ISSN 2515-8260 Volume 09, Issue 04, 2022

"STUDY OF HEMATOLOGICAL PARAMETRS IN EARLY DIAGNOSIS OF NEONATAL SEPTICEMIA IN TERTIARY CARE CENTER"

Dr Hetal Joshi(Senior Resident) , Dr Ashwini Shukla (Professor) , Dr Drashti Patel (Senior Resident)

Dr Toral Jivani (Associate Professor)

INTRODUCTION

Neonatal Sepsis is the most commonly observed and the important cause for neonatal morbidity as well as mortality in our country[1,2]. Neonatal Sepsis is difficult to diagnose clinically because of non- specific symptoms of disease presentation. Appropriate as well as timely diagnosis of the disease is most important factor to reduce mortality and morbidity in the neonates[3] .

Depending on the onset of sepsis, it can be early sepsis or late sepsis[4]. Inability to diagnose neonatal sepsis leads to unnecessary exposure of the neonate to high doses of antibiotics. These high doses of antibiotics as well its unnecessary use leads to its side effects as well as drug resistance. This further leads to emergence of drug resistant neonatal septicemia which further increases the risk of mortality and morbidity in the neonates. Thus, early diagnosis of the disease is must to improve the prognosis of the neonates.

Preterm and premature infants are highly susceptible to such infections because of its weak immune system. Incidence of neonatal septicemia is higher in premature neonates compared to full term neonates[5].

Definite diagnosis of neonatal septicemia is difficult to make clinically and it can only be done by blood culture for organisms. Other tests with positive predictive value like haptoglobin and immuno-electrophoresis can be performed but they are time consuming and costly[6].

Other non-specific tests for the measurement of acute phase reactants, cytokines, bacterial genomes and cell surface antigens can be performed to consider the early diagnosis of neonatal sepsis. Various hematological parameters can be assessed for early detection of neonatal sepsis and its timely management. Tests performed for the diagnosis of the disease should be specific as well as sensitive . It should be less time consuming and cost effective[7 - 11].

In our study, for early diagnosis of the neonatal sepsis various hematological parameters are evaluated and each of them is assessed to find reliable parameters for diagnosis of the disease.

Materials and Method

Prospective descriptive study was carried out on 84 neonates admitted in NICU in tertiary care hospital. Various hematological parameters were evaluated from the peripheral smear of the neonates after giemsa staining of the smear slide. Blood culture and C-Reactive protein levels were also monitored of these patients. Scoring System evaluated from the peripheral smear were done interpreted according to the table and flow chart mentioned below.

Hematological Scoring System

CRITERIA	ABNORMALITY	SCORE
Total WBC count	<5000/mm^3	1
	>25000/ mm^3 at birth	1
	>30000/mm^3 (12 to 24 hours)	1
	>21000/mm^3day 2 onwards	1
Total PMN count	No mature polymorphs seen	2
	Increased/decreased	1
Immature PMN count	Increased	1
Immature : Total PMN ratio	Increased	1
Immature : Mature PMN ratio	>0.3	1
Degenerative changes in PMN	Toxic granules/cytoplasmic vacuoles	1
Platelet	<15000/mm^3 count	1

