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Pathology

Comparison of Platelet Indices with Apache II Scoring System in Assessing the Disease Severity of Patients with Critical Illness- A Cross Sectional Study

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Abstract **Original Research Article**

Thrombocytopenia is encountered in day to day clinical practice and the criterion for patient's admission in the intensive care unit (ICU) depends upon various risk factors. APACHE II and many other scoring systems are generally used in ICU patients to assess the mortality risk. Studies have revealed the use of hematological indices analyzed in counters in predicting the outcome of various diseases. Platelet indices such as Mean platelet Volume(MPV)Platelet Distribution Width(PDW) and Plateletcrit(PCT)as considered as the markers of platelet activation. Hence we attempted to compare the platelet indices with APACHE II scoring system in assessing the risk severity in patients admitted in ICU with thrombocytopenia. The study was conducted in a tertiary care hospital, south india. A cross sectional descriptive study was conducted over a period of year (2017-2018).Patients who were admitted in ICU with thrombocytopenia were evaluated with clinical details. Thrombocytopenia workup including complete blood counts, platelet indices and peripheral blood picture was carried out. APACHEII score, Estimated and Percentage mortality were calculated. Statistical analysis was done by using commercially available statistical software packages. We found a cause related mortality risk particularly in sepsis where there is severe thrombocytopenia and among the platelet indices PDW showed a significant correlation with APACHEII score, estimated and Percentage mortality(p=0.046,r=0.026,p=0.031)respectively. We also found significant correlation of platelet count and plateletcrit with percentage mortality (p=0.053,r=-0.197,p=0.023,r=-0.230).Percentage mortality had a causal relationship and in our study it had an inverse association with platelet count and plateletcrit in assessing the disease severity. In cases of thrombocytopenia, PDW can be utilized in estimating the disease severity in cases of sepsis along with APACHEII scoring system among critically ill patients.

Keywords: Thrombocytopenia, APACHEII score, Sepsis, Platelet indices, Mortality.

INTRODUCTION

Thrombocytopenia occurs in various conditions with associated risks and it is a common haemostatic disorder among severely ill patients with prevalence of approximately 13% - 48% admitted in intensive care unit [1,2]. Studies have revealed about 25% - 51% of patients in the intensive care unit to have thrombocytopenia [1,2].Thrombocytopenia is defined as a platelet count below 2.5 th the lower Percentile of the normal platelet count distribution i.e. below 150,000/micro L for adults[2,3]. Degrees of thrombocytopenia can be further subdivided into mild (plateletcount 100,000 to 150,000/microL), moderate (50,000 to 99,000/microL), and severe (<50,000 /microL) [2,3]. Correlation between platelet count and bleeding risk varies according to the underlying causes and sometimes is unpredictable which remains as a challenge for the physicians towards effective clinical management [4]. Platelet indices which includes Platelet distribution width (PDW), Plateletcrit (PCT) and Mean platelet Volume (MPV) are calculated by automated hematology analyzers which have been utilized clinically in recent years as important parameters for various disease entities [5].Very few Indian studies have highlighted the importance of assessing the platelet indices in critically considered ill patients to predict the risk of morbidity and mortality. Hence in our present study we have aimed to evaluate the different causes of thrombocytopenia and also to investigate the correlation between Platelet indices and risk of severity in critically ill adult patients admitted in ICU by calculating APACHE II scoring system, at a tertiary care hospital in South India.

MATERIALS AND METHODS

A Cross-sectional, hospital based study for

adult patients aged between 18 and 85 years admitted in ICU in tertiary care hospital with thrombocytopenia was conducted over a period of 1 year (01.10.2017 to 1.10.2018)with platelet count below150, 000/ micro L admitted in the ICU. Exclusion criteria in our study includes, Pregnant women, Patients with active hemorrhage, C Patients who have history of blood or platelets transfusion prior to the admission, Patients who are using anti-platelet drugs such as clopidogrel prior to their admission and Patients who have received radiotherapy, chemotherapy or bone marrow transplant one month prior to admission and with Pseudo thrombocytopenia. The institutional SOPs (Standard Operating Procedures) were followed for the sample collection and for conducting the tests. 3ml of whole blood was collected from the cubital vein with a vacutainer system in to k3 EDTA tubes. A complete hemogram was done within four hours of the blood collection by using Beckman Coulter LH 750. Dedicated reagents and standard methodologies were used. The 2-level quality control procedures performed every day and the analyzer was maintained according to the manufacturer's instructions during the entire period of study. Platelet count and platelet indices were noted. If unexpected low platelet counts were obtained in automated analyzer then counts were verified in fresh sample processed in sodium citrate vial and peripheral smear was examined to rule out pseudo thrombocytopenia. Medical history, clinical examination and other relevant details will be collected from medical records. APACHE II scoring system was used to monitor the clinical severity of the patients. Descriptive analysis and hypothesis testing was done by appropriate statistical tests by using commercially available statistical software packages. All quantitative variables were estimated using measures of central location (i.e) Mean and standard deviation. Student t-test and chi- square test was applied to find the association of socio-demographic factors, clinical parameters and outcome parameters with diagnosis. Pearson correlation was done to compare the age and clinical parameters with outcome parameters. ANOVA regression analysis was applied to find the correlation between clinical and outcome parameters in cases of sepsis.

