (<15 cv %)	6(8%)

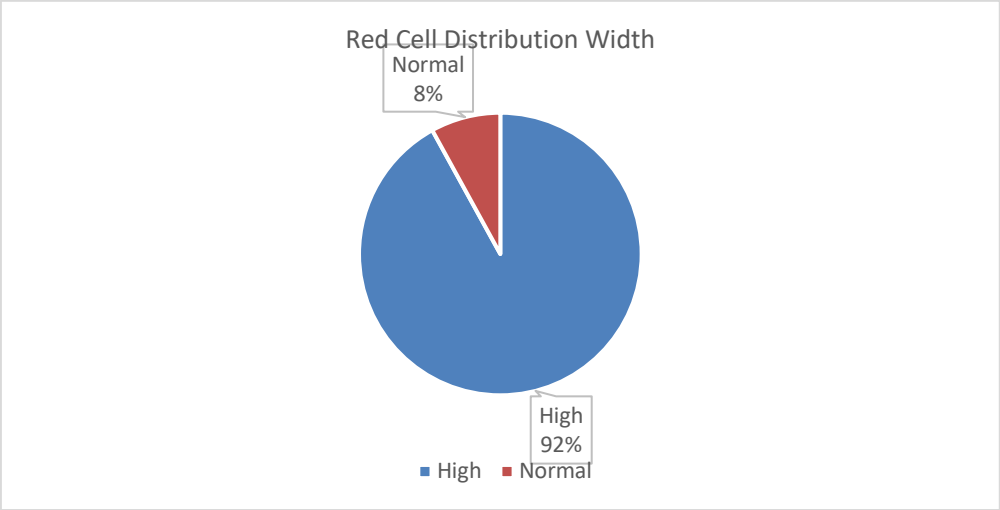

Figure 8: Red Cell Distribution Width

Table 9: C - reactive protein (N=80)

C-Reactive Protein	No. of cases (%)
High (>10 mg/dl)	77(96%)
Low (<10 mg/dl)	3(4%)

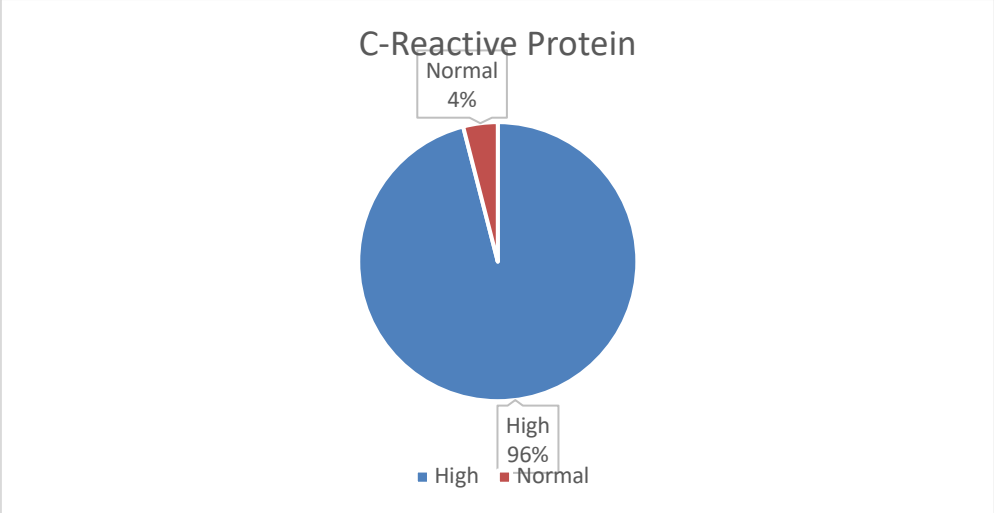

Figure 9: C - reactive protein

Discussion

Neonatal sepsis is still a leading cause of mortality and morbidity in developing countries like India. The importance of the sepsis screen in the identification of newborn sepsis cannot be overstated. Furthermore, babies with sepsis generally decline quickly.

Early and efficient diagnosis is difficult for clinicians so failure or delay in treatment is likely to result in severe mortality and morbidity.[4] Blood culture which is gold standard for diagnosis is difficult to obtain and has very low sensitivity due to various preanalytical and analytical issues and is not available during therapeutic window. PCR for detection of antigen is currently gaining acceptance but are quite expensive. Haematological and biochemical investigations are early and commonly sought investigations by the clinicians when sepsis is suspected.