ISSN 2515-8260 Volume 09, Issue 04, 2022

The normal values are

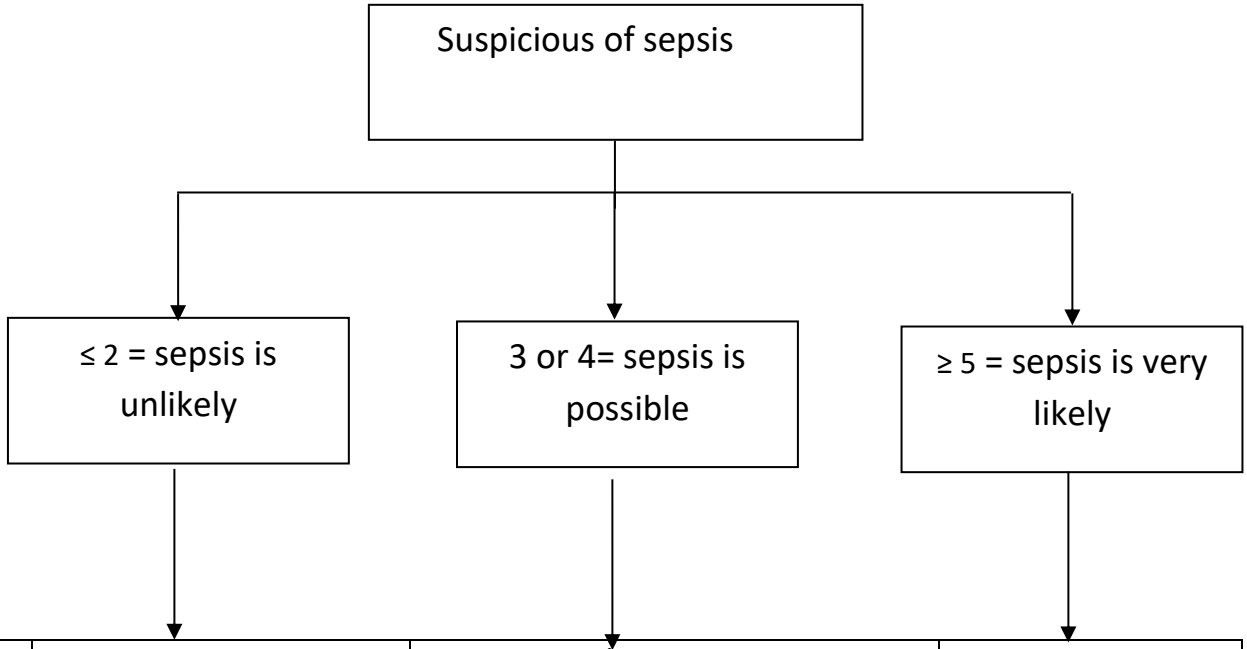
Total PMN count—1800–5400/mm^3

Immature PMN count—600/mm^3

Immature: Total PMN ratio—0.120

Immature: Mature PMN ratio—> 0.3

Interpretation Flow Chart



CRP	Negative	Positive/Negative	Positive
BLOOD CULTURE	Negative	Positive/Negative	Positive

Minimum score- 0

Maximum score- 8

ISSN 2515-8260 Volume 09, Issue 04, 2022

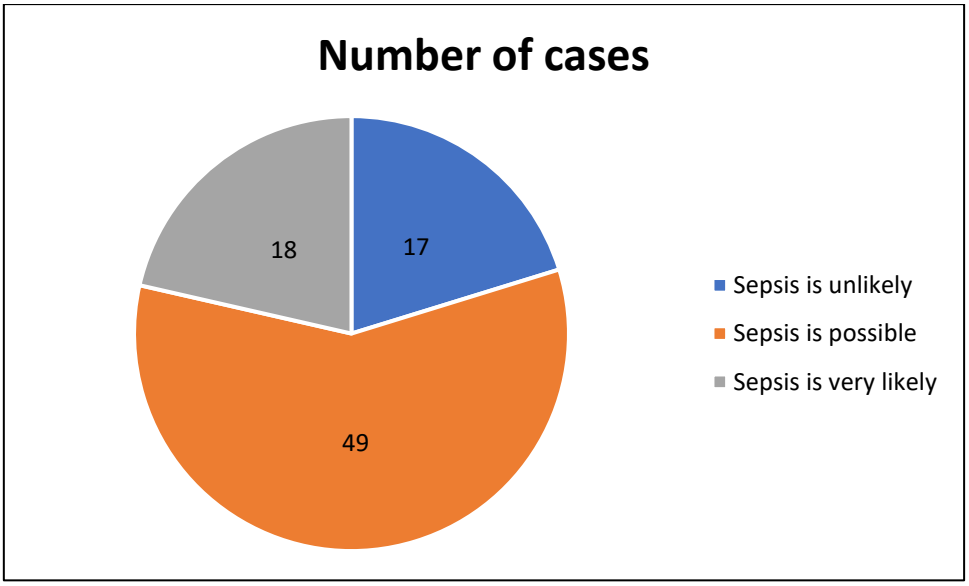
Observation and Result

The study conducted by us included total of 84 neonates. Based on the hematological scoring system, neonates were divided into groups of sepsis is unlikely, sepsis is possible and sepsis is very likely.

