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Original Research Article

Analysis of Thrombocytopenia and Utility of Platelet Indices

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Abstract

Background: Haematology analyser that determine Platelet indices, such as Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Platelet-crit (PCT) and Platelet large cell ratio (P-LCR) may provide some valuable information regarding the underlying mechanism and pathogenesis of thrombocytopenia.

Methods: Prospective observational study of 200 thrombocytopenic samples, hemogram analysis done by automated haematology analyser and Statistical analysis was done.

Results: Among the 200 cases of thrombocytopenia,66 cases were classified intohypo productive and 134 cases into hyper-destructive thrombocytopenia. Most common cause of hypo-productive and hyper-destructive was Megaloblastic anaemia(52%) and Dengue(42%) respectively. Both MPV and PDW were increased in hyper-destructive thrombocytopenia compared to hypo productive thrombocytopenia.

Conclusion: Increased MPV and PDW may provide a reliable positive diagnosis of Immune Thrombocytopenic Purpura in case of thrombocytopenic patients.

Keywords: Thrombocytopenia; Immune thrombocytopenia; Platelet indices; Mean platelet volume; Platelet distribution width.

Introduction

Platelet volume indices are easily available such as Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), Plateletcrit (PCT) and Platelet large cell ratio (P-LCR) may provide some valuable information regarding the underlying mechanism and pathogenesis of thrombocytopenia.[1,2](Table 1)

The present study, thus aimed to investigate the role of platelet volume indices in differential diagnoses of thrombocytopenia in an attempt to consider the use of these indices in the initial evaluation of these patients.[3]

Table 1: Normal Reference Ranges of Platelet Indices.

Mean platelet volume (MPV)	**9.4–12.3 fl**
Platelet distribution width (PDW)	10.0%-17.9%
Platelet crit (PCT)	0.22–0.24%
P-LCR	15-30%

Objective

To investigate the role of platelet indices in evaluation of thrombocytopenia.

Materials and Methods

The Prospective observational study was conducted at S. Nijalingappa Medical college, Bagalkot, Karnataka. Patients with the platelet count below 150X10^9/L who volunteered to participate were enrolled in our study.

Sample size: 200

Relevant clinical details of these thrombocytopenic patients were collected. Blood sample for analysis Complete blood count was collected in 2ml EDTA anti-coagulated tubes. All blood samples were analysed within 2 hrs of sample collection. Platelet indices (platelet count, mean platelet volume and platelet distribution width, P-LCR and platelet-crit) were measured using Swelab Alfa Automated haematology analyser in the laboratory. Peripheral blood smear was also studied to correlate the platelet count with the analyser values and to rule out pseudo-thrombocytopenia.

Based on clinical history and laboratory reports patients were divided into hypo-productive thrombocytopenia and hyper-destructive thrombocytopenia. Computerized statistical analysis was performed using SPSS (statistical package of social sciences).

Results

Among the 200 cases of thrombocytopenia, 66 cases were grouped under hypo-productive thrombocytopenia and 134 cases into hyper destructive thrombocytopenia.

Age group ranged from 2 days to 70 yrs. Oldest case was having dengue fever induced thrombocytopenia and youngest was diagnosed as neonatal thrombocytopenia due to respiratory distress.

Most common age group in hypo production and hyper destruction group was 40-50 years and 20-30 years respectively.

Male to female ratio in hypo production and hyper destruction group was 1:1 and 1.9:1 respectively.

Among hypo productive thrombocytopenia most common cause was Megaloblastic anaemia (52%) followed by Panytopenia(33%). (Fig. 1)

Among hyper destructive thrombocyto-penia most common cause was Dengue (42%) followed by sepsis (20%). (Fig. 2)

In this study we found Mean value with standard deviation of MPV in hyper destructive and hypo productive thrombocytopenia as 12.2±1.8 and 8.69±1.1 respectively. (Table 2)

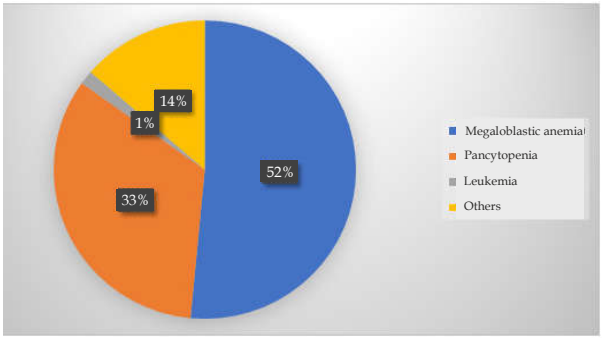

Fig. 1: Etiological Distribution of hypo-Productive Thrombocytopenia.

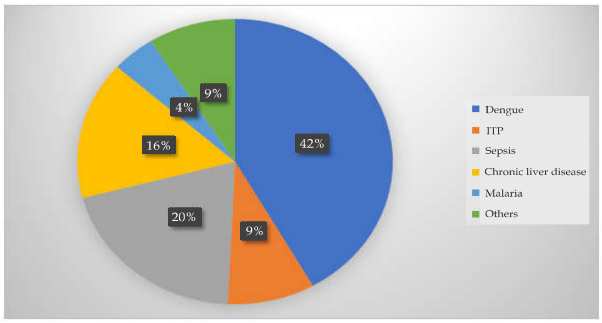

Fig. 2: Etiological Distribution of hyper-Destructive Thrombocytopenia.

Table 2: Mean Values with Standard Deviation of Mpv, Pdw, L-Pcr and Platelet-Crit in hypo-Productive and hyper-Destructive Thrombocytopenia.

