Application of Platelet Parameters in Diagnosis of Adult Sepsis Patients

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Abstract: *Platelet count and Platelet indices ,Mean platelet volume (MPV)and Platelet distribution width (PDW) are routinely done blood tests to monitor neonatal sepsis. However their importance as sepsis indicators in adult patients have not been fully explored. Only limited studies has been done in adult patients. Our study aims to evaluate the variations in platelet count and platelet indices (MPV, PDW) in adult sepsis. We conducted a retrospective study from January 2018 to December 2018 on adult patients admitted to ICU of Rama medical college and hospital, Hapur (Delhi NCR). 60 sepsis and 60 control patients were enrolled based on their laboratory and clinical data obtained from medical records department. After comparing their data, we found that thrombocytopenia was more common in the sepsis group. Also MPV and PDW values were observed to be relatively increased in sepsis patients as compared to the control group. The difference in their mean was found to be statistically significant. Hence platelet count and platelet indices which are commonly performed blood tests can be used as indicators of sepsis.*

I. Introduction

Platelets are important component of blood as they play a major role in various physiological and pathological processes like hemostasis, coagulation, thrombosis, inflammation, microbial host defense, angiogenesis and remodeling.[1,2]

The concept of sepsis refers to the presence of an infectious systemic inflammatory response syndrome (SIRS). There is severe organ dysfunction, caused by an inadequate response of the organism to an infectious agent.[3]

In a multicentric study in ICU setting from India, the incidence and in-hospital mortality rate of severe sepsis were 16.45% and 65% respectively.[4]

The haemostatic system is frequently disturbed during sepsis. Coagulation system and platelets are strongly activated in sepsis resulting in depletion of coagulation factors, thrombocytopenia and DIC.[5]There is also peripheral non-immune destruction,hemophagocytic histiocytosis, and marrow suppression, all playing different roles in thrombocytopenia in septic patients.[6]

Thrombocytopenia (platelet count < 150,000/µl) is common in critically ill patients, with an estimatedincidence of 20%–40% at some point during the intensive care unit (ICU) stay. Thrombocytopenia is recognized as an independent risk factor for mortality in ICU patients.[7]

Platelet indices are a group of parameters that are usedto measure the total amount of platelets, platelets morphology and proliferation kinetics.The commonly used Platelet indices include platelet count, mean platelet volume (MPV),platelet distribution width (PDW), and plateletocrit (PCT).[1]

Increased platelet volume and size reflects the presence of a thrombotic and inflammatory milieu; thus, MPV is suggested as a possible marker of platelet function and activation. Over the past decade, various studies have shown that increased MPV is an independent risk factor for cardiovascular and cerebrovascular diseases and is associated with poor clinical outcomes of these diseases. Moreover, MPV has been considered asan index for inflammation, disease activity, and efficacy of anti-inflammatory treatment in severalchronic inflammatory disorders.[8]

The reference range for MPV IS 7.9 fL-13.7 fL in males and 8 fL -13.28 fL in females.[9]Platelet distribution width (PDW) is an indicator of variation in platelet size. Normal values of PDW are between 10 % and 17.9 %.[10]

All these indices can be measured by an inexpensive and easily available routine blood count; however their application as predictors of sepsis remains uncertain.[11]

Earlier studies have analyzed inflammatory biomarkers for diagnosis of sepsis,however only few studies have been done in our country to investigate importance of platelet parameters in diagnosis of adult sepsis patients. In our study we intend to find the relation between sepsis and platelet parameters (platelet count, MPV, PDW) in adult patients..

II. Material And Methods:

It is a retrospective study conducted from January 2018 to December 2018 on patients admitted to ICU of Rama medical college and hospital, Hapur (Delhi NCR). In our study, 60 cases and 60 controls were selected based on their laboratory and clinical findings. The patient data was obtained from medical records department of our hospital. The aim of the study was to assess platelet count and platelet indices as a biomarker of sepsis in adult patients. The cases were those patients whose diagnosis was done on the basis of clinical features in combination with laboratory examination findings by a specialist doctor.

Inclusion criteria:
1. The duration of stay in hospital ICU was more than 24 hours
2. Age group of 18 to 60 years

The control group included those patients from Out-patient and In-patient department with
1. No SIRS criteria in their medical records data.
2. Normal total leucocyte count.
3. No proven infectious disease diagnosis

SIRS is the occurrence of at least two of the following criterias : Fever>38°C or <36°C, Heart rate>90 /min, Respiratoryrate >20/ min, white blood cell count (WBC count)>12000 or >4000 /L.[6]

Statistical analysis:

The statistical software named EPI INFO software Version 7.2 was usedfor the analysis of the data. The groups were compared using Student's t-testfor continuous variables and the Pearson's Chi-square test (or Fisher's exacttest, if required) for categorical variables. The p-value of 0.05 or less was considered statistically significant.

III. Result

Out of the 60 sepsis patients in our study, 38 were males and 22 were females. The control group comprised of 33 male and 27 female patients. Thus the male to female ratio of 1.73:1 was observed in our study.The differences in age and gender data of study and control group were statistically not significant (p >0.05)

Table no 1: Comparison of demographic and laboratory parameters between patients with sepsis and control group.

Parameters	Patients with sepsis (n=60)	Control group (n=60)	P value
Gender (male)	38 (63.33)	33 (55)	0.1777
Age	42.03 ± 11.49	44.33 ± 10.82	0.2613
Platelet count	1.39 ± 0.62	1.89 ± 0.75	0.0001
MPV	11.67 ± 1.55	10.59 ± 1.18	0.00004
PDW	15.24 ± 1.28	14.37 ± 1.24	0.00024

Results are expressed as n(%), mean± 2standard deviation

Thrombocytopenia was observed in 33 patients diagnosed as sepsis whereas only 15 patients in control group had low platelet counts. The difference was found to be statistically significant (p value < 0.05).
Also a statistically significant difference in was observed in MPV and PDW mean values of sepsis patients and control group (p value < 0.05). Patients with sepsis were commonly associated with relatively higher MPV and PDW values as compared to control group.
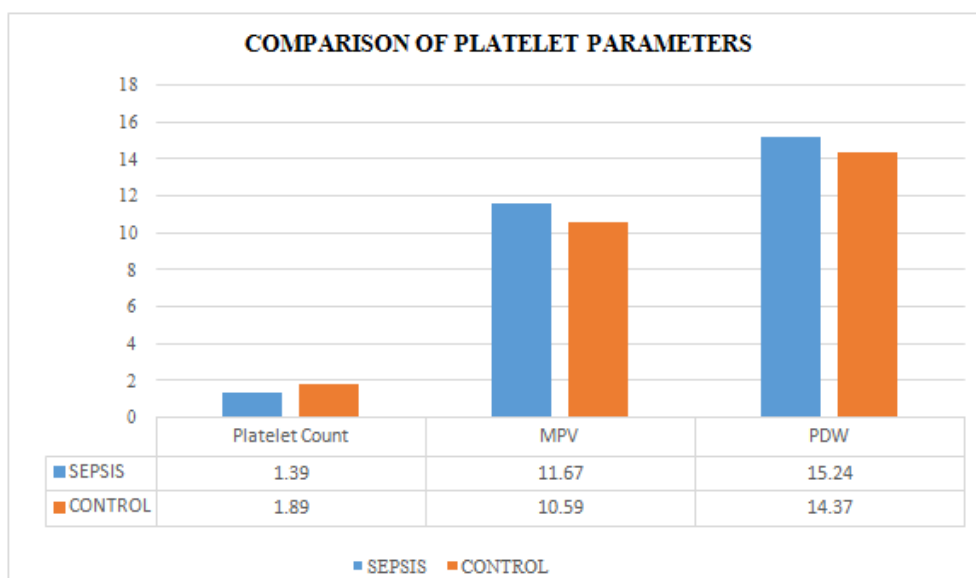
IV. Discussion

In a study done in India on sepsis, Mean age was 38.15 years with a standard deviation of ±16.97. Male population in the study was 62% and female was 38% with male to female ratio of 1.63:1.[4]These findings were in close proximity to our study findings which revealed mean age as 42.03 ± 11.49 and with male to female ratio of 1.73:1.

Now a days due to the availability of improvised automated hematology analyzers, platelet parameters can be estimated with better standardization and accuracy. Hence they are proving to be of greater clinical utility. Platelet indices can be derived from the platelet distribution curve obtained from impedance or optical methods. It includes mean platelet volume (MPV), platelet distribution width (PDW) and the fraction of large platelets. The MPV describes theaverage platelet size reported in femtolitre (fL) and is available on most haematology analysers. The PDW is a measure of the heterogeneity in platelet size either defined as the distribution width at 20% frequency level or calculated as the standard deviation of platelet volume divided by MPV × 100. Derived platelet indices are, however, highly specific to the individual technologies, with different analysers havingdifferent reference ranges of MPV and PDW.[12]

Various studies have been done to evaluate significance of platelet count and indices in pediatric sepsis patients.

Choudhary RR et al concluded that MPV and PDW may be used for screening cases of neonatal sepsis.[13] Similarly, Choudhary D.K. reported that platelet count and platelet indices can be used as early diagnostic and prognostic biomarkers for neonatal sepsis. However, in comparison, there are only fewer studies done to analyse the importance of platelet indices test on adult sepsis patients.[10]

In our study done on adult patients, we found that thrombocytopenia was more common insepsis patients as compared to the control group. The platelet count mean in our sepsis group was 139×10^9/l which was much lower than that found in control group (189×10^9/l). However Guclu E et al did not find significant difference between platelet counts of sepsis and control group.[6]

In a study done by Gucyetmez B, the combinations of CRP, Lymphocyte count and Platelet count can be used to determine the likelihood of sepsis. They obtained an average platelet count of 171×10^9/l in sepsis patients while it was 190×10^9/l in non-sepsis SIRS patients.[14]

Also, we determined that both MPV and PDW values are significantly higher in patients with sepsis in comparison with control group. The mean MPV and PDW value in our study cases was 11.67 ± 1.55 and 15.24 ± 1.28 respectively. One study reported mean MPV and PDW value as 11.00 ± 2.554 and 12.99 ± 3.347 respectively in patients with sepsis with multiorgan dysfunction. Also their study found that the difference in mean PDW and MPV values between controls and patients with sepsis with multiorgan dysfunction was statistically significant.[2]These findings were in concordance with results of our study. Another study also reported similar findings in sepsis patients. They concluded that these indices are also useful in predicting prognosis of sepsis patients.[6]

Several studies have been done to analyze platelet indices and its correlation with sepsis severity. Among them Kim C H et al and Gao Y et al concluded that MPV can be a useful test in risk stratification of sepsis patients and predicting mortality.[8,11] In a study done by Zhang S et al , they established association

between platelet indices (low platelet count, high MPV, high PDW value) and illness severity and risk of mortality.[1]

V. Conclusion

Platelet parameters (Platelet count, MPV, PDW) can be used as diagnostic aids in adult sepsis patients. Increased MPV and PDW value with decreased platelet count suggest a strong possibility of sepsis. Simple complete blood count test which is routinely done in all patients admitted to health care facilities should be closely evaluated to identify and monitor sepsis patients.

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