Table 1: Clinical Group Distribution

Groups	Number of cases
Sepsis is unlikely	17 (20.2%)
Sepsis is possible	49 (58.3%)
Sepsis is very likely	18 (21.5%)

Chart 1: Clinical Group Distribution



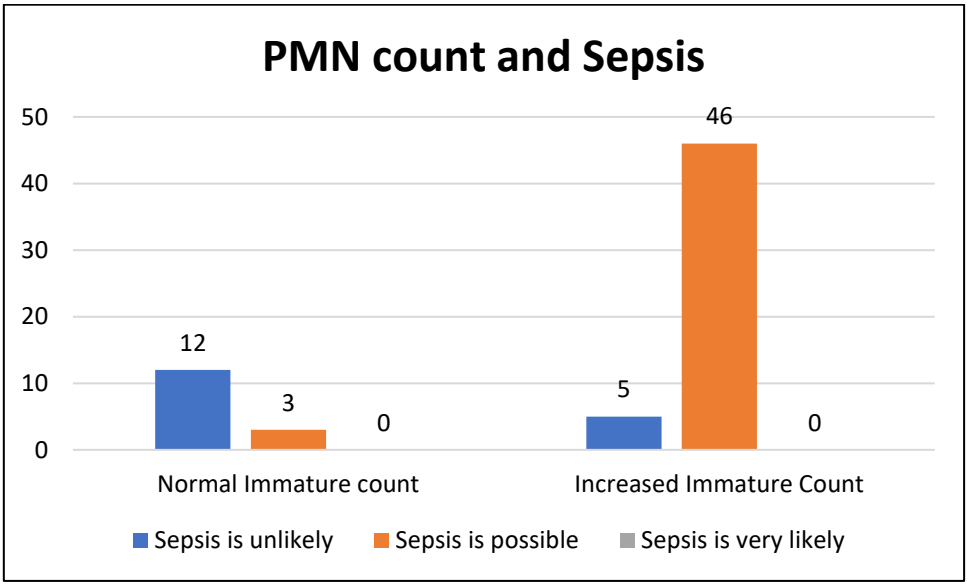
According to Rodwells Hematological scoring system, 17 (20.2%) cases were in Sepsis is unlikely group, 49 (58.3%) cases were in Sepsis is possible group and 18 (21.5%) cases were in Sepsis is very likely group. (Table 1, Chart 1)

Table 2: Correlation of Immature PMN count and Sepsis

Clinical Distribution	Normal Immature count	Increased Immature Count
Sepsis is unlikely (n=17)	12 (70.6%)	5 (29.4%)
Sepsis is possible (n=49)	3 (6.1%)	46 (93.9%)
Sepsis is very likely (n=18)	1 (5.5%)	17 (94.5%)

ISSN 2515-8260 Volume 09, Issue 04, 2022

Chart 2: Correlation of Immature PMN count and Sepsis



Out of 18 neonates in the Sepsis is very likely group, 17 (94.5%) cases had increased immature PMN count and 46 (93.9%) cases out of 49 cases of the neonates in the sepsis is possible group had increased immature PMN count .Only 5 (29.4%) cases out of 17 cases of the neonates in sepsis is unlikely group had increased immature PMN count. Remaining of 12 (70.6%) cases of sepsis is unlikely group has normal immature PMN count. Immature PMN count is significant predictor of the neonatal sepsis. (Table 2, Chart 2)

Table 3: Correlation of I:T ratio and Sepsis

Clinical Distribution	Normal I:T ratio	Increased I:T ratio
Sepsis is unlikely (n=17)	5 (29.4%)	12 (70.6%)
Sepsis is possible (n=49)	0 (0%)	48 (100%)
Sepsis is very likely (n=18)	0 (0%)	18 (100%)

