ORIGINAL RESEARCH PAPER

Volume-8 | Issue-5 | May-2019 | PRINT ISSN No 2277 - 8179

INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

DIAGNOSTIC ROLE OF PLATELET INDICES AND BONE MARROW EXAMINATION IN THROMBOCYTOPENIA

Pathology

Dr. Poonam Nanwani* MD, Associate professor, Department of pathology, MGM Medical College, Indore *Corresponding Author

Dr. Sativan Khatri MBBS, Demonstrator, Department of pathology, MGM Medical College, Indore

ABSTRACT

Introduction:- Thrombocytopenia is a significant finding in hospitalized patients. Bone marrow aspiration help in differentiate, whether it is due to hypoproduction or hyperdestruction. Automated blood cell analyzer enable to measure platelet indices such as mean platelet volume (MPV), platelet size deviation width (PDW) and platelet-large cell ratio (P-LCR). These have brought about some information for thrombocytopenia.

Aim: To study the relationship of platelet indices with respect to the underlying mechanism of thrombocytopenia diagnosed on the basis of bone marrow examination.

Method and material - Retrospective study, carried out in Department of Pathology from January 2017 to December 2018. A total of 57 cases were studied. Bone marrow examination report, Platelet indices and relevant clinical details of the thrombocytopenic patients were collected.

Results : with the help of bone marrow aspiration we divide the cases of thrombocytopenia in hyperdestructive and hypodestructive thrombocytopenia. In hyperdestructive thrombocytopenia patients, the MPV and P-LCR were significantly higher; the best cutoff value for MPV was greater than 10.9 fl and for P-LCR was greater than 33.9 %, with a diagnostic accuracy of 81.2 and 97.4%, respectively.

Conclusion: The Platelet indices should be considered in the diagnosis of thrombocytopenia along with bone marrow aspiration for diagnosis of thrombocytopenia. Mean platelet volume, platelet distribution width and P-LCR provide useful information in discriminating the hypoproductive and hyperdestructive thrombocytopenia.

KEYWORDS

Bone Marrow Aspiration, Platelet Indices, Hyperdestructive Thrombocytopenia, Hypoproductive Thrombocytopenia

Introduction

A platelet count of less than 150×10^9/L is considered to be thrombocytopenia. The two main causes of thrombocytopenia are increase destruction or peripheral consumption (hyper-destructive thrombocytopenia), and decreased platelet productions (hypo-productive thrombocytopenia) are associated with a number of bone marrow diseases [1]. Distinction between these categories is made by bone marrow examination. Hyperdestructive thrombocytopenia is a result of extramedullary platelet destruction with normal or increased bone marrow production, e.g., immune thrombocytopenic purpura (ITP), secondary ITP and disseminated intravascular coagulation. Hypoproductive thrombocytopenias are caused by decreased bone marrow production because of primary or secondary bone marrow diseases such as aplastic anemia, acute leukemia, myelodysplastic syndrome and post chemotherapy [2]. Studies in literature have shown the utility of platelet indices in identifying the pathomechanism in various causes of thrombocytopenia. There is increasing evidence that platelet indices, such as Mean Platelet Volume (MPV), Platelet Distribution Width (PDW), and Platelet Large Cell Ratio (P-LCR), have a significant role in the discrimination between hypoproductive and hyperdestructive thrombocytopenia [2-4]. MPV is postulated as surrogate marker of bone marrow activity. High MPV suggests increased megakaryocytic activity and low MPV indicates marrow suppression [5]. PDW measures the variability in the size of platelets. P-LCR is a ratio of large platelets to total platelet count. P-LCR is directly related to PDW and MPV whereas it is inversely related to platelet count [5].

Aim:

To study the relationship of platelet indices with respect to the underlying mechanism of thrombocytopenia diagnosed on the basis of bone marrow examination.

Materials and Methods

This is a retrospective analytical study undertaken in the Department of Pathology, over a period of two years, starting from January 2017 to December 2018. The study involved 57 cases of thrombocytopenia satisfying the inclusion criteria, based on the etiology and divided them into two categories: thrombocytopenia due to hypoproduction and hyperdestructive causes.

