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EVALUATION OF THROMBOCYTOPENIA IN THE PEDIATRIC PATIENTS BY PLATELET INDICES: A STUDY IN A TERTIARY CARE HOSPITAL.

Pathology

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ABSTRACT

Background: Evaluation of thrombocytopenia involves a meticulous approach in which complete clinical history, clinical examination, complete hemogram and bone marrow aspiration if indicated, are included. The various platelet indices produced by the automated analysers such as, Mean platelet volume (MPV), Platelet distribution width (PDW), Plateletcrit (PCT) and Large cell ratio (LCR) can be used to distinguish the underlying etiology of thrombocytopenia.

Methods: Total of seventy three thrombocytopenic patients <14 years with proper clinic-hematological work up were included in the study. The results were compared by manual examination of the peripheral blood smear.

Results: Patients were grouped based on the mechanism- Peripheral destruction 54 (73.9%), Hypoproduction 10 (13.6%), Hypersplenism 9 (12.3%). There was a linear correlation between the platelet count and all the platelet derived indices (MPV, PDW, PCT, LCR) in the patients with peripheral destruction of platelets.The p-value of all the derivatives was statistically significant (level of significance less than 0.05). In patients with hypoproduction and hypersplenism,there was positive correlation between the platelet count and MPV, PDW, PCT & LCR. None of the p-values were statistically significant.

Conclusions: Platelet indices especially MPV and PDW can be used as important initial and supportive tool to differentiate between the hyperdestructive versus hypoprodution and hypersplenism cases.

KEYWORDS

Platelet Indices, Thrombocytopenia, Peripheral Destruction, Hypoproduction, Hypersplenismmll - Morel-lavallee Lesion

Introduction:

Thrombocytopenia is defined as a platelet count under 1.5lac/mm^3. It is the most common cause of defects in primary hemostasis and can present with bleeding in children. Platelets are essential for maintaining the integrity of the endothelium and formation of the hemostatic plug by aggregating and adhering to each other (primary hemostasis). The role of the secondary factors (coagulation system) comes later when the injury is extensive.[1]

Thrombocytopenia is generally suspected in children when they present with bleeding in the mucous membranes and petechiae in the skin. But it can also be accidently picked up on the routine blood investigations for the other causes.[1]

The causes of thrombocytopenia are broadly classified in to three groups: (1) Hypoproduction (2) Peripheral destruction and (3) Splenic sequesteration.[1,2,5]

Unlike the widespread use of the red blood indices for understanding the etiology of anemias; use of platelet derived indices is limited. These indices (Mean Platelet Volume, Platelet Distribution Width, Plateletcrit, Large Cell Ratio) are not used in clinical context; mainly because of an ignorance of their possible usefulness and also due to the difficulties encountered in standardization of the their values. The MPV is considered as a surrogate marker for bone marrow activity and compares the average size of the platelet.[1,2,3,4,5] The PDW expresses the variability in the size of the platelets. The percentage refers to the proportion of the platelets that have size more than 20fl.[1,3] P-LCR is a ratio of large platelets to the total platelet count.[1,3,5]

Material and Methods:

This study was conducted in the Hematology section of the Pathology Department of Guru Gobind Singh Medical College and Hospital, Faridkot, Punjab. Seventy three patients, aged <14 years with a platelet count < 1.5 lac/mm^3 were included in the study. In each case the important demographic, personal and clinical information such as age, sex & provisional clinical diagnosis were recorded.

The venous sample of the patient were collected in the EDTA containing vacutainers. The samples were analyzed in the automated cell counters. In the case of thrombocytopenia (Platelet count < 1.5 lac/mm^3), various platelet indices i.e.; Platelet count, Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Plateletcrit (PCT) and Large Cell Ratio (LCR) were noted.

The blood samples were counter checked manually by making a peripheral blood film/smear and stained with the Leishman stain. All the above mentioned data was collected, correlated and statistical significance between the various platelet derived indices and the platelet count was assessed. The relation of each of these platelet derived indices was correlated with the cause/ etiology of the thrombocytopenia.

RESULTS

The thrombocytopenic patients (n=73) were grouped into three categories as per the underlying mechanism in Table 1 and Figure 1.

Male to female ratio of 1:1.3 was observed in patients with peripheral destruction, whereas equal male to female ratio was seen in patients with hypoproduction. In the hypersplenism category the ratio was 2:1.

