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Value of Mean Platelet Volume in Diagnosis of Neonatal Sepsis

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ABSTRACT

Background: Early management is necessary for neonatal sepsis (NS), a clinical disease that may be life-threatening. Initial symptoms are frequently vague and might resemble a number of other medical disorders. In newborn populations, NS is a significant cause of death and morbidity.

Objective: The objective of this study was to study Mean Platelet Volume (MPV) in diagnosis and of neonatal sepsis.

Patients and Methods: This study was a case control study which conducted at Neonatology unit, Pediatrics department, Zagazig University Hospitals. Mean Platelet Volume were measured for all neonates.

Results: There was no statistically significant difference between cases group and controls group regarding demographic data. There was statistically positive correlation between MPV and WBCs and negative correlation between MPV and (Apgar score). MPV showed a significant negative correlation with gestational age, birth weight, platelet count, whereas it showed statistically significant positive correlation with CRP and the I/T ratio. In this study, regarding Diagnostic accuracy of MPV, Sensitivity was 96.7%, Specificity was 93.3%, PPV was 67.4%, NPV was 50% and accuracy was 66.7%.

Conclusion: MPV increases significantly in neonates with sepsis. MPV could be a useful as early diagnostic marker in neonatal sepsis.

Keywords: Mean Platelet Volume, Diagnosis, Neonatal Sepsis.

INTRODUCTION

Due to its high morbidity and mortality, neonatal sepsis has become a challenge for world health [(1)]. Sepsis kills almost 0.6 million infants annually, or 22% of all neonatal fatalities, in the world. Clinicians face a severe difficulty with this [(2)]. Blood culture is the diagnostic standard for sepsis, although it has a limited sensitivity and often takes 42–72 hours to get a response. These flaws frequently cause delayed and missing diagnosis [(3)].

A perfect sepsis biomarker with high sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) has been continuously sought after in order to diagnose and rule out neonatal sepsis as early as possible and begin giving the newborn the proper medications. When not to administer antibiotics when sepsis is suspected and how long to administer antibiotics for when sepsis is confirmed will be determined by the ideal sepsis biomarker [(4)].

Newborn referral to a hospital should be prompted by the following common clinical indications of neonatal sepsis: difficulties feeding, seizures, movement only when encouraged, respiration rate >60 per min, severe chest in drawn, and axillary temperature >37.5 °C or <35.5 °C [(2)].

Finding indicators for newborn sepsis that accurately pinpoint patients who are at risk of infection has long been a goal of research [(5)].

The platelet histogram on automated Coulter counters yields the Mean Platelet Volume (MPV), which is the arithmetic mean volume of the platelets. In femtoliters (fL), it is measured. Megakaryocyte ploidy and platelet number, which are cytokine dependent, control platelet volume. The average size of platelets detected in blood is gauged by mean platelet volume. The development of a more invasive infection or the existence of an infection that is resistant to antibiotic treatment might both be indicated by a rise in MPV [(6)].

The present work aimed to study MPV in diagnosis of neonatal sepsis.

PATIENTS AND METHODS

Technical design:

A. Study setting: Neonatology unit, Pediatrics department, Zagazig University Hospitals.

B. Sample size: Sample size is 45 divided into 2 groups.

Case group: 30 neonates diagnosed NS.

Control group: 15 neonates were apparently healthy control.

Inclusion criteria: Full term neonates and preterm neonates.

Exclusion criteria: Dysmorphic features suggestive of chromosomal anomalies. Perinatal asphyxia, and neonates under course of antibiotics prior to appropriate blood sampling.

Operational design:

Study design: This a case control study that approved by from institutional review board (IRB).

All neonates were subjected to the following:

1- Complete history:

2- Clinical examination including assessment of:

- Gestational age.
- Birth weight.
- Clinical signs of sepsis: poor suckling, lethargy, poor Moro reflex, RD, Jaundice…etc

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3- Laboratory investigations at the time of diagnosis NS including CBC with differential leucocytic count, MPV, CRP.

Sampling:

Four milliliters of venous blood samples collected aseptically by venipuncture from all participants and distributed as follows: Two ml of whole blood on EDTA for CBC and MPV.

Administrative design:

This study was approved by the Institutional Review Board (IRB) at Zagazig university hospitals.

Ethical consent:

The study was authorized by Zagazig University's Ethical Institutional Review Board. All studied participants provided written informed permission after being informed of our research's goals. The Declaration of Helsinki for human beings, which is the international medical association's code of ethics, was followed during the conduct of this study.

Statistical analysis

The data were coded, entered and processed on computer using Statistical package for social science (SPSS) (version24).The results were represented in tabular and diagrammatic forms then interpreted. Mean, standard deviation, range, frequency, and percentage were use as descriptive statistics.

Chi-Square testX^2 was used to test the association variables for categorical data. **Student's t-test** was used to assess the statistical significance of the difference between two population means in a study involving independent samples. **r→Pearson's Product correlation coefficient:** it evaluates the linear association between 2 quantitative variables (one is the independent var.X, and the other is the dependent var., Y). Value of "r" ranges from -1 to 1, 0= no linear correlation, 1= perfect positive correlation, -1 = perfect negative correlation.

Positive= increase in the independent variable leads to increase in the dependent variable.
Negative = increase in the independent variable leads to decrease in the dependent variable.

ROC curve = receiver operator characteristic curve, **Sensitivity =** ability of the test to detect the true +ve cases with minimal false negatives, **Specificity =** ability of the test to detect the true –ve cases with minimal false positives, **PPV= positive predictive value=** probability that an individual with +ve test result (≥cut off value) has the condition.

NPV=negative predictive value = probability that an individual with –ve test result **don't have** the condition. The accepted level of significance in this work was stated at 0.05 (P <0.05 was considered significant). P value >0.05 is non-significant (N-S).

RESULTS

There was no statistically significant difference between Cases group and Controls group regarding demographic data **Table (1)**.

Table (1): Comparison between Cases group and Controls group regarding demographic data.

			Cases group	Controls group	t.test	P. value
Age in Days	**Mean ± SD**		4.13± 1.65	4.00± 1.25	0.274	0.785
Sex	**Female**	**No.**	9	6	X^2 0.450	0.502
		%	30.0%	40.0%		
	Male	**No.**	21	9		
		%	70.0%	60.0%		
Mode of delivery	**CS**	**No.**	20	8	X^2 0.756	0.384
		%	66.7%	53.3%		
	vaginal	**No.**	10	7		
		%	33.3%	46.7%		

The percentage of diabetes mellitus, maternal fever above 37, maternal antibiotics and maternal urinary tract infection was statistically higher among cases group than controls group **Table (2)**.

Table (2): Comparison between Cases group and Controls group regarding perinatal history.

			Cases group	Controls group	X^2	P. value
Diabetes mellitus	**Yes**	**No.**	12	0.0	8.182	0.004
		%	40.0%	0.0%		
	No	**No.**	18	15		
		%	60.0%	100.0%		
Maternal fever above 37	**Yes**	**No.**	16	0.0	12.414	0.000
		%	53.3%	0.0%		
	No	**No.**	14	15		
		%	46.7%	100.0%		
Maternal antibiotics	**Yes**	**No.**	22	0.0	21.522	0.000
		%	73.3%	0.0%		
	No	**No.**	8	15		
		%	26.7%	100.0%		
Maternal urinary tract infection	**Yes**	**No.**	25	0.0	28.125	0.000
		%	83.3%	0.0%		
	No	**No.**	5	15		
		%	16.7%	100.0%		

There was no statistically significant difference between Cases group and Controls group regarding Apgar score at 1 min. Mean value of Apgar score at 5 min was statistically lower among cases group than controls group. The percentage of fever was statistically higher among cases group than controls group **Table (3)**.

Table (3): Comparison between Cases group and Controls group regarding post natal history.

			Cases group	Controls group	t.test	P. value
Apgar score at 1 min	**Mean ± SD**		4.90± 0.959	5.26± 0.457	-1.397-	0.170
Apgar score at 5 min	**Mean ± SD**		7.00± 1.41	8.13± 0.516	-2.991-	0.005
Fever	**Yes**	**No.**	16	0	X^2 12.414	0.000
		%	53.3%	0.0%		
	No	**No.**	14	15		
		%	46.7%	100.0%		

There was no statistically significant difference between Cases group and Controls group regarding examination **Table (4)**.

Table (4): Comparison between Cases group and Controls group regarding examination.

		Cases group	Controls group	t.test	P. value
GA	**Mean ± SD**	36.10± 2.91	37.26± 1.66	-1.431-	0.160
Birth weight (gram)	**Mean ± SD**	3103.26± 121.84	3007.93± 235.34	1.800	0.079

Mean value of MPV was statistically higher among cases group than controls group **Table (5)**.

Table (5): Comparison between Cases group and Controls group regarding MPV.

		Cases group	Controls group	t.test	P. value
MPV	**Mean ± SD**	7.93± 1.15	7.28± .554	2.063	0.045

This table shows that there were statistically positive correlation between MPV and WBCs and negative correlation between MPV and (Apgar score at 1 min, Apgar score at 5 min) while There was no statistically significant correlation between MPV and the other variables **Table (6)**.

Table (6): Correlation between MPV and other variables.

Correlation	Pearson's correlation	
	r	p
age (days) * MPV	0.212	0.162
GA * MPV	-0.046-	0.767
Birth weight (gram) * MPV	0.124	0.418
Apgar score at 1 min. * MPV	-0.402-	0.006
Apgar score at 5 min. * MPV	-0.514-	0.000
Hb * MPV	-0.277-	0.065
WBCs * MPV	0.298	0.047
Platlets * MPV	-0.093-	0.544

Regarding Diagnostic accuracy of MPV, Sensitivity was 96.7%, Specificity was 93.3%, PPV was 67.4%, NPV was 50% and accuracy was 66.7% **(Table 7)**.

Table (7): Accuracy of MPV in diagnosis of cases.

	Cut off value	AUC	Sensitivity	Specificity	PPV	NPV	Accuracy
MPV	6.50	0.69	96.7%	%93.3	67.4%	50.0%	66.7%

DISCUSSION

In the current study, there was no significant difference between both groups concerning age or sex (p>0.05).

These findings were comparable with the result of study done by **El-Gendy *et al.*** [7] who found there was no significant difference in patients and controls in terms of sex and age.

This study showed that there was no statistically significant difference between cases group and controls group regarding demographic data. The percentage of males among patients with neonatal sepsis was (70%) than females, Male >females.

This was in agreement with the previous findings of **Mohsen *et al.*** [8] who explained this due to the fact that male babies receive medical services at a higher rate than female babies in this region.

This is in disagreement with **Bassuoni *et al.*** [9] who aimed to determine the role of CD64 expression as a neutrophil surface marker in diagnosis of neonatal sepsis. Their study population comprised 62 neonates with gestational ages of 26-41 weeks who have sepsis and 18 healthy age and sex-matched neonates. They found that among NS in their study (male to female ratio 1 : 1).

This study showed that, there was no statistically significant difference between cases and controls regarding mode of delivery.

This was in agreement with **Rass *et al.*** [10] who found that as regards the mode of delivery, there was no significant difference between the two groups.

In this study, there was a highly significant decrease in the Apgar score at the first minute and the fifth minute in the patient group compared with the control group.

Similarly, **Gonzalez *et al.*** [11] found a significant statistical decrease in the Apgar score at the first minute and the fifth minute in the patient group compared with the control group.

In this study, there was no significant differences in gestational age. Also, there was no significant differences in birth weight measurement.

In harmony with the present study, **El-Gendy *et al.*** [7] who reported that there were no significant differences in birth weight in his study.

In the current study, we found that MPV was significantly higher in patients than controls.

This is in agreement with **Shalaby *et al.*** [12] who found Septic neonates showed statistically higher values of MPV than the control group.

This comes in agreement with the study of **Aydin *et al.*** [13] who found that MPV in newborns with septicemia was significantly higher than in control group.

Similar results were found by **Oncel *et al.*** [14] who studied MPV in neonatal sepsis and found that there was a statistically significant increase with regard to MPV values in patients with sepsis.

This agrees with **Omran *et al.*** [15] who found that Mean platelet volume showed significant difference between septic neonates and controls (10.2±1.2fL vs.8.0±0.5fL respectively).

CONCLUSION

MPV increases significantly in neonates with sepsis. MPV could be a useful as early diagnostic marker in neonatal sepsis.

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