Inclusion Criteria:

Total 43 cases of marrow proven aplastic anemia, acute leukemia, megaloblastic anemia and myelodysplastic syndrome with platelet count of <1.5 lakh/cumm with available platelet indices constituted hypoproductive thrombocytopenia. All the remaining 14 cases of immune thrombocytopenia and megaloblastic anemia with platelet count of <1.5 lakh/cumm with available platelet indices were included in the category of hyperdestructive thrombocytopenia.

Exclusion Criteria: Cases with unavailable platelet indices were excluded from the study.

Subjects: A total 57 cases satisfying the inclusion criteria were selected and grouped into above mentioned two categories.

Sample Processing: The blood sample were collected in EDTA vacationer . The marrow aspiration smears were stained with field stain. Bone marrow biopsies and clot preparation were processed in histopathology section. The hematological parameters such as platelet count, MPV, PDW, P-LCR were estimated by automated analyzer and the results were computed. Adequacy of megakaryocytes in bone marrow aspiration was assessed as follows: normal (one megakaryocyte per one to three low-power fields), decreased (one megakaryocyte per five to ten low-power fields) or increased (more than two megakaryocytes per low-power field) (6) Platelet indices and bone marrow megakaryocytes were analyzed and correlated in both the group.

Results

The mean age of patients in hypoproductive and hyperdestructive groups was 01 and 21 years. Male to female ratio in our study in hypoproductive and hyperdestructive groups was 1:1 and 1:1.5 respectively. The mean values of platelet count in hypoproductive and hyperdestructive groups were 0.35 lacks/cumm and 0.48 lacks/cumm respectively.

This study included 57 patients of thrombocytopenia who were classified into hypoproductive and hyperdestructive group on the basis of megakaryocyte number on bone marrow smears. In the hypoproductive we had 43 cases and in the hyperdestruction there were 14 cases. The distribution of cases in each subgroup were shown in table.1 The mean MPV in the hypoproduction group is 8.6 ± 1.5 and in the hyperdestruction group is 11.5 ± 1.0 . The mean PDW in the hypoproduction group is 15.2 ± 3.1 and in the hyperdestruction group is 18.2 ± 2.5. Mean values of different platelet indices in Hyper-destruction Immune thrombocytopenia and hypo-production thrombocytopenia were shown in Table.2.

Table 1: The distribution of thrombocytopenia cases in each subgroup

Etiology	No. of cases
Hypoproduction	
Aplastic anemia	07
Megaloblastic anemia	06
Acute Lymphoblastic Leukemia	22
Acute myeloblastic Leukemia	05
MDS	03
Hyperdestructive	
ITP	06
Megaloblastic anemia	08

Table 2: Mean values of different platelet indices in Hypoproduction thrombocytopenia and Hyperdestruction thrombocytopenia

Platelet indices	Hypoproduction	Hyperdestruction
Platelet count (mean ± SD) (Lacks/cumm)	0.35	0.48
MPV (mean ± SD) (fl)	8.6 ± 1.5	11.5 ± 1.0
PDW (mean ± SD) (fl)	15.8 ± 3.1	18.2 ± 2.5
LCR	23.5 ± 4.2	37.3±7.6

Table 3: Number of megakaryocytes on the basis of bone marrow aspiration smears.

Categories	No. of cases	Megakaryocytes		
		Decreased	Normal	Increased
Hypoproduction	43	43	0	0
Hyperdestruction	14	0	05	09
Total	57	43	05	09

Bone marrow findings in cases of aplastic anemia (Hypoproduction thrombocytopenia) shown in figure 1 and 2 . Bone marrow aspiration clot preparation (Figure 3) of a case of Immune thrombocytopenic purpura show increased megakaryocytes with hypolobate and hyperlobate form.