A Spearman's rank-order correlation was run to assess the relationship between the platelet count and the platelet derived indices in patients with peripheral destruction and hypersplenism as the underlying mechanism of thrombocytopenia. Preliminary analysis showed the relationship to be montonic as assessed by the visual inspection of a scatter plot. There was a linear correlation between the platelet count and all the platelet derived indices (MPV, PDW, PCT, LCR) in the patients with peripheral destruction of platelets as the underlying cause of thrombocytopenia. The p-value of all the derivatives was statistically significant (level of significance less than 0.05). In patients with hypersplenism, Spearman's Correlation was in linear correlation and none the values were statistically significant (Table 2, Graphs1-2, 5-6)

A Pearsons Product moment correlation was run to assess the relationship between platelet count and all the platelet derived indices (MPV, PDW, PCT, LCR) in the patients with hypoproduction as the cause of thrombocytopenia. Preliminary analysis showed the relationship to be linear with both variables normally distributed, as assessed by Shapiro-Wilk's Test (p>0.05), and there were no outliners. There was a positive relation between the platelet count and MPV, PDW, PCT & LCR (Table 2, Graphs3,4). None of the p-values were statistically significant.

Discussion

Advances in technology have made it possible to record and analyse various platelet indices like MPV, PDW, PCT, L-CR. Bone marrow sampling is an invasive, expensive and an unnecessary first line investigation in the thrombocytopenic patients. Thus, non-invasive procedure are required especially in small children.[1,2]

Large sized platelets are seen in diseases like ITP, May Hegglin anomaly and Bernard Soulier's syndrome while small platelets are seen in aplastic anemia, Wiskott Aldrich syndrome, thrombocytopenia absent radii syndrome and storage pool disorder. Elevated level of MPV is an indication of increased megakaryocyte shedding of platelets and raised PDW indicates anisocytosis.[1,2]

In the present study, the category of patients in which peripheral destruction of the platelets was the underlying etiology of thrombocytopenia; all the platelet parameters were statistically significant. Whereas, in the catogories of hypersplenism and hypoproduction all the platelet parameters were in linear correlation and none of the parameters were statistically significant.

Aponte-Barrios et al and Rajashekar et alreported a similar finding in which the ITP patients had a statistically significant values in relation to all the platelet parameters as compared to hypoproduction cases.[1] Similar results were also demonstrated in a comparison study of platelet indices in the hypoproduction and hyperdestructive cases, thus concluding that MPV and PDW can be used as reliable tests for positive diagnosis of ITP.[4,5] Baig et al also reported similar results in a study conducted over one year in which a significant p values were obtained in the peripheral destruction patients.[7] In concordance, Negash et al and Parveen S reported a significant correlation in the hyperdestructive category.[8,9] DA Elsewefy et al and other studies reported a significant value in hyperdestructive category with MPV >9.7fl.[10,11] In contrast, Katti et al concluded an inverse relationship between the individual parameters and the platelet count and a linear relationship in cases of hypoproduction.[2,3]

In conclusion, platelet indices especially MPV and PDW can be used as important tool to differentiate between the hyperdestructive versus hypoprodution and hypersplenism cases. This can to some extent avoid the use of bone marrow aspiration as a tool for the diagnostic evaluation of thrombocytopenic patients.

Conflict of Interest: None

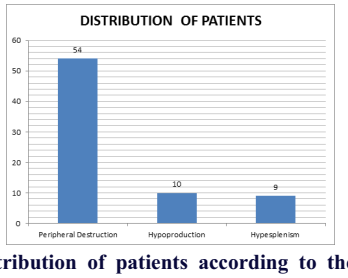


Figure1: Distribution of patients according to the underlying mechanism

Table 1: Etiological Groups of the study

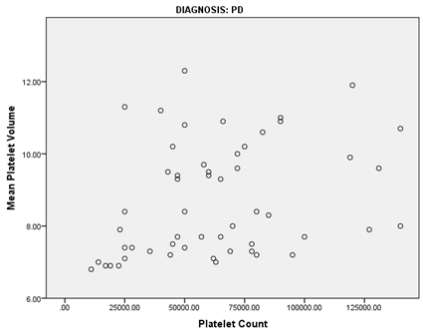
Peripheral Destruction (n=54)		
Sepsis	20	37%
Pre term delivery	11	20.3%
ITP	09	16.6%
Respiratory distress	05	9.3%
Fever with/without diarrhoea	04	7.4%
Pneumonia	03	5.5%
Jaundice	02	3.7%
Hypoproduction (n=10)		
Acute Leukemia	05	50%
Megaloblastic Anemia	04	40%
Sepsis	01	10%
Hypersplenism (n=9)		
Hepatosplenomegaly	07	77.7%
Chronic Malaria	02	22.2%

Table 2: Correlation coffiecient (r value) and p value of the variables in all the categories.

