

Spectrum of Platelet Histograms in Adult Thrombocytopenia

Dr. Vara Prasad BM¹, Dr. Atira Mirza², Dr. Mangalagouri SR³

¹Assistant Professor, Department of Pathology, Ramaiah Medical College, Bengaluru, India

²Senior Resident, Department of Pathology, Ramaiah Medical College, Bengaluru, India

³Professor & HOD, Department of Pathology, Ramaiah Medical College, Bengaluru, India

Corresponding Author: Dr. Atira Mirza

DOI: <https://doi.org/10.52403/ijhsr.20240115>

ABSTRACT

Background: With hematology automation, both platelet indices and their histograms are available from the cell counters at no extra cost or time. The variations of histograms in various underlying mechanisms of thrombocytopenias are explored in this study.

Methods: Adults with thrombocytopenia determined were categorized into four groups based on the mechanism of thrombocytopenia and variations in platelet histograms were studied in all groups. Data was collated and analyzed using Microsoft Excel.

Results: A total of 440 adults with thrombocytopenia were seen, most of them had hyperdestructive type (55.91%) followed by hypoproduktive type (39.78%), abnormal pooling (2.27%) and EDTA induced thrombocytopenia (2.04%). The following variations in histogram were seen; Normal curve (6.8%), Curve not touching/reaching the baseline (37.27%), Broad based curve (7.9%), Bimodal curve (7.5%), Curve with short peak (39.3%) and Saw-tooth appearance of curve (1.1%) and correlated with the above-mentioned mechanisms of thrombocytopenias using SPSS software version 20.

Conclusion: An awareness regarding the variations in the platelet curve ensures a good correlation with its numerical parameters and also with the etiology of thrombocytopenias. Automation taking over in most of the laboratories, it is imperative to have knowledge about these simple yet, often overlooked platelet histograms

Key Words: Thrombocytopenia, platelet histograms.

INTRODUCTION

Platelets are the first line of defence in preventing blood loss because of micro- and macro-vascular injury by maintaining the integrity of the endothelium, achieved by aggregating and adhering to each other. A platelet count of less than $150 \times 10^9/L$ is defined as thrombocytopenia. Thus, bleeding is a frequently occurring complication in a low platelet count as platelets play a vital role in primary hemostasis.¹ During the evaluation of patients with thrombocytopenia, it is essential to understand the underlying

mechanism of thrombocytopenia and classify the mechanism of thrombocytopenia into hyper destructive, hypo productive, abnormal platelet pooling or EDTA induced. This approach will narrow differentials, avoid unnecessary investigations and aid in targeted management². Hypo-productive thrombocytopenia results from decreased bone marrow production because of primary or secondary bone marrow diseases such as aplastic anemia, acute myeloid leukemia (AML), pancytopenia, megaloblastic anaemia, myelodysplastic syndrome and

post-chemotherapy³. Hyper-destructive thrombocytopenia is because of extra-medullary platelet destruction with normal or increased production in the bone marrow like disseminated intra-vascular coagulopathy (DIC), immune thrombocytopenic purpura (ITP), and secondary ITP, sepsis, viral fever. Splenic sequestration occurs mainly in congestive splenomegaly because of chronic infection, myeloproliferative disease, lymphomas, homozygous sickle cell disease, haemoglobin C disease (HbC), Gaucher's disease, thalassemia major, and so on⁴. The gold standard method for discriminating the causes of thrombocytopenia is bone marrow examination, but it is invasive and expensive and carries an overt risk of bleeding diathesis. Therefore, it is not recommended as a first-line diagnostic procedure¹. Manual methods for determination of haematological parameters in laboratories which are labor intensive and time consuming are now largely replaced by automated analysers. These analysers routinely give platelet histogram in addition to platelet count and indices at no extra cost^{5,6,7}.

This study attempts to find the usefulness of platelet histogram in the initial evaluation of patients with thrombocytopenia and to correlate the same with the underlying etiology of thrombocytopenia

Aims and objectives

To study variation of histogram of platelets in clinical correlation with thrombocytopenia patients.

To study the relationship of histogram of platelets in relation to mechanism of thrombocytopenia.

MATERIALS AND METHODS

This is a cross sectional study conducted in the hematology section, Ramaiah medical

college and hospital in the central laboratory over a period of 7 months from June to November 2023. A total of 440 patients aged 18years above with platelet count of less than $150 \times 10^9/L$ were included in the study. The sample collected in EDTA anti-coagulant were run in sysmex XN-550 auto analyser for platelet count and histograms. To rule out pseudo-thrombocytopenia cases a peripheral smear stained with Leishman's stain was reviewed by the pathologist. Relevant clinical data (history of fever, platelet transfusion, drug intake, organomegaly etc), working clinical diagnosis and supportive investigations including serological results of the patient were included.