Chart 3: Correlation of I:T ratio and Sepsis

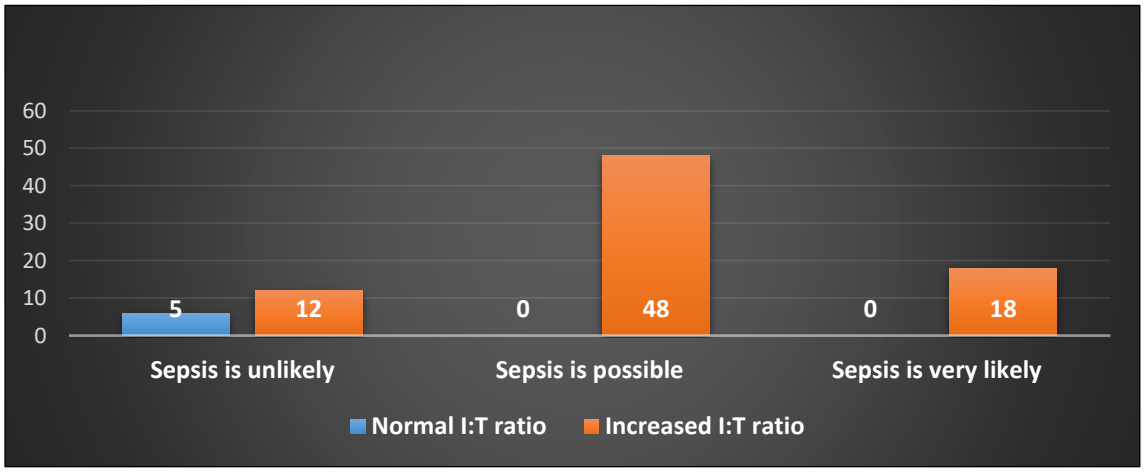
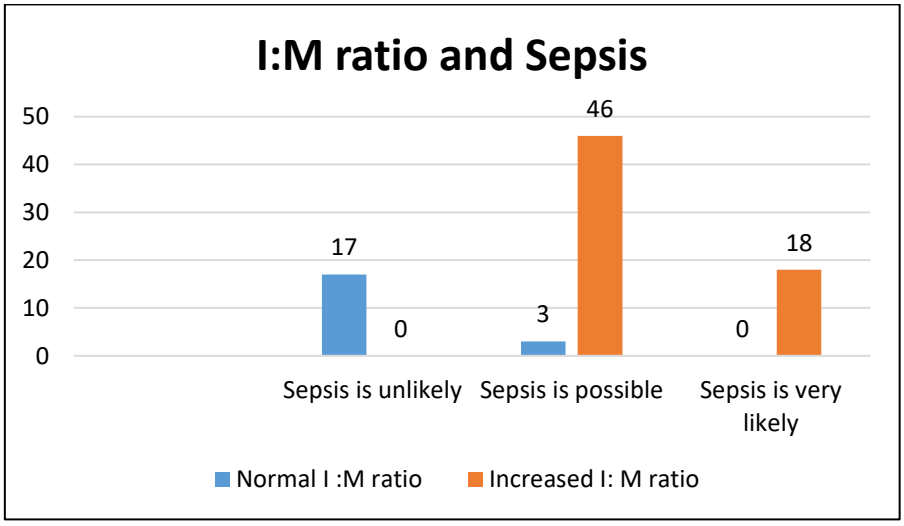


Table 3 and Chart 3 shows all the cases in sepsis is very likely group and sepsis is possible group had higher I:T PMN ratio.

Table 4: Correlation of I:M ratio and Sepsis

Clinical Distribution	Normal I :M ratio	Increased I: M ratio
Sepsis is unlikely (n=17)	17 (100%)	0 (0%)
Sepsis is possible (n=49)	3 (6.2%)	46 (93.8%)
Sepsis is very likely (n=18)	0 (0%)	18 (100%)