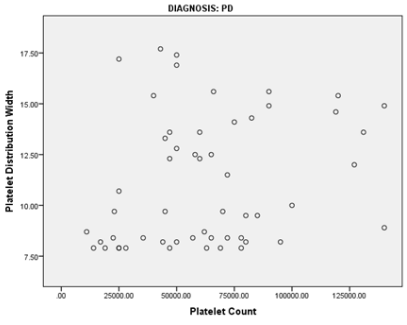
Category	MPV		PDW		PCT		LCR	
	Correl - ation	Sig. (2-tailed)	Correl - ation	Sig. (2-tailed)	Correl - Ation	Sig. (2-tailed)	Correl - ation	Sig. (2-tailed)
Peripheral Destruction (Spearrman's rho)	0.377**	0.005	0.273*	0.046	0.539	0.000**	0.272	0.047*
Hypoproduction (Pearson's correlation)	0.312	0.380	0.338	0.339	0.317	0.372	0.269	0.452
Hypersplenism (Spearrman's rho)	0.377	0.318	0.452	0.222	0.598	0.089	0.078	0.841

* Correlation is significant at the 0.05 level (2-tailed).

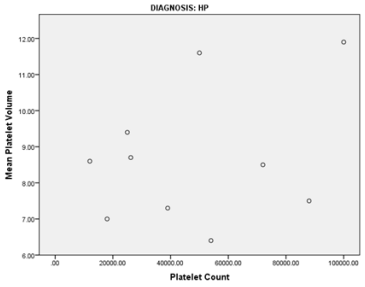
** Correlation is significant at the 0.01 level (2-tailed).



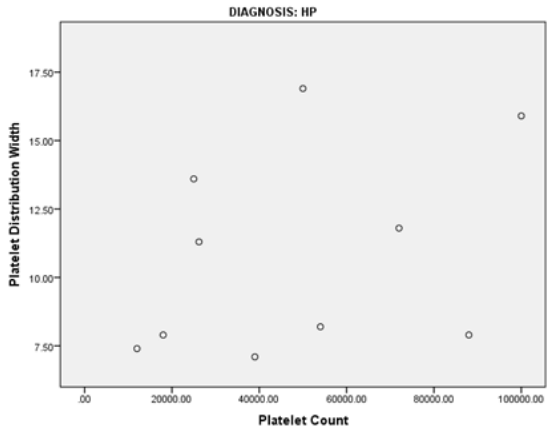
Graph 1: Peripheral destruction cases. Correlation between Platelet Count and MPV. r=0.377, p <0.05



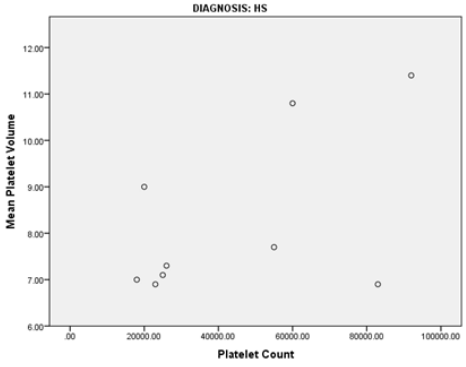
Graph 2: Peripheral destruction cases. Correlation between Platelet Count and PDW. r=0.273, p <0.05



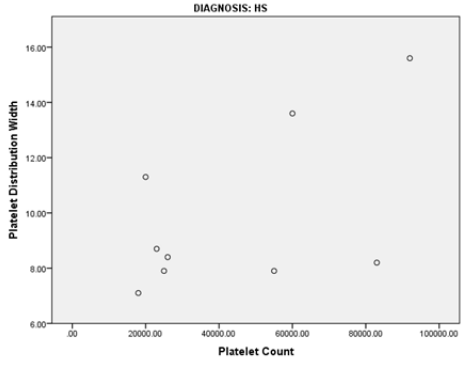
Graph 3: Hypoproduction cases. Correlation between Platelet Count and MPV. r=0.312, p >0.05



Graph 4: Hypoproduction cases. Correlation between Platelet Count and PDW. r=0.338, p >0.05



Graph 5: Hypersplenism cases. Correlation between Platelet Count and MPV. r=0.377, p >0.05



Graph 6: Hypersplenism cases. Correlation between Platelet Count and PDW. r=0.452, p >0.05

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