Based on the mechanism of thrombocytopenia the cases were divided into 4 categories as follows: category1- hyper destructive, category2 – hypo productive, category3 – abnormal pooling and category 4 - EDTA induced thrombocytopenia. Platelet histograms of above-mentioned categories were studied.

STATISTICAL ANALYSIS

The data collected was entered in excel sheet and analysed using the software package for social sciences (SPSS) program version 20. Variations in platelet histograms of four etiological categories of thrombocytopenic patients were studied.

RESULTS

This study included 440 patients of thrombocytopenia who were classified into 4 categories. Majority of patients fell into the age group of 18-40years. The male to female ratio was 2.2:1. In category 1 we had 246 cases. In category 2 there were 175 cases, category 3 had 10 cases and category 4 had 9 cases.

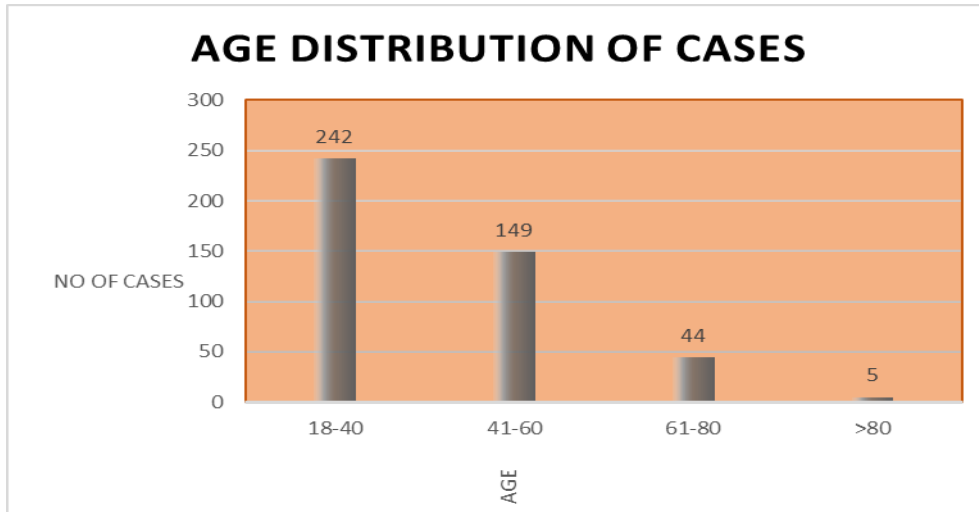


Fig 1: figure showing age distribution of cases

Table1: showing distribution of thrombocytopenia cases in each category.

ETIOLOGY	CAUSES	NO OF CASES	TOTAL
category1 (hyper destructive cases)	Fever	112	246(55.91%)
	sepsis	46	
	ITP	18	
	Liver disease	32	
	Renal disease	38	
category2 (hypo productive cases)	Aplastic anaemia	15	175(39.78%)
	Megaloblastic anaemia	22	
	Leukemia/MDS	88	
	Pancytopenia	50	
Category 3 (abnormal pooling cases)	splenomegaly	10	10(2.27%)
category 4 (EDTA induced thrombocytopenia cases)	Antibodies	9	9(2.04%)

Table2: showing different patterns of platelet histograms in thrombocytopenic cases

category	patterns of platelet Histograms						Total
	NC	NBT	BM	SHP	SW	BB	
category 1	9	130	26	60	0	21	246(55.91%)
category 2	13	32	6	112	0	12	175(39.78%)
category 3	6	1	1	1	0	1	10(2.27%)
category 4	2	1	0	0	5	1	9(2.04%)
Total	30(6.8%)	164(37.27%)	33(7.5%)	173(39.3%)	5(1.1%)	35(7.9%)	440(100%)

*NC-Normal curve, NBT- Curve not touching base line, BM- Bimodal, SHP- short peak, SW- Saw tooth, BB-broad Base.

