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Original Research Article

Mean platelet volume (MPV) as a diagnostic marker in neonatal sepsis

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ABSTRACT

Background: Neonatal sepsis is a frequent and important cause of morbidity and mortality which accounts for one quarter of neonatal deaths. There are very few studies done in India to evaluate the role of MPV as diagnostic marker of neonatal sepsis.
Methods: Prospective case control study in a tertiary care hospital. Neonates > 30 weeks gestation admitted to neonatal intensive care unit during the study period of 1 year with clinically suspected were included in the study. Neonates with Septic screen positive and culture positive sepsis were included in group A and normal neonates were included in Group B. MPV was done for all the subjects and values more than 10.2fl was considered positive. Newborns with congenital anomalies and who were already on antibiotics prior to admission were excluded from the study. Statistical analysis was done using Statistical Package of Social Sciences (SPSS) version 17.0.
Results: 106 neonates were included in the study. MPV showed statistically significant difference between the study groups (mean 12.8±1.52, 10.82±1.20 respectively) at a cut of value of 10.2fl and a sensitivity of 93%, specificity of 84 % with a positive predictive value of 83% and negative predictive value of 94%.
Conclusions: MPV can be used as an adjuvant marker along with established septic screen to ensure early diagnosis and treatment of neonatal sepsis with no additional expense.

Keywords: IT ratio, Mean platelet volume, Micro ESR, Neonate, Preterm, Sepsis

INTRODUCTION

Neonatal sepsis is a clinical syndrome characterized by signs and symptoms of infection with or without accompanying bacteraemia in the first month of life.[1] Neonatal sepsis is a frequent and important cause of morbidity and mortality which accounts for one quarter of neonatal deaths. Fatality due to sepsis is between 30% and 50%.[2] The clinical signs and symptoms of sepsis in newborns may be subtle and hence requires a high degree of suspicion to diagnose it. There is no single laboratory test with 100% sensitivity and specificity.[3] Blood culture remains to be the gold standard test to diagnose neonatal sepsis but it takes almost about 2-8 days for the results to come, is relatively expensive and has a low positivity rate.[4] All newborns suspected to have sepsis should undergo a septic screen which include total leucocyte count (TLC), absolute neutrophil count (ANC), immature to mature neutrophil ratio (I:T ratio), micro erythrocyte sedimentation rate (Micro ESR) and C-reactive protein (CRP).[5] The need of the hour is to identify a test that is cheap, accurate, and easy to perform with quick availability of reports to enhance the early detection of neonatal sepsis as early diagnosis and treatment reduces the morbidity and mortality.[6]

Mean platelet volume (MPV) is the measurement of average size of platelets in the blood and it is a coulter generated parameter routinely available with complete blood counts. MPV is a simple and easy method of

assessing platelet function.[7] Platelet production climbs at the beginning of septicaemia due to platelet destruction, and larger and younger platelets are secreted to the peripheral blood. However, bone marrow is repressed subsequently, and thrombocytopenia is seen.[8] Elevated MPV indicates endothelial damages as well as platelet activation. Thrombocyte consumption and MPV values escalate in acute infections.[9] There are very few studies done in India to evaluate the role of MPV as diagnostic marker of neonatal sepsis.[10] Aim of the study was to provide information about the early diagnostic value of mean platelet volume and its sensitivity.

METHODS

It is a prospective case control study done at tertiary care hospital in Dakshina Kannada district of Karnataka. Written informed consent was taken from all the parents. Detailed history was taken from parents and thorough clinical examination of the neonates were done. The clinical features of sepsis considered were as follows (Table 1).[11]

Table 1: Clinical features suggestive of neonatal sepsis.

Clinical features	
Respiratory	Rate > 60/min, grunting, severe chest indrawing, central cyanosis
Cardiac	Poor perfusion, rapid and weak pulse
Neurological	Convulsions, drowsy/unconscious, decreased activity, bulging fontanelle
Gastrointestinal	Jaundice, poor feeding, abdominal distension
Musculoskeletal	Edema or erythema overlying bones or joints
Dermatological	Skin pustules, peri umbilical erythema or purulence
Temperature	>37.7 C or <35.5 C

All neonates who fulfilled the inclusion criteria underwent septic screening and were considered in the study group. Septic screen was sent and neonates with ≥2/5 positive parameters were considered to have sepsis (Table 2).[11]

Table 2: Laboratory parameters for sepsis.

Laboratory parameter	Positive for sepsis
Total leucocyte count	<5000/mm^3, >30,000/mm^3
Immature/total neutrophils	>0.2
Micro ESR	>15mm in first hour
C reactive protein (CRP)	> 6mg/dl
Absolute neutrophil count	As per Manroe and Mouzinhos chart

Inclusion criteria

- All neonates >30 weeks gestation admitted to neonatal intensive care unit with clinically suspected neonatal sepsis during the study period of 1 year from November 2017-November 2018 were included in the study.

Exclusion criteria

- Neonates who were already on antibiotics prior to admission
- Neonates with congenital anomalies.