	MPV	PDW	L-PCR	Platelet crit
Hypoproductive thrombocytopenia	8.69±1.1	12.1±3.4	25.1±5.2	0.07±0.02
Hyperdestructive thrombocytopenia	12.2±1.8	14.2±2.8	34.2±3.6	0.08±0.03

Discussion

Simple, inexpensive and non-invasive tests like MPV have been reported to identify the causes of thrombocytopenia as hypo-productive and hyper-destructive with sufficient predictive capacity, sensitivity and specificity was concluded in studies done by Ntaios G.et al, Bowles K. et al, Kaito K. et. al.[4-6] Study done by Farias MG. et al and Sewakdas KP. et al found that high PDW has been associated with hyper destructive thrombocytopenia because of the release of heterogenous population of platelets which vary in their size (anisocytosis).[6,7] In our study, we also found that MPV and PDW were increased in hyper-destructive thrombocytopenia as compared to the hypo-productive group, when

compared with the other studies. (Table 3)

In our study, among hypo productive thrombocytopenia most common cause was Megaloblastic anaemia, similar observations were made in the study done by Narasimhulu et al12. Among hyper destructive thrombocytopenia most common cause was Dengue fever, similar results were seen in the study done by Narasimhulu et al12 and Katti et. al.[13] (Table 4)

Most often the patients with ITP present with severe thrombocytopenia and haemorrhagic events, which constitutes emergency and there is significant risk of intracranial or gastrointestinal haemorrhage. With all the clinical history, physical examination, laboratory findings within hours clinicians should diagnose and treat the patient. It is a diagnosis of exclusion. There is no available test for the positive diagnosis of ITP. Our study provides two reliable, positive diagnostic tests – namely MPV, PDW and, to a lesser extent, P-LCR for the differential diagnosis of ITP from Hypo-productive thrombocytopenia. These tests are routinely generated by automated cell counters and are available within the very first minutes after the examination of the patient. This is similar to the study done by George Ntaios et. al.[4]

Among the categories of hypo-productive thrombocytopenia, it has been observed that patients with acute leukemia had normal MPV with an increase in PDW, whereas those with aplastic anemia had decreased MPV and increase in PDW.[15] In our study, we found lower MPV in megaloblastic hypo-productive thrombocytopenia and acute leukemia.

We found that P-LCR was increased in destructive thrombocytopenia patients compared with hypoproliferative thrombocytopenia and a good marker for aid in the differential diagnosis of conditions associated with abnormal platelet

Table 3: Distribution and Comparison of Platelet Indices in Thrombocytopenia with Similar Studies.

Platelet indices	Negash et al[9]	Baig M.A. et al[10]	Parveen et al[11]	Narasimhulu et al[12]	Present study
Hypo-productive thrombocytopenia					
MPV	9.7±0.9	8.5 ±1.27	10.17 ±1.3	8.14±1.2	8.69 ±1.1
PDW	13.2 ±2.3	14.10 ±1.15	19.7 ±5.4	18.6±1.2	12.1 ±3.4
PCT	–	0.08 ±0.12	0.06 ±0.03	0.06±0.03	0.07 ±0.02
P-LCR	25 ±7	31.90 ±3.46	–	14.4±1.1	25.1 ±5.2
Hyper-destructive thrombocytopenia					
MPV	12.4±3.6	11.6± 2.25	12.3±0.9	12.4±0.9	12.2±1.8
PDW	15.5±3.2	15.16±1.36	19.3±4.2	20.4±5.6	14.2±2.8
PCT	–	0.09±0.14	0.08±0.1	0.08±0.01	0.08±0.03
P-LCR	36.8±13	34.30±0.14	–	45.6±13.4	34.2±3.6

Table 4: Etiological Distribution of Thrombocytopenia in Each Subgroup and Comparison with Similar Studies.

Etiologies	Katti et al[13]	Numbenjapon et al[4]	Parveen et al[11]	Narasimhulu et al[12]	Present study
Hypo-production Total cases (%)					
Pancytopenia/Aplastic anemia	–	12 (11.8%)	–	356 (9.2%)	22 (33%)
Megaloblastic anemia	08(8%)	4(3.9%)	11(9.2%)	422 (10.9%)	33 (52%)
Leukemia	06(6%)	22(21.6%)	2(1.7%)	31 (0.8%)	1 (1%)
Others	–	–	13(10.8%)	65 (1.7%)	9 (14%)
Hyper-destruction Total cases (%)					
ITP	4 (4%)	53 (52%)	3 (2.5%)	614 (15.9%)	12 (9%)
Viral fever/Dengue	29 (29%)	–	26 (21.7%)	1167 (30.2%)	56 (42%)
Malaria	24 (24%)	–	8 (6.7%)	35 (0.9%)	6 (4%)
Chronic liver disease	3 (3%)	–	20 (16.7)	46 (1.2%)	21 (16%)
Sepsis	4 (4%)	9 (8.8%)	6 (5%)	301 (7.9%)	27 (20%)
DIC	2 (2%)	–	–	124 (3.2%)	–
Others	19 (19%)	2 (2%)	31 (25.8%)	703 (18.2%)	12 (9%)
Total	100	102	120	3864	200

counts similar to the study done by Elsewefy DA et. al.[16]

PCT value is not altered much by severity of thrombocytopenia of either hypo productive or hyper destructive aetiology because in healthy subjects platelet mass is closely regulated to keep it constant.[17] We also found that platelet crit values are not much altered in both hyper-destructive and hypo-productive groups.

Conclusion

- There is increasing evidence that platelet indices have indeed a significant role in the differential diagnosis of Thrombocytopenia.
- Their use can be of great help in clinical practice since they are routinely generated by automated cell counters. Moreover, invasive methods, like bone marrow aspiration could be avoided.
- Our study concludes that increased MPV and PDW may provide a reliable positive diagnosis of ITP in case of thrombocytopenic patients.

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