RESULTS

Table-1: baseline characteristics in our study

Variables	Mean	Standard Deviation	Minimum Value	Maximum Value
Age	48.88	15.643	18	85
Platelet count	78490	41840.364	4000	149000
Mean platelet	8.204	1.2453	5.6	13.0
Volume				
Platelet	17.761	1.11	11.5	19.6
Distribution width				
Plateletcrit	0.068	0.0434	0.002	0.227
Apache ii score	22.97	7.950	09	38
Estimated	47.124	24.1534	9.9	88.4
Mortality				
Percentage	51.624	26.8519	7.9	94.0
Mortality				

Table-2: association of clinical and outcome parameters with causes of thrombocytopenia

Variables	Mean	Standard Deviation	P –value for t –test Analysis
Platelet count	78490	41840.364	0.04*
Mean platelet volume	8.204	1.2453	0.038
Platelet distribution	17.761	1.11	0.01*
Width			
Plateletcrit	0.068	0.0434	0.04*
Apache ii score	22.97	7.950	<0.001*
Estimated mortality	47.124	24.1534	<0.001*
Percentage mortality	51.624	26.8519	<0.001*

*statistically significant ($p < 0.05$)

Table-3: association of age and clinical parameters with outcome parameters

Variables		Apache ii score	Estimated mortality	Percentage
				Mortality
Age	Pearson	0.312**	0.307**	0.329**
	Correlation			
	Significance (2 – Tailed)	0.002*	0.002*	0.001*
	After controlling for age, sex and diagnosis			
Platelet count	Pearson	-0.143	-0.161	-0.197
	Correlation			
	Significance (2 – Tailed)	0.162	0.115	0.053*
Mean platelet	Pearson	-0.026	-0.035	-0.031
Volume	Correlation			
	Significance (2-Tailed)	0.803	0.734	0.760
Platelet	Pearson	-0.067	-0.061	-0.057
Distribution	Correlation			
Width				
	Significance(2 – tailed)	0.516	0.553	0.576
Plateletcrit	Pearson	-0.114	-0.136	-0.230
	Correlation			
	Significance (2 – Tailed)	0.266	0.185	0.023*

*correlation is significant at the 0.01 level.

T**able-4: association of clinical parameters with apache ii score**

Clinical Parameters	Unstandardised Coefficient		Standardised Coefficient	T	Significance
	B	Std. Error	Beta		
Platelet Count	-5.194	0.000	-0.318	-1.034	0.308
Mean Platelet	-0.320	0.918	-0.071	-0.349	0.749
Volume Platelet Distribution	-2.420	1.173	-0.342	-2.063	0.046*
Width Plateletcrit	9.018	58.634	0.045	0.154	0.879

* Statistically significant at the level of 0.05 ($p < 0.05$)

Table-5: association of clinical parameters with estimated mortality

Clinical Parameters	Unstandardised Coefficient		Standardised Coefficient	T	Significance
	B	Std. Error	Beta		
Platelet Count	0.000	0.000	-0.401	-1.33	0.191
Mean Platelet Volume	-1.337	2.863	-0.093	-0.467	0.643
Platelet Distribution Width	-8.493	3.658	-0.377	-2.32	0.026*
Plateletcrit	46.83	182.837	0.074	0.256	0.799

1. Statistically significant at the level of 0.05 ($p < 0.05$)

Table-6: association of clinical parameters with percentage mortality

Clinical Parameters	Unstandardised Coefficient		Standardised Coefficient	T	Significance
	B	Std. Error	Beta		
Platelet count	0.000	0.000	-0.393	-1.321	0.195
Mean platelet Volume	-1.245	2.916	-0.084	-0.427	0.672
Platelet Distribution Width	-8.341	3.725	-0.359	-2.239	0.031*
Plateletcrit	3.440	186.208	0.005	0.018	0.985

* Statistically significant at the level of 0.05 ($p < 0.05$)

