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Original Research Article

A Comparative Study to Explore the Behavior of Platelet Indices in Sepsis and their Clinical Prognostic Value

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Abstract

Background: Sepsis is still one of the main causes of infants and children mortality especially in developing, economically challenged countries with limited resources. This study aims to explore the behavior of platelet indices in sepsis and their clinical prognostic value.

Material and Methods: A total of 70 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.

Results: A total of 70 patients of either sex admitted in Nalanda Medical College & Hospital, Patna. Complete Hemogram of the patients. Mean hemoglobin in the Survivors group and Non survivors' group was 12.62±1.29 and 9.82±1.28 respectively. Mean hemoglobin and Mean Total Leucocyte count value came out to be statistically significant. Mean platelet counts in the Group I (Survivors group) and Group II (Non survivors' group) were found to be significant ($p < 0.01$). Mean plateletcrit of both the groups. In group I, it was 276.49±43.90 and in group II, it was 0.16±0.08. On statistical analysis, the difference among both the groups was found to be comparable and thus statistically insignificant ($p > 0.05$).

Conclusion: A statistically significant difference was seen between survivors and non-survivors for platelet indices which make the platelet indices easily available, cheap and useful prognostic markers for patients in septic shock.

Keywords: Outcome, Osteosynthesis, Proximal Tibial Fracture.

Introduction

Sepsis is a major childhood disease both in terms of frequency and severity, and severe sepsis is still considered the main cause of death from infection in childhood. The prevalence of severe sepsis and septic shock among hospitalized children ranges from 1 to 26%. Mortality is high, ranging from 5% in developed countries reaching up to 35% in developing countries [1].

Although sepsis is considered a worldwide public health problem, it is still not tracked in the Global Burden of Disease report published by the WHO and World Bank [2] which is one of the most important sources of information for health policies decision-making in the world [3].

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. [4]

In the meantime, there are accumulating evidence about the important role of platelets in the inflammatory process, microbial host defense, wound healing, angiogenesis, and remodeling in addition to their contribution to hemostasis and thrombosis [5]. Some proteins released from platelet granules influence vascular wall and immune cell function [5–8], other proteins are microbicidal and antibacterial [7].

Originally, these indices have been applied in the diagnosis of hematological diseases. Recently, it has been discovered that these indices are related to the severity of illness and patient's prognosis. A reduction in platelet count is an independent risk factor for critically ill patients in intensive care unit [9]. In addition, Acute Physiology and Chronic Health Evaluation II (APACHE II) System also includes thrombocytopenia as an independent risk factor for mortality [10]. However, whether other PLT indices are associated with the severity of illness and patient's prognosis is still under exploration. So, we aim to explore the behavior of platelet indices in sepsis and their clinical prognostic value.

Material and Methods:

A total of 70 patients of either sex admitted in Nalanda Medical College & Hospital, Patna for 12 months. with clinical features, lab investigations and/or radiological features suggestive of sepsis were enrolled over a period of one year. 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.

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

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 $P \leq 0.05$.

Results:

Table 1: Mean values of diastolic B.P in group I & II (82.31±112.98 & 69.52±6.81 respectively) were also statistically significant. Similarly mean values of systolic B.P among the two groups were also found to

be statistically significant. Mean Respiratory rate in Group I patients is 20.54±1.89 and among Group II patients is 30.32±5.89. On statistical analysis it was found to be significant ($p < 0.01$).

Table 2 illustrates the Complete Hemogram of the patients. Mean hemoglobin in the Survivors group and Non survivors' group was 12.62±1.29 and 9.82±1.28 respectively. Mean hemoglobin and Mean Total Leucocyte count value came out to be statistically significant.

Table 3 shows Mean platelet counts in the Group I (Survivors group) and Group II (Non survivors' group) were found to be significant ($p < 0.01$).

Table 4 depicts Mean platelet volume (MPV) of both the groups. In group I, MPV was 7.20±0.98 and in group II, it was 13.63±0.95. On statistical analysis, the values were found to be statistically significant ($P<0.01$).

Table 5 illustrates mean Platelet distribution width (PDW) of both the groups. On statistical analysis, the difference among both the groups was found to be statistically significant ($p < 0.01$).

Table 6 shows mean plateletcrit of both the groups. In group I, it was 276.49±43.90 and in group II, it was 0.16±0.08. On statistical analysis, the difference among both the groups was found to be comparable and thus statistically insignificant ($p > 0.05$).