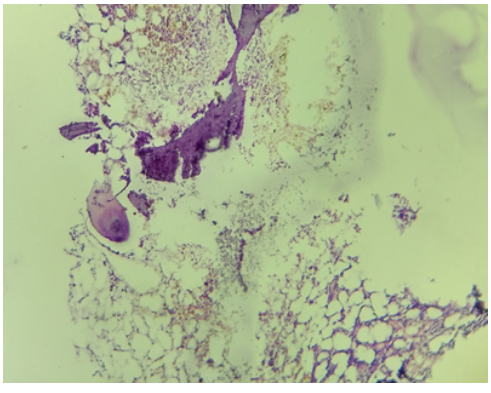

Figure 1. Bone marrow biopsy case of Aplastic anemia , reduced megakaryocytes

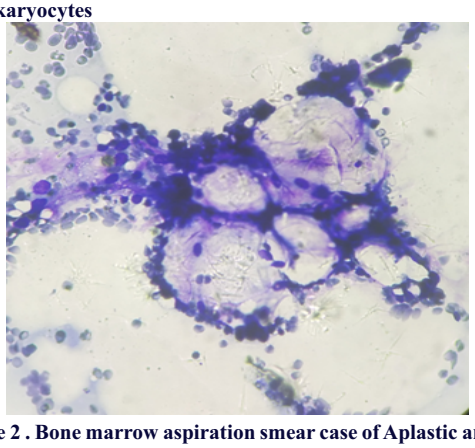

Figure 2 . Bone marrow aspiration smear case of Aplastic anemia, Absent megakaryocytes

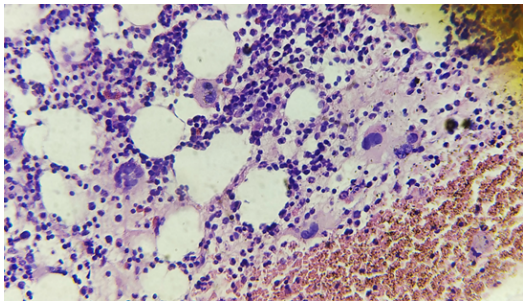

Figure 3. A case of Immune thrombocytopenic purpura showing increased megakaryocytes; hypolobate form (black arrow) , Hyperlobate form (Red arrow) {Bone marrow clot preparation}

Discussion

Platelet count below 1.5 lakh/mm^3 defines thrombocytopenia but does not alone explain the underlying pathomechanism unless a bone marrow examination is done which shows decreased production of megakaryocytes, ineffective thrombopoiesis or increased peripheral destruction. Along with bone marrow examination , the usefulness of other parameters estimated by the automated analysers are being investigated which include platelet indices such as PDW, MPV and P-LCR. The combined interpretation of MPV, PDW & P-LCR can prove to be very useful parameters to differentiate thrombocytopenias of various etiologies.

Bone marrow findings in cases of thrombocytopenia give a definite diagnosis of the underlying pathomechanism, The findings of decrease in megakaryocytes in aplastic anemia and leukemia, and increase in the number of megakaryocytes in immune thrombocytopenia were consistent with other studies [6,7,8].

The number of megakaryocytes in megaloblastic anemia was normal, increased and decreased in 35.7%, 21.4% and 42.9% of cases. In contrast results were seen in a study by Gupta et al., with normal, increased and decreased megakaryocytes in 8.3%, 58.3%, 33.3 % of cases respectively (9). Choudhary et al., found absent, decreased normal and increased megakaryocytes in 2.4% 16.0%, 47.4% and 34.2% of cases respectively (6).

Platelet indices include Platelet Distribution Width (PDW) , Mean Platelet Volume (MPV) and platelet large cell ratio (P-LCR). Though these parameters have been available from the routinely used blood cell counters in the laboratory, their exact role in application to clinical diagnosis has still not been fully established (10)

In our study also we found a significant low (8.6 ± 1.5) mean MPV in the hypoproduction group than in the hyperdestruction group (11.5 ± 1.0) Numbenjapon et al[8] also found that MPV was significantly higher in hyperdestruction group compared to hypoproductive thrombocytopenia. In hyper destructive thrombocytopenia, bone marrow compensates actively for the platelet loss and start releasing young larger platelets ("left shift") which tend to decrease in size during its 7-10 days life span (11)

In our study also we found a low (15.8 ± 3.1) PDW in the hypoproduction group than in the hyperdestruction group (18.2 ± 2.5). In our study also we found a significant low (23.5 ± 4.2) P-LCR in the hypoproduction group than in the hyperdestruction group (37.3±7.6). We concluded that all the three platelet indices were significantly low in the hypodestructive group compared with the hyperproductive group which is consistent with other studies by Katti et al., Elsewefy et al., Baig et al., and Barrios et al.(2-5).