Table 9: Comparison of age prevalence of neonatal sepsis

Authors	Year	Percentage	
		<7 days	>/=7 days
Present study	2024-25	86%	14%
Vinay BS et al. [5]	2015	90%	10%
Khair at el. [6]	2010	66.7%	33.3%
Agrawal at el. [7]	2001	67%	33%
Pruthvi D at el. [8]	2021	66%	34%
Sanjay et al. [9]	2021	79%	21%

The present study stated that incidence of neonatal septicaemia is more in early age of life (<7 days) (86%) compared to delayed age at presentation (14%) which is most comparable with study done by Vinay BS et al. [5] (90%).

Table 10: Comparison of gender prevalence of neonatal sepsis

Study	Year	Percentage	
		Male	Female
Present study	2024-25	60%	40%
Darnifayanti et al. [10]	2015	54%	46%
Vinay BS et al. [5]	2015	66.6%	33.4%
Saboohi E et al. [11]	2019	56%	44%

Table 11: Comparison of abnormal total leukocyte count

Study	Year	Percentage
Present study	2024-25	65%
V. Gomathi et al. [12]	2022	62%
Patel U et al. [13]	2014	41%
Saboohi E et al. [11]	2019	66%

In present study 65% of neonatal sepsis cases show abnormal total leukocyte count (either leukopenia or leukocytosis) which has the closest association with study done by V Gomathi et al. [12] (62%) and least association with study done by Patel U et al. [13] (41%).

Table 12: Comparison of abnormal absolute neutrophil count

Study	Year	Percentage
Present study	2024-25	68%
Sanjay et al. [9]	2021	70%

In present study 68% of neonatal sepsis cases show abnormal absolute neutrophil count (either neutropenia or neutrophilia) which is comparable with study done by Sanjay et al. [9] (70%).

Table 13: Comparison of increased I/T ratio

Study	Year	Percentage
Present study	2024-25	40%
Vinay BS et al. [5]	2015	52%
Rodwell et al. [14]	1988	47%
Patel U et al. [13]	2014	63%
Saboohi E et al. [11]	2019	46%

The present study show increased I/T ratio in 40% of neonatal sepsis cases which is more comparable with study done by Saboohi E et al. [11] (46%) and less comparable with study done by Patel U et al. [13] (63%).

Table 14: Comparison of increased I/M ratio

Study	Year	Percentage
Present study	2024-25	32%
Khushbu et al. [15]	2020	25%

Table 15: Comparison of decreased platelet count

Study	Year	Percentage
Present study	2024-25	52%
Vinay BS et al. [5]	2015	42%
Philip AG et al. [16]	1980	62.5%
Pruthvi D et al. [8]	2021	45%
Sanjay et al. [9]	2021	39.5%
Shah N et al. [17]	2024	62.5%

Disseminated intravascular coagulation and the harmful effects of endotoxin on platelets cause thrombocytopenia in neonates with sepsis. This study finds decreased platelet count in 52% cases of neonatal sepsis.

Table 16: Comparison of raised CRP level

Study	Year	Percentage
Present study	2024-25	96%
Vinay BS et al. [5]	2015	80%
Patel U et al. [13]	2014	81.7%
Pruthvi et al. [8]	2021	89%
Sanjay et al. [9]	2021	84%

CRP levels are directly proportional to degree of inflammation. In routine CRP has better value in following the progress of disease. CRP can be a useful guide in making a decision to discontinue antibiotic therapy, thus facilitating early discharge, significantly reduced cost, complications of treatment and misuse of antibiotics.[18] This study shows raised CRP levels in 96% cases which makes it one of the most helpful indicator and most correlated with study done by Pruthvi et al. [8] (89%).

Conclusion:

Although blood culture is a “gold standard” test in diagnosing sepsis but its main limitation is its delayed result, more chances of contamination, high cost and nonavailability in most peripheral setups in our country. The haematological and biochemical parameters studied in this study are cost effective, less time consuming and easy to perform. Understanding these dynamics can enhance diagnosis and treatment, highlighting the need for personalized approaches in neonatal sepsis management.

Ethical approval:

The study was approved by the institutional Ethical Committee

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