Chart 4: Correlation of I:M ratio and Sepsis



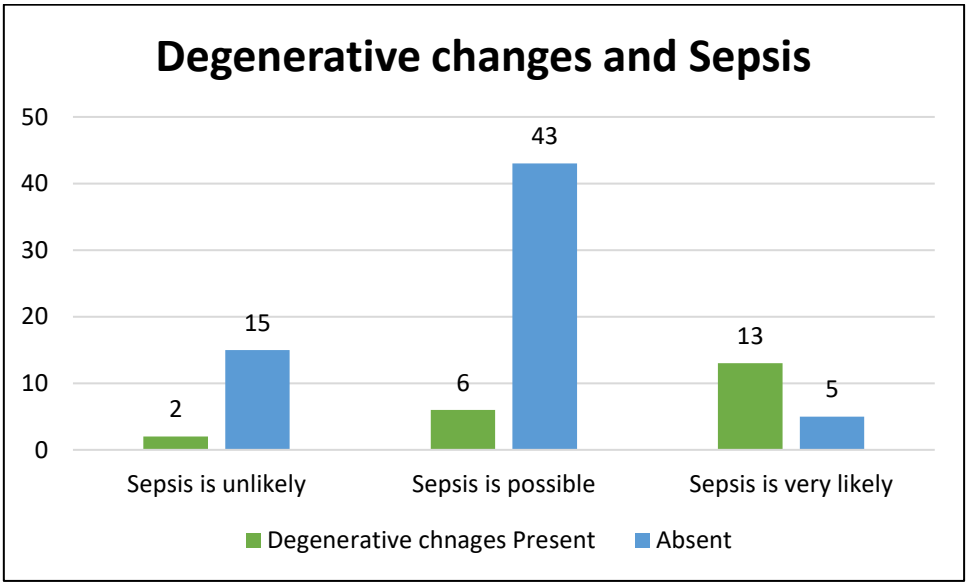
All the cases in sepsis is very likely group and 46 (93.8%) cases out of 49 cases of the neonates in sepsis is possible group had higher I:M PMN ratio .All the cases of sepsis is unlikely group had normal I:M ratio. (Table 4, Chart 4)

Table 5: Degenerative changes and Sepsis

Clinical Distribution	Degenerative changes Present	Absent
Sepsis is unlikely (n=17)	2 (11.8%)	15 (88.2%)
Sepsis is possible (n=49)	6 (12.2%)	43 (87.8%)
Sepsis is very likely (n=18)	13 (72.2%)	5 (27.8%)

ISSN 2515-8260 Volume 09, Issue 04, 2022

Chart 5 : Degenerative changes and Sepsis



According to our study, 13 (72.2%) of the patients in sepsis is very likely group and 6 (12.2%) cases of the neonates in sepsis is possible group had degenerative changes in PMN like toxic granules and vacuolations. Degenerative changes in the PMN is a significant predictor of sepsis. (Table 5, Chart 5)

Table 6: CRP and Sepsis

Clinical Distribution	CRP Positive	CRP Negative
Sepsis is unlikely (n=17)	5 (29.4%)	12 (70.6%)
Sepsis is possible (n=49)	47 (95.9%)	2 (4.1%)
Sepsis is very likely (n=18)	18 (100%)	0 (0%)

Chart 6: CRP and Sepsis

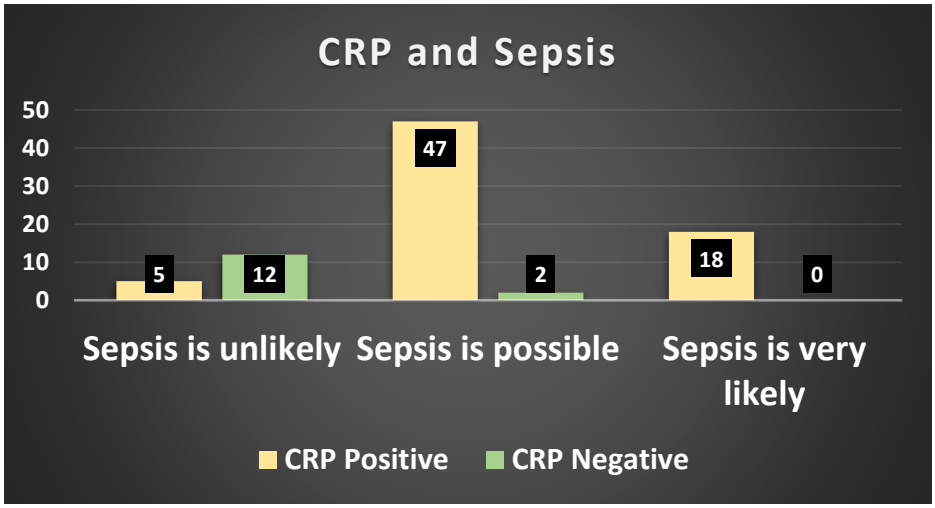
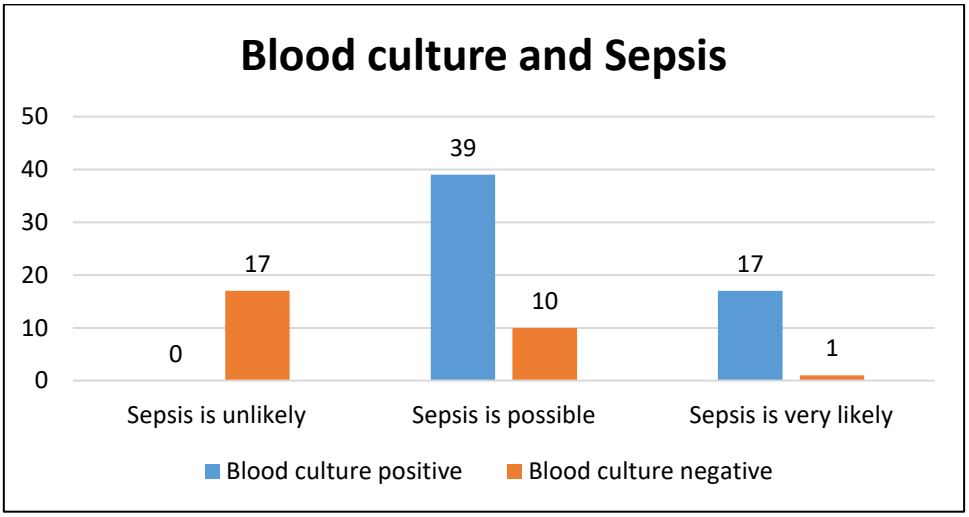