Clinically well newborns and those newborns without any symptoms and signs were taken as controls. Demographic data collected from all the neonates included gender, birth weight, gestational age and leaking PV. Under aseptic precautions venous blood sample was drawn prior to starting antibiotic medications. 1ml of blood was collected for blood culture initially followed by 2ml blood in plain vacutainer and EDTA vacutainer each. Plain vacutainer was sent for CRP estimation, which was done by quantitative method and result above 6mg/dl was considered positive. EDTA vacutainer was sent for complete blood count (CBC), differential leucocyte count (DLC), mean platelet volume (MPV), total leucocyte count (TLC) and peripheral smears for estimation of Immature: Total neutrophil (I:T) ratio. CBC is done by Sysmex XN 1000 coulter method in present laboratory. MPV was done for all the subjects and values more than 10.2fl was considered positive. Neonates with significant growth in blood culture were considered as proven sepsis. Neonates were divided into two groups. Group A included neonates with proven and probable sepsis and group B included normal neonates.

Statistical analysis

Statistical analysis was done using Statistical Package of Social Sciences (SPSS) version 17.0. Chi square test was used to compare means of categorical variables and independent t test for continuous variables. Non parametric quantitative data were assessed by Mann-Whitney's U test. P value <0.05 was considered as significant. Receiver operator curve (ROC) was generated and the area under curve (AUC) was calculated. Sensitivity, specificity, positive predictive value (PPV) and negative predictive values (NPV) were also analyzed.

RESULTS

135 neonates were eligible for the study, of which 29 neonates were excluded from the study. Remaining 106 neonates were included in the study (Figure 1).

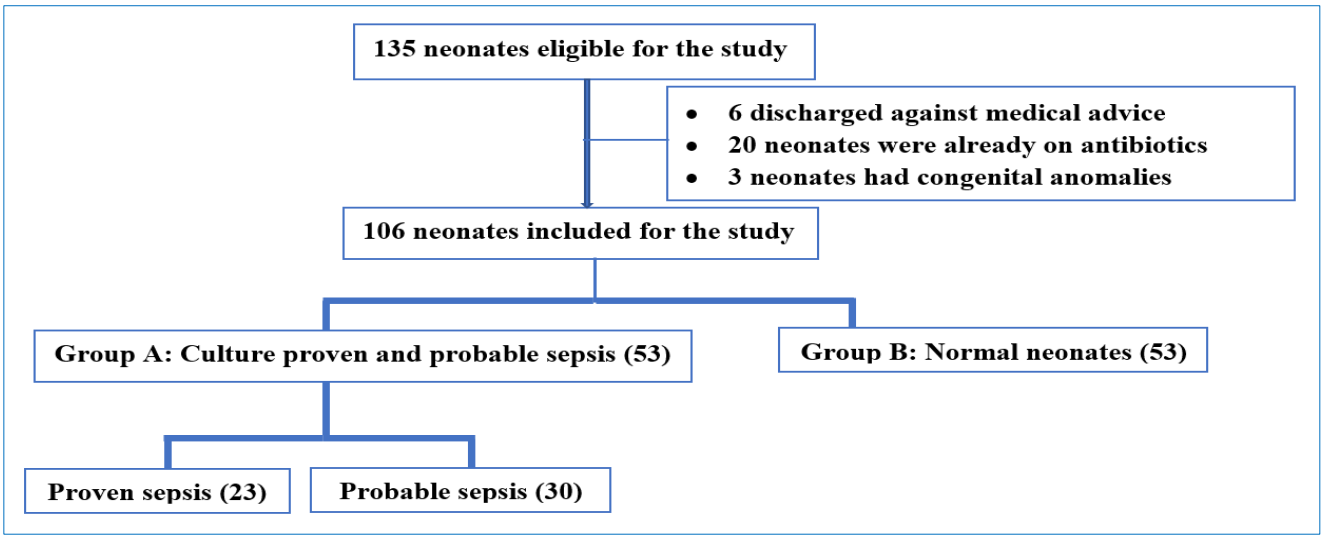

Figure 1: Study flow diagram.

Statistical differences were observed between the study group regarding the birth weight and mode of delivery. The number of low birth weight babies weighing <2.5kg was significantly higher in the study group. The babies born by normal vaginal delivery (NVD) were higher in the control group and those born by LSCS were higher in the study group (p value <0.001) (Table 3).

Table 3: Demographic data of the study population.