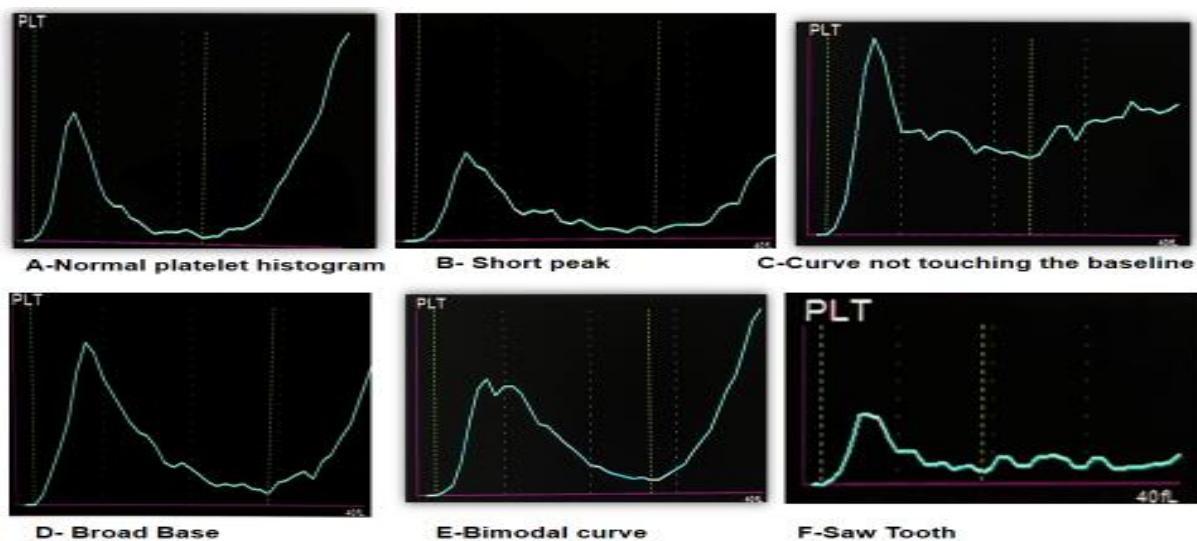


Figure 2: A- showing Normal curve, B – Short Peak, C-Curve Not touching baseline, D- Broad Base, E- Bimodal, F-Saw tooth.

DISCUSSION

Thrombocytopenia is a commonly encountered condition in clinical practice. The underlying mechanisms of thrombocytopenia can be broadly categorized as hyperdestructive causes, hypoproliferative causes, causes due to abnormal pooling and EDTA induced thrombocytopenias⁸. A Histogram is a graphical representation of the results of automated analysis on a hematology analyser where the cell size is plotted on X axis and cell count is plotted on Y-Axis^{9,10}. The analyser display platelet histograms along with other platelet indices were also available¹¹. The thrombocytopenia cases in our study fell into third decade of life with male to female ratio being 2.2:1, similar to study conducted by Shetty et al¹². Hyperdestructive cases of thrombocytopenia included fever of varying etiology, liver disease, ITP, Sepsis and renal diseases¹³. In our study distribution of aetiologies were similar to other studies by Katti et al and Shetty et al^{12,14}. Dengue cases, followed by malaria predominated during the study. Hypo productive group included leukemia/MDS, pancytopenia, anemias¹⁵. As ours is an oncocentre most of our patients fell into leukemic/MDS category. Immune Thrombocytopenic purpura (ITP) is a condition where there is accelerated platelet destruction by autoantibodies including cold agglutinin type of IgG, IgM and IgA with platelet surface antigens. This causes a compensatory increase in platelet production, as a result of which circulating platelets in patients with ITP are younger and have larger size causing the broad base in the platelet curve^{16,17}. A significant number of cases showed curve with a broad base. Unrecognized pseudo-thrombocytopenia may result in unnecessary laboratory testing and unwarranted interventions by clinicians. Examination of a well-stained peripheral blood smear is mandatory for every case of thrombocytopenia to rule out platelet clumping (Pseudo-Thrombocytopenia)^{18,19}.

CONCLUSION

Always a study knowledge of histograms in particularly platelet histograms like various curves ensures a good clinical correlation with its numerical parameters and its mechanism of thrombocytopenia.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: None

Source of Funding: None

Conflict of Interest: All Authors declare that they have no conflict of interest or any sort pertaining to the article.

REFERENCES

1. Park Y, Schoene N, Harris W. Mean platelet volume as an indicator of platelet activation: methodological issues. *Platelets*. 2002 Sep;13(5-6):301-6.
2. Parveen S, Vimal M. Role of platelet indices in differentiating hypoproliferative and hyperdestructive thrombocytopenia. *Annals of Pathol Lab Med*. 2017; 4(3):288-91.
3. Numbenjapon T, Mahapo N, Pornvipavee R, Sriswasdi C, Mongkonsritragoon W, Leelasiri A, et al. A prospective evaluation of normal mean platelet volume in discriminating hyperdestructive thrombocytopenia from hypoproliferative thrombocytopenia. *Int J Lab Hematol*. 2008; 30(5): 408-14
4. George JN, Rizvi MA, examination of blood thrombocytopenia. *William textbook of hematology*, Chapter 2.
5. Shah AR, Chaudhary SN, Shah MH, et al. Role of platelet parameters in diagnosing various clinical conditions. *Natl J Med Res* 2013; 3: 162-65
6. Khairkar PS, Pandey A, More S, Pandey M. Platelet Distribution Width (PDW) - A Rarely Studied Platelet Index for Determining the Causes of Thrombocytopenia. *Ann. Int. Med. Den. Res*. 2016;2(4):193-97
7. Hamzullah K, Adnan M, Fazle B, Naila T, Ameerzullah. Role of mean platelet volume (MPV), platelet distribution width (PDW) and platelet large cell ratio (PLCR) in diagnosis of hyperdestructive thrombocytopenia.

- Professional Med J 2019; 26(8):1266-71. DOI: 10.29309/TPMJ/2019.26.08.3867.
8. Gulati I, Kumar H, Sheth J, Dey I. Diagnostic implication of mean platelet volume in thrombocytopenia. *Med J DY Patil Univ* 2017; 10: 370-5.
 9. R. Bhadran, S. S. Mathew, A. J, and B. Jayalekshmi, "A Study on RBC Histogram In Different Morphological Types of Anemia In Comparison With Peripheral Blood Smears in A Tertiary Care Centre In Rural South india," *International Journal of Applied Research*, vol. 6, no. 10, pp. 425–430, 2020.
 10. E. T. A. Thomas, B. S, and A. Majeed, "Clinical Utility of Blood Cell Histogram Interpretation," *Journal of Clinical Diagnostic Research*, vol. 11, no. 9, Sep. 2017, Accessed: Nov. 28, 2022. [Online]
 11. Khaleel KJ, Ahmed AA, Alwash A, Anwar A. Platelet indices and their relations to platelet count in hypoproduative and hyper-destructive Thrombocytopenia. *Karbala J. Med.* 2014; 7(2): 1952-8.
 12. Shetty, Archana & H.V, Shubha & Chowdappa, Vijaya & G, Vivek. (2020). A Study of Variation in Adult Thrombocytopenic Histograms A Graph Often Overlooked. *Annals of Pathology and Laboratory Medicine*. 7. A83-88. 10.21276/apalm.2665.
 13. Elsewefy DA, Farweez BA, Ibrahim RR: Platelet indices: consideration in thrombocytopenia. *Egyptian J Haematol* 2014, 39: 134–8
 14. Katti TV, Mhetre SC, Annigeri C. How far are the platelet indices mirror image of mechanism of thrombocytopenia- mystery still remains? *Int J Adv Med* 2014; 1: 200-5.
 15. Paula ES, Ronal JH. Platelets and megakaryocytes. In: Lee GR, Foerster J, Lukens J, Paraskevas F, Glader BE, Rodgers GM. (eds) *Wintrobe's Clinical Hematology*, 11th edn. Philadelphia, PA: Lippincott Williams and Wilkins, 2001; 615–42.
 16. Numbenjapon T, Mahapo N, Pornvipavee R, Sriswasdi C, Mongkonsritragoon W, Leelasiri A, et al. A prospective evaluation of normal mean platelet volume in discriminating hyperdestructive thrombocytopenia from hypoproduative thrombocytopenia. *Int J Lab Hematol*. 2008; 30(5): 408-14.
 17. Thomas ETA, Bhagya S, Majeed A. Clinical Utility of Blood Cell Histogram Interpretation. *J Clin Diagn Res*. 2017; 11(9): OE01–OE04. doi:10.7860/JCDR/2017/28508.10620
 18. Shabnam I, D S C, B C J. Ethylenediaminetetraacetic Acid (EDTA) - dependent pseudothrombocytopenia: a case report. *J Clin Diagn Res*. 2014; 8: FL03–4.
 19. Dewa Ayu Puja Satya Dinarta, Anik Handayati, and Symsul Arifin, Siti Sakdiah, "Compatibility Between Platelet Histogram with IP Message and Platelet Morphology in Thrombocytopenia Patients", *International Journal of Advanced Health Science and Technology*, vol.3, no. 6, pp. 335-340, December. 2023.

How to cite this article: Vara Prasad BM, Atira Mirza, Mangalagouri SR. Spectrum of platelet histograms in adult thrombocytopenia. *Int J Health Sci Res*. 2024; 14(1):114-118. DOI: <https://doi.org/10.52403/ijhsr.20240115>