Table 6 and Chart 6 shows 100% cases of neonates in sepsis is very likely group had elevated CRP and only 29.4% cases of sepsis is unlikely group had elevated CRP. 70.6% cases of the neonates in the sepsis is unlikely group had normal CRP.

Table7: Blood Culture and Sepsis

Clinical Distribution	Blood culture positive	Blood culture negative
Sepsis is unlikely (n=17)	0 (0%)	17 (100%)
Sepsis is possible (n=49)	39 (79.6%)	10 (20.4%)
Sepsis is very likely (n=18)	17 (94.4%)	1 (5.6%)

Chart 7: Blood Culture and Sepsis



Majority of the cases of neonates as shown in Table 7 and Chart 7 had blood culture positive in sepsis is very likely group.

94.4% cases in the sepsis is very likely group of the neonates had blood culture positive and none of the neonates in the sepsis is unlikely group had positive blood culture.

17 cases (100%) showed blood culture negative and according to our study it was in sepsis is unlikely group.

Premature rupture of membrane, prolonged labour, meconium-stained amniotic fluid, prematurity and activity of the neonate were not the predictors of neonatal sepsis. Gestational age, birth weight and requirement of resuscitation perinatally were significant predictors of neonatal sepsis.

ISSN 2515-8260 Volume 09, Issue 04, 2022

Table 8 : Comparison of HSS with blood culture determining sensitivity and specificity

Hematological Score	Blood culture Positive	Blood culture Negative
Score <4 (n = 66)	39	27
Score >5 (n = 18)	17	1

Specificity = 96.43% ,

Sensitivity = 30.36%

Positive Predictive Value = 94.44%

Negative Predictive Value = 40.91%

Table 8 shows the study conducted , is highly specific and has very high positive predictive value. This suggests HSS helps diagnosing early cases of neonatal septicemia and thus decreasing morbidity and mortality.

Specificity of 96.43% suggests all the neonates with the disease will be correctly identified by the HSS score. Hence chances of diagnosing the neonates who are diseased is very high.

Positive predictive value of HSS score of the study conducted was 94.44% suggesting very high probability of truly diagnosing the neonates with sepsis.