Table 1: Vital Parameters of Survivors and Non-Survivors

Parameters	Group I (n=52) (Survivors)	Group II (n-18) (Non survivors)	Statistical significance (p value)
Pulse Rate (per min)	112.13±7.25	110.2±9.87	0.35
Respiratory Rate (per min)	20.54±1.89	30.32±5.89	**0.001(S)**
SBP (mm of Hg)	115±17.9	90.76±17.76	**0.001(S)**
DBP (mm of Hg)	82.31±112.98	69.52±6.81	**0.001(S)**
Body Temperature (*F)	100.01±1.98	102.75±1.06	0.72

Table 2: Complete Hemogram of Group I (Survivors) and Group II (Non survivors)

Investigations	Group I (n=52) (Survivors)	Group II (n-18) (non-Survivors)	Statistical significance
Hemoglobin (g/dL)	12.62±1.29	9.82±1.28	**0.001 (S)**
Total Leucocyte Count (10^3 per cu mm)	13.72±1.76	18.09±3.99	**0.001 (S)**
Neutrophils %	70.28±76.52	79.02±9.21	0.73
Lymphocyte %	22.61±8.43	18.21±7.65	0.42
Monocyte %	5.18±2.92	5.22±3.80	0.38
Eosinophils %	1.41±0.86	2.73±1.64	0.79
RBC count (10^6 per cu mm)	5.26±0.80	3.86±0.782	**0.001 (S)**
Mean Corpuscular Volume (MCV), fL	89.64±8.64	89.05±8.21	0.21
Mean Corpuscular Hemoglobin (MCH)	30.73±3.71	29.03±2.92	0.18
Mean Corpuscular Hemoglobin Concentration (MCHC), g/dL	31.69±2.90	31.28±3.26	0.88
Hematocrit	35.28±5.83	32.74±6.72	**0.001 (S)**

Table 3: Platelet Count among Survivors and Non survivors

Investigations	Group I (n=52) (Survivors)	Group II (n=18) (Non-Survivors)	Statistical significance (p value)
Platelet Count (10^3 per cu mm)	276.49±43.90	152.61±48.62	0.001 (S)

Table 4: Mean platelet volume among Survivors and Non survivors

Investigations	Group I (n=52) (Survivors)	Group II (n-18) (Non-Survivors)	Statistical significance (p value)
Mean Platelet Volume (MPV), fL	7.20±0.98	13.63±0.95	**0.001 (S)**

Table 5: Platelet Distribution Width among Survivors and Non survivors

Investigations	Group I (n=52) (Survivors)	Group II (n-18) (non-Survivors)	Statistical significance (p value)
Mean Platelet distribution width	14.76±3.96	17.29±0.96	0.001 (S)

Table 6: Plateletcrit among survivors and Non survivors

Investigations	Group I (n=52) (Survivors)	Group II (n-18) (Non survivors)	Statistical significance (p value)
Mean Plateletcrit (%)	0.33±0.10	0.16±0.08	0.1**(NS)**

Discussion:

In our study, we took 70 patients having sepsis admitted in Medicine wards and ICU. In our study out of total 70 patients, 52 (74.2%) patients survived, and 18 (25.7%) patients examined 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. [11]. observed that platelet count in subjects developing sepsis is significantly less than platelet count of those not developing sepsis.

Pollack et al., in 2015 stated that the increase in PRISM score is significantly associated with increase in morbidity and mortality and could estimate morbidity and mortality risk [12]. Non-survivors had also higher CRP levels than survivors. It is well known that CRP is an acute phase reactant synthesized in liver in response to infection or inflammation and its serum concentration can increase up to 1000-fold during acute inflammatory events and correlated well with severity of infection [13]. Moreover, many studies observed that CRP concentrations at ICU admission were associated with organ dysfunction, increased ICU length of stay, and higher mortality [14].

Our study showed Mean platelet counts in the Group I (Survivors group) and Group II (Non survivors' group) were statistically significant ($p < 0.01$). Vanderlelie et al. [15] 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 newborn cohort with sepsis study by Guida et al. [16] 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.

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. When platelets have been excessively consumed, bone marrow will produce a large number of immature platelets which have larger volume than mature ones. At that time, both newly produced platelets with large volume and mature platelets with small volume simultaneously present in the blood, therefore, both mean platelet volume and platelet distribution width (coefficient of platelet size variation) will be increased correspondingly. [17]. Therefore, this study provides comprehensive view of sepsis severity.

Conclusion:

A statistically significant difference was seen between survivors and non-survivors for platelet indices which make the platelet indices easily available, cheap and useful prognostic markers for patients in septic shock.

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