In a study by XU et al., though significant differences were observed in platelet count, MPV and PDW between patients with ITP and patients with bone marrow failure, they concluded that MPV and PDW do not have enough predictive efficiency for the diagnosis of bone marrow failure in thrombocytopenic patients [12].

Conclusion

Bone marrow examination is the gold standard for differentiating hypoproductive thrombocytopenias from the hyperdestructive causes and platelet indices are of significant discriminative value in differentiating the various causes of thrombocytopenias. The Mean

platelet volume, Platelet distribution width and platelet large cell ratio provide useful information in discriminating the hypoproductive and hyperdestructive thrombocytopenia. Thus interpretation of this platelet indices help the patients to avoid unnecessary invasive investigations like bone marrow examination in cases of immune thrombocytopenic purpura.

Footnotes
Source of Support: Nil
Conflict of Interest: None declared.

REFERENCES

1. Sekhon SS, Roy V. Thrombocytopenia in adults: a practical approach to evaluation and management. South Med J. 2006;99(5):491–498. doi: 10.1097/01.smj.0000209275.75045.d4. [PubMed] [CrossRef] [Google Scholar]
2. Katti TV, Mhetre SC, Annigeri C. How far are the platelet indices [3]mirror image of mechanism of thrombocytopenia-mystery still remains? Int J of Adv in Med. 2014;1(3):200-05.
3. Elsewefy DA, Farweez BA, Ibrahim RR. Platelet indices: [4]consideration in thrombocytopenia. Egyptian J Haematol. 2014;39(3):134-38.
4. Baig MA. Platelet indices-evaluation of their diagnostic role in [5]pediatric thrombocytopenias. Int J Res Med Sci. 2015;3(9):2284-89.
5. Bashir AB, Saeed OK , Mohammed BA, and Ageep AK. Role [6]of platelet indices in patients with dengue infection in Red sea State, Sudan. Int J Sci Research. 2013;4(1):1573-76.
6. Choudhary PK, Sing SK, Basnet RB. Study of megakaryocytes [9]in bone marrow aspiration smears in patients with thrombocytopenia. Journal of Pathology of Nepal 2013;3:476-81.
7. Muhury M, Mathai AM, Rai S, Naik R, Pai MR, et al.Megakaryocytic [13]alterations in thrombocytopenia: A bone marrow aspiration study. Ind J Pathol Microbiol. 2009; 52(4):490-94.
8. Bhasin TS, Sharma S, Manjari M, Mannan R, Kansal V et al. [14]Changes in megakaryocytes in cases of thrombocytopenia: bone marrow aspiration and biopsy analysis. J Clin Diagn Res. 2013;7(3):473-79.)
9. Gupta P , Goswami A, Chavda J, Goswami N, Shah S. Study of [10]megakaryocytes in bone marrow aspiration smears in patients with thrombocytopenia. Journal of Dental and Medical Sciences. 2015;14(6):30-33.
10. Giovanetti TV, do Nascimento AJ, de Paula JP. Platelet indices: laboratory and clinical applications. Rev Bras Hematol E Hemoter. 2011;33(2):164–5.
11. Kottke-Marchant K, Corcoran G. The laboratory diagnosis of platelet disorders: an algorithmic approach. Arch Pathol Lab Med. 2002;126(2):133–146.)
12. Xu RL, Zheng ZJ, MaYJ, Hu YP, Zhuang SH. Platelet volume [12]indices have low diagnostic efficiency for predicting bone marrow failure in thrombocytopenic patients. Experimental and Therapeutic Medicine. 2013;5:209-14.