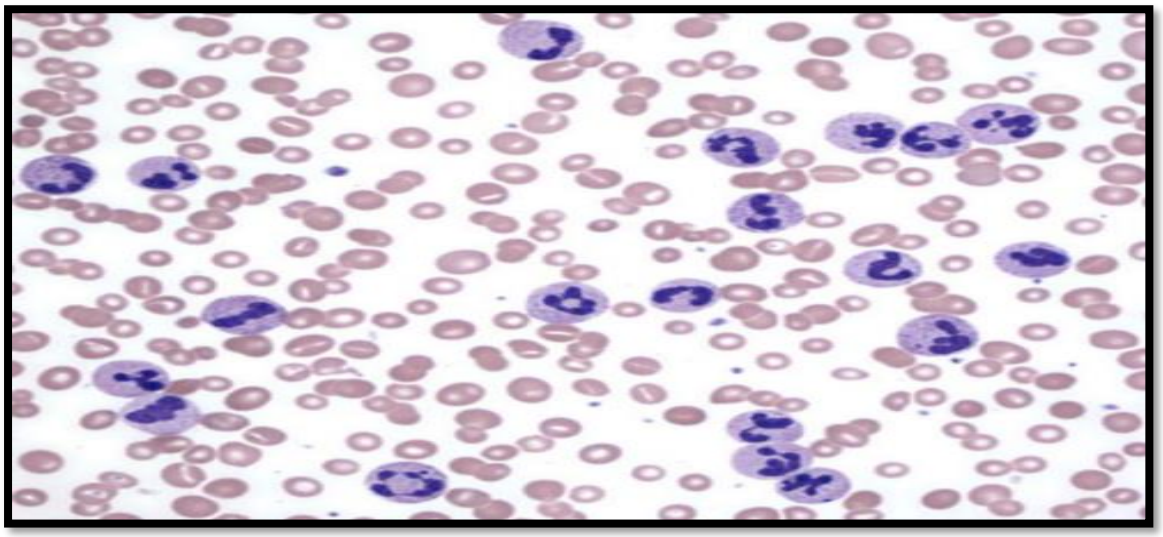


Figure 1 : 40x peripheral smear showing Leucocytosis

ISSN 2515-8260 Volume 09, Issue 04, 2022

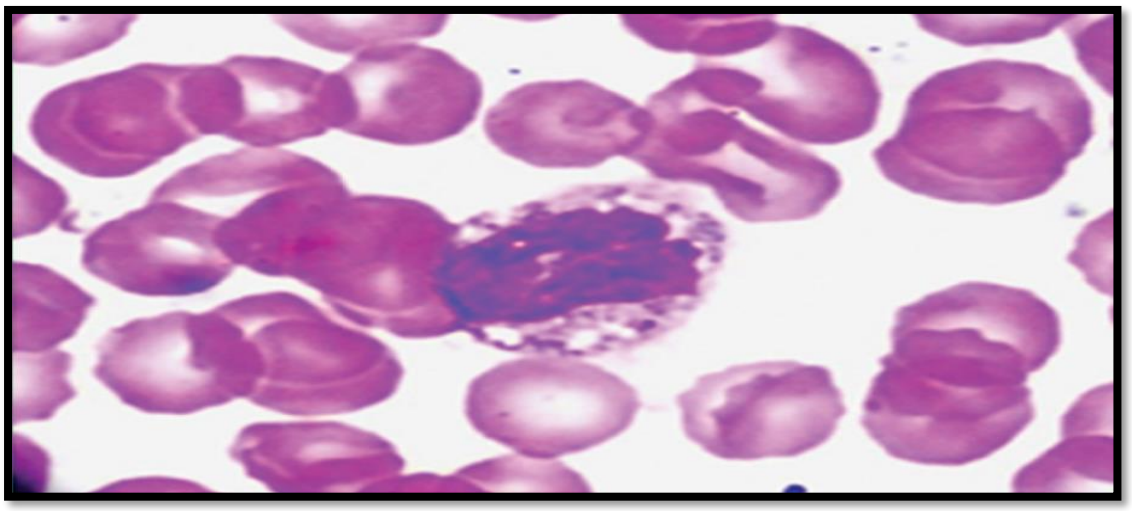


Figure 2 : 100x image of peripheral smear showing myelocyte with prominent Toxic granules vacuolations and cytoplasmic vacuolations

Discussion

Neonatal sepsis is one major cause of morbidity and mortality in developing countries, but is treatable if diagnosed on time . Hematological Scoring System plays and important role in early diagnosis of neonatal sepsis and considerably decreases the risk of morbidity and mortality. Gold standard method to diagnose the sepsis is blood culture. But delay in getting the final report and sensitivity of the organisms to various antibiotics is the major drawback. Various clinical and hematological parameters are used to diagnose the neonatal sepsis.

In our study, specificity, and positive predictive value were significantly more for HSS scoring system. Ghosh et al. and Narasimha et al. reported that Immature: Total (I:T) PMN (Polymorphoneuclear Neutrophil) ratio acts as reliable indicator of neonatal sepsis [6,12].

Elevated I:M PMN ratio was reliable indicator in identifying sepsis which is similar to the study done by Philip et al and Basu et al. [13,14] Immature PMN count is an excellent predictor of sepsis which correlates with study done by Gosh et al and Narasima et al. [6,12]

ISSN 2515-8260 Volume 09, Issue 04, 2022

Conclusion

Hematological scoring system is a very simple, easy to perform, reliable and cost-effective tool for the early diagnosis of neonatal sepsis. All these parameters were high highly specific in predicting neonatal septicemia. The time consumed to score sepsis is less compared to blood culture and hence it can be used for early diagnosis of neonatal septicemia. Blood culture, being gold standard is used to diagnose neonatal septicemia but hematological scoring system can be used by the clinician for categorization of the neonates as high risk for sepsis or not.

This will help for timely treatment of neonatal sepsis and unnecessary antibiotic administration in the neonates.

References

1. Bang AT, Bang RA, Bactule SB, Reddy HM, Deshmukh MD. Effect of home-based neonatal care and management of sepsis on neonatal mortality: field trial in rural India. Lancet 1999;354:1955-61
2. Stoll BJ. The global impact of neonatal infection. Clin Perinatol 1997;24:1-21
3. Speer CP, Ghar M, Schrotter W. Eary diagnosis of neonatal infection. Monatsschr Kinderheilkd. 1985; 133 (9):665-668.
4. Manisha M, Chinki Gupta, Mahajan NC. Performance Evaluation of haematological scoring system in early diagnosis of neonatal sepsis. J Clin Neonatol 2013 2(1): 25-29.
5. Narasima and Harendra kumar. Significance of Hematological scoring systemin early diagnosis of Neonatal sepsis. Indian J HematolBlood Trans 2011; 27:14-7.
6. Ghosh S, Mittal M, Jeganathan G. Early diagnosis of neonatal sepsis using a haematological scoring system. Indian J Med Sci 2001;55(9):495-500.
7. Sharma A, Kutty C, Saharwal U, Mohan. Evaluation of sepsis screen for diagnosis of neonatal septicaemia. Indian J Pediatr. 1993; 60:559-63.

8. Mishra PK, Kumar R, Mallick K, Mehra P. Simple hematologicl tests for diagnosis of neonatal sepsis. Indian Pediatric. 1989; 26:156-60.
9. Baltimore RS, Huie SM, Meek J, Schuchat A, O'brien KL. Early onset neonatal sepsis in the era of group B streptococcal prevention. Pediatrics. 2001; 108:1094-8.
10. Gladstone IM, Ehrenkranz RA, Edberg SC, Baltimore RS. A 10 year review of neonatal sepsis in comparison with the previous 50 year experience. Pediatr Infect Dis J. 1990; 9:819-25.
11. Varsha, Rusia U, Sikka M, Faridi MM, Madan N. Validity of haematological parameters in identification of early and late onset neonatal infection. Indian J Pathol Microbiol. 2003; 46:565-8.
12. Shirin M, Hossain MM, Mamun MAA, Chowdhury NA, Qadar A. Sensitivity & Specificity of C-reactive Protein (CRP) and thrombocytopenia in the diagnosis of neonatal sepsis. Bangladesh J child health. 2005; 29 (2):41-45.
13. Basu S, Guruprasad, Narang A, Garewal G. Diagnosis of sepsis in the high risk neonate using a haematological scoring system. Indian J Hemato Blood Transfusion. 1999; 17:32-34.
14. Purushothaman Ganesan, Priyadarshini Shanmugam, Shameem Banu Abdul Sattar, Shenbaga Lalitha Shankar. Evaluatioon of IL 6 , CRP and hs – CRP as Early Markers of Neonatal Sepsis. J Clin Diagn Res. 2016 May; 10(5): DC13–DC17