Out of 100 samples collected, 65 were males and 35 were females belonging to a population between 18 to 85 years of age.Out of 100 thrombocytopenic cases admitted in ICU 43 cases had sepsis, 19 cases had chronic liver disease, 8 cases had chronic kidney disease, 8 cases had malignancy, 5 cases had dengue and 17 had diseases of other category. Other cases included Pancreatitis, Rat killer poisoning, Thrombotic Thrombocytopenic Purpura, Myelodysplastic syndrome, Aplastic anemia. The clinical parameters included in our study were Platelet count, Mean Platelet volume (MPV), Platelet distribution width (PDW) and Plateletcrit (PCT).Outcome parameters in our study include APACHE II scoring system, estimated and percentage mortality. The Mean, Standard deviation, minimum and maximum values of the above said parameters are depicted in [Table 1].Student t - test analysis was done to find the association of clinical parameters and outcome parameters with causes of thrombocytopenia. [Table 2]Pearson correlation was done to check for association of Age and clinical parameters with outcome parameters. It was observed that a statistically significant association was present between Age and Outcome Parameters [Table 3]. After controlling for age, Pearson correlation between clinical and outcome parameters showed negative correlation of platelet count and Plateletcrit with Percentage mortality[Table 3].Since the majority of studied cases were diagnosed as sepsis with thrombocytopenia, we had limited the association of clinical parameters with outcome parameters to those subjects alone ANOVA regression analysis was performed to check for correlation between the clinical and outcome parameters in cases of sepsis. The results are depicted in [Table 4, 5, 6].

DISCUSSION

Our study showed male preponderance and the

majority of patients admitted forthrombocytopenia in ICU were found to have sepsis, which is consistent with the studies conducted by Stéphan F, Riedler *et al*. [6] A statistically significant correlation was established between causes of thrombocytopenia and APACHE II score, Estimated and Percentage mortality respectively. Our study had 43 cases of sepsis; the low platelet count in these cases was explained due to peripheral non-immune destruction, marrow suppression, hemophagocytic histiocytosis [7-9]. Similar events of platelet activation lead to thrombocytopenia in 16 cases diagnosed to have malignancy [8]. We had 19 cases of Chronic liver disease, thrombocytopenia in these cases were explained due to decreased thrombopoitein levels and bone marrow suppression[9] 5 cases of Dengue were included in our study and thrombocytopenia in these patients were due to dengue virus antibodies destroying the platelets attached to dengue viral antigen [8,9]. 8 cases of chronic kidney disease in our study found to have thrombocytopenia due to decreased erythropoietin secretion and accumulation of toxic metabolites which lead to platelet dysfunction [9]. 17 cases of other disease category includes 8 cases of pancreatitis, 5 cases of Aplastic anemia, 2 cases of Rat killer poisoning, 1 case of Myelodysplastic syndrome (MDS) and 1 cases of Thrombotic Thrombocytopenic Purpura (TTP).Thrombocytopenia in these cases was explained due to platelet activation and bone marrow suppression[10]. The cause related thrombocytopenia has direct effect on mortality risk as we had observed in cases of sepsis who presented with high risk mortality [Table 2]. Similar observations were recorded in a study conducted by Brun *et al*. among critically ill patients admitted in ICU [11]. In our study, there was a statistically significant correlation between Age and Outcome parameters ($p<0.001$)(Table 3).However, age by itself cannot be considered as an individual parameter for increased mortality risk since worsening of pre-existing co -morbidities occurs with advancement of chronological age [12]. It was also found that patients who had low platelet count and low plateletcrit had higher Percentage mortality ($p = 0.053$ and $p = 0.023$) ($r = -0.197$, $r = - 0.230$)(Table 3,4,5,6) as various degrees of thrombocytopenia reflect the severity of the disease [4]. Since majority of cases in our study presented with sepsis, an association was attempted between platelet indices and outcome parameters. We found a significant positive association of Platelet Distribution Width with APACHE II score, estimated and percentage mortality. (Table 4, 5, 6)($p = 0.046$, $p = 0.026$ and $p = 0.031$).This can be explained in cases of sepsis where platelet activation induces the platelets to obtain a spherical shape with subsequent pseudopodia formation along with the generation of younger platelets [12]. The above events contribute to the changes in platelet distribution width as it measures the incongruity among the Platelets. Similar results have been derived in the study conducted by Zhang S et al where patients with a low Platelet count, low Plateletcrit, high Mean platelet volume and high Platelet distribution width showed higher risk of mortality [13]. Many other studies conducted by Guclu *et al*. found Mean Platelet volume to be a significant parameter in evaluating disease severity in patients with sepsisn[14]. Whereas in our study such a relationship was not established [Table 4,5,6].

CONCLUSION

In our study, there is a cause specific association with mortality risk and we found that in cases of sepsis Platelet Distribution Width had a significant positivecorrelation with outcome parameters. We have also found that in all cases of thrombocytopenia, Plateletcrit had an inverse relationship with Percentage Mortality.

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