Demographic parameters	Group A (n=53)	Group B (n=53)	p value
Birth weight (kg)			
<2.5kg n (%)	36 (67.9)	17 (32.1)	<0.001
≥2.5kg n (%)	17 (32.1)	36 (67.9)	
Sex			
Male n (%)	25 (51)	24 (49)	0.846
Female n (%)	28 (49.1)	29 (50.9)	
Mode of delivery			
Normal vaginal delivery (NVD)	18 (31.6)	39 (68.4)	<0.001
Lower segment caesarian section (LSCS)	35 (71.4)	14 (28.6)	

There was significant difference between the two groups regarding the septic screen except total leucocyte count. IT ratio showed significant statistical difference between the study groups (mean 0.21±0.08, 0.13±0.05 respectively), ANC showed significant statistical difference(mean 5879±2938, 5338±1932 respectively), micro ESR showed significant statistical difference with mean of 9.17±2.97, 8.25±2.25 respectively), platelet count showed significant statistical difference between the study population (mean 2.16±0.92, 2.27±0.53 respectively), MPV also showed statistical difference between the study groups (mean 12.8±1.52, 10.82 ±1.20 respectively) at a cut of value of 10.2fl, CRP showed significant statistical difference between the study groups (mean 12±1.5, 5±0.5 respectively). But total leucocyte count showed no statistical significance between the 2 groups (Table 4).

Table 4: Hematological investigations done in study group.

Hematological parameters	Group A	Group B	p value
IT Ratio	0.21±0.08	0.13±0.05	<0.001
ANC	5879± 2938	5338±1932	<0.001
Micro ESR	9.17±2.97	8.25±2.25	<0.001
TLC	12472±5184	11484±5596	0.089
Platelet count	2.16±0.92	2.27±0.53	<0.001
MPV	12.8±1.52	10.82 ±1.20	<0.001
CRP	12±1.5	5±0.5	<0.001

ROC Curve was generated for MPV in neonatal sepsis and the AUC was 0.927 (Figure 2).

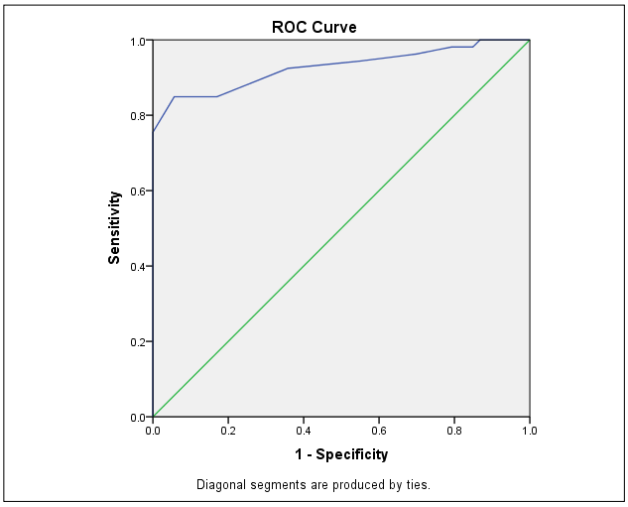

Figure 2: ROC Curve of MPV in neonatal sepsis.

DISCUSSION

Sepsis remains to be one of the main causes of neonatal mortality. Early diagnosis and treatment of neonates with suspected sepsis is essential to prevent further complications.[6] Present study aimed to determine the role of MPV as an early diagnostic marker of neonatal sepsis.

In present study, MPV was significantly higher (12.8±1.52) in the study group as compared to the control group. 10.82±1.20. In the study done by Catal F, MPV value of 10.35fL was identified as the cut off to identify patients with probable sepsis with a sensitivity of 97.8% and specificity of 78.7% and a MPV value of 10.75fL was determined as the cut off value for patients with high risk of mortality at diagnosis of sepsis with a sensitivity of 95.2% and a specificity of 84.9% .[12]

Present study showed sensitivity of 93% and specificity of 84 % at a cut off of 10.2fl for MPV and a positive predictive value of 83% and negative predictive value of 94%. Similar finding of 82 % sensitivity was seen in a study conducted by Aydin B et al at a cut off value of 10.4fl.[13] Recently a study done by Yao et al. found that optimal cut-off point of MPV for the diagnosis of sepsis was 11.4fL, with sensitivity of 40.5% and specificity of 88.4%.[14]

MPV between proven sepsis and probable sepsis was also compared in present study, however it did not show any statistical significance. This is in correlation to the study conducted by Catal F et al, who reported higher MPV values in newborns with sepsis with no significant difference in proven and probable sepsis in preterm infants.[12] In contrast to present study, the study done by Aksoy et al, who concluded that there was no significant difference in MPV between septic and control infants.[15] This difference may be due to the dissimilarity in the demographic data of the studied group as they focused on MPV in the sepsis of very low birth weight neonates.

As the levels of MPV are significantly higher in cases in comparison to controls, it can be used as an early diagnostic marker in neonatal sepsis. However, as it was a single center study including a small size study population with most cases included being preterm and low birth weight babies further studies should be conducted to firmly establish the role of MPV in neonatal sepsis.

CONCLUSION

Neonatal sepsis is often accompanied by thrombocytopenia. Although important platelet indices are readily available while obtaining routine complete blood counts (CBC), they are less studied among neonates although there are data conducted among adults. MPV which is a platelet index obtained from complete blood count can be used an adjuvant marker along with established septic screen to ensure early diagnosis and treatment with no additional expense. However further studies in large scale populations maybe needed to firmly establish the role MPV in neonatal sepsis.

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