Section: Pathology

Original Research Article

PLATELET INDICES: DIAGNOSTIC / PROGNOSTIC TOOLS IN EVALUATION OF ETIOLOGY OF THROMBOCYTOPENIA

S Himaja[1], N C Parankusa[2], P Sree Valli[3], Naseeruddin Sheikh[4], B. Rani Aishwarya[5], A. Venkatalakshmi[6]

[1]*Associate Professor, Department of Pathology, Government Medical College, Rajamahendravaram, Andhra Pradesh, India.*
[2]*Associate Professor, Department of Pathology, Government, Medical, College, Rajamahendravaