

The Correlation of Platelet Count and Indices with Severity of Sepsis in Patients with Sepsis

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Abstract

Aim: To study the correlation of platelet count and indices with severity of sepsis. **Material and Methods:** The present prospective clinical study was conducted in the Department of General Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India, from June 2019 to March 2020. A total of 100 patients diagnosed with sepsis were included in the study. All of them were thoroughly evaluated in terms of routine and specific biochemical investigations and complete blood count including platelet indices like mean platelet volume (MPV), platelet distribution width (PDW), plateletcrit (PCT) and platelet large cell ratio (PLCR). To establish the diagnosis of Sepsis, SIRS (Systemic Inflammatory Response Syndrome) criteria were followed. The cases were divided into Survivors and Non survivors (who expired during the treatment process). **Results:** Mean platelet counts in the Survivors group and Non-survivors group were $203.305 \pm 39.84 \times 10^9/L$ and $121.92 \pm 43.55 \times 10^9/L$ respectively. The Mean platelet volume among the Survivors and Non-survivors group in the present study were 8.72 ± 0.96 fL and 11.46 ± 0.98 fL respectively. Mean Platelet distribution width value in Survivors group was 12.79 ± 2.02 and in Non-survivors groups it was 15.67 ± 0.85 . The Mean plateletcrit values in Survivor and Non-survivor group were 0.23 ± 0.05 % and 0.19 ± 0.07 % respectively. The p value was found to be significant in case of Platelet counts, MPV and PDW among the Survivors and Non-survivors group. **Conclusion:** Platelet indices showed a statistically significant difference between survivors and non-survivors, indicating that platelet indices are readily accessible, inexpensive, and valuable prognostic indicators for patients in septic shock.

Keywords: Sepsis, Platelet, PDW.

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Introduction

Sepsis is a major healthcare problem affecting millions of people worldwide each year[1]. Platelet indices are a group of parameters that are used to measure the total amount, morphology and proliferation kinetics of platelets. The commonly used

platelet indices include platelet count, mean platelet volume (MPV), platelet distribution width (PDW), and Plateletcrit (PCT).

Mean platelet volume is a measure of the average size of platelets. Platelet

Distribution width is an indicator of volume variability in platelets size and is increased in the presence of platelet anisocytosis. Plateletcrit is the volume occupied by platelets in the blood as a percentage

Originally, these indices have been applied in the diagnosis of hematological diseases. Recently, it has been discovered patient's prognosis. A reduction in platelet count is an independent risk factor for critically ill patients in intensive care unit [2]. In addition, Acute Physiology and Chronic Health Evaluation II (APACHE II) System also includes thrombocytopenia as an independent risk factor for mortality [3].

However, whether other PLT indices are associated with the severity of illness and patient's prognosis is still under exploration. Thus, we conducted a prospective study to explore whether platelet indices could be used to determine the severity of illness in sepsis patients.

Materials and methods

The present prospective clinical study was conducted in the Department of General Medicine, Nalanda Medical College and Hospital, Patna, Bihar, India, from June 2019 to March 2020. A total of 100 patients of either sex admitted to a tertiary health care centre in Bihar with clinical features, lab investigations and/or radiological

features suggestive of sepsis. They constituted our study group. Diagnosis of Sepsis was established with the help of SIRS criteria. Routine and specific lab investigations pertaining to our study were performed. Complete Hemogram was done by the Automatic cell counter installed in the Pathology department of our institute.

Investigation reports of the patients who survived sepsis (Survivors) and who expired due to sepsis (Non-survivors) were compared statistically.

Statistical analysis

The data was coded and entered into Microsoft Excel spreadsheet. Descriptive statistics including computation of percentages, means and standard deviations were done. The independent (unpaired or student's) t test (for quantitative data within two groups) was used for quantitative data comparison of all clinical indicators. Chi-square test was used for qualitative data whenever two or more than two groups were used to compare. Level of significance was set at $P \leq 0.05$. Patients with concomitant hematological diseases (e.g. hematological malignancies, autoimmune thrombocytopenic purpura and reactive thrombocytosis) and pregnant or breastfeeding patients were excluded from the study.

Table 1: Complete Hemogram of Group I (Survivors) and Group II (Non survivors)

Investigations	Group I (n=72) (Survivors)	Group II (n=28) (Non Survivors)	p-value
Hemoglobin (g/dL)	12.62±2.21	9.51±1.16	0.001 (S)
Total Leucocyte Count (10 ³ per cu mm)	13.22±1.31	17.78±2.601	0.001 (S)
Neutrophils %	72.58±73.07	73.07±8.77	0.82
Lymphocyte %	19.58±6.74	18.21±7.35	0.53
Monocyte %	4.19±2.37	5.07±2.49	0.25
Eosinophils %	1.77±0.92	1.92±1.14	0.63
RBC count (10 ⁶ per cu mm)	4.16±0.73	3.45±0.604	0.001 (S)
Mean Corpuscular Volume (MCV), fL	86.52±7.12	85.92±8.39	0.8
Mean Corpuscular Hemoglobin (MCH)	28.88±3.02	27.42±2.76	0.12
Mean Corpuscular Hemoglobin Concentration (MCHC), g/dL	32.44±2.54	32.07±2.61	0.64
Hematocrit	36.13±6.66	30.28±4.41	0.001 (S)

Test applied: student t-test

Complete Hemogram of the patients. Mean hemoglobin in the Survivors group and Non survivors group was 12.62 ± 2.21 and 9.51 ± 1.16 respectively. The values on statistical analysis were found to be

significant (<0.01). Mean Total Leucocyte count value among the two groups was 13.22 ± 1.31 and 17.78 ± 2.601 respectively. It also came out to be statistically significant.

Table 2: Comparison of platelet indices

Investigations	Group I (n=72) (Survivors)	Group II (n=28) (Non Survivors)	p-value
Platelet Count (103 per cu mm)	203.305 ± 39.24	121.92 ± 43.55	0.001 (S)
Mean Platelet Volume (MPV), fL	8.72 ± 0.96	11.46 ± 0.98	0.001 (S)
Mean Platelet distribution width	12.79 ± 2.02	15.67 ± 0.85	0.001 (S)
Mean Plateletcrit (%)	0.23 ± 0.05	0.19 ± 0.07	0.1(NS)

Test applied: student t-test

Mean platelet counts in the Group I (Survivors group) and Group II (Non survivors group) were 203.305 ± 39.84 and 121.92 ± 43.55 respectively. (MPV) of both the groups. In group I, MPV was 8.72 ± 0.96 and in group II, it was 11.46 ± 0.98 . In group I, mean PDW was 12.79 ± 2.02 and in group II, it was 15.67 ± 0.85 . In group I, it was 0.23 ± 0.05 and in group II, it was 0.19 ± 0.07 . On statistical analysis, the difference among both the groups was found to be comparable and thus statistically insignificant ($p > 0.05$).

Discussion

In our study out of total 100 patients, 72 (72%) patients survived and 28 (28%) patients expired during the treatment process.

The platelets are intimately involved in the pathogenesis of sepsis, participating in the immune response and interacting with bacteria. Platelet abnormalities occur frequently in critical illness, especially in septic patients, and are associated with poorer outcomes. Dhananjay *et al.* [4] observed that platelet count in subjects developing sepsis is significantly less than platelet count of those not developing sepsis. In our study, among Survivors and

Non survivors groups, the Mean platelet count were 203.305 ± 39.24 and 121.92 ± 43.55 respectively (p value 0.01) i.e. significantly lower platelet counts were seen in patients who expired during the course of treatment. The findings are in concordance with the studies by Sheng Zhang *et al.* [5] study. The platelet count among the two groups in sheng Zhang *et al.* [5] study was 196.5 ± 103.3 and 141.1 ± 48.3 and the pvalue was 0.001.

The Mean platelet volume among the Survivors and Non survivors group in the present study were 8.72 ± 0.96 and 11.46 ± 0.98 respectively. P value was 0.001 i.e., statistically significant. Our observation is in tune with results of many studies on the subject. Vanderlelie *et al.* [6] in 1983 showed that mean platelet volume (MPV) was elevated in 13 of the 25 septicemia patients and returned to normal values as soon as the disease was under control. In a new born cohorts with sepsis study by Guida *et al.* [7] in 2003, thrombocytopenia and high MPV appeared to be prominent. They suggested that an elevated MPV indicates that the infection is invasive, systemic and uncontrolled and is related to the severity of the disease and

therefore MPV may be a useful assessment tool for prognostic features of septic shock.

Platelet indices are a group of indices that are used to measure the platelet count and platelet morphology. Under physiological conditions, the amount of platelets in blood can be maintained in an equilibrium state by regeneration and elimination. Thus, either the platelet or their morphology remains relatively constant. Under Pathophysiological conditions, any factor which could inhibit platelet regeneration, increase their activation or accelerate their death once overwhelming the capacity of self-regulation will cause changes in both platelet count and morphology and thus results in a change in platelet indices [8]. Research have shown that activation of the coagulation system, severe infection, trauma, systemic inflammatory reaction syndrome and thrombotic diseases could all result in changes in platelet indices. Plateletcrit is the arithmetic product of platelet count and platelet volume. A reduction of platelet count and plateletcrit simultaneously indicates that platelets have been excessively consumed. Thus, instead of only measuring platelet count as has been done previously, to measure all of the platelet indices, will provide us a more comprehensive view of sepsis severity.

Conclusion

In conclusion, the current investigation found that patients who died from sepsis had lower mean platelet counts than patients who survived sepsis (Survivors). The research also found that non-survivors had higher mean platelet volume and mean platelet distribution width than survivors. These findings are in line with numerous other worldwide researches on the issue. These indicators (platelet count and platelet indices), which are easily accessible in all tertiary health facilities globally, should be closely examined in patients with sepsis. Our research also showed that the measures

may be used to assess severity and predict prognosis in sepsis patients. More research is needed to validate the link between platelet count and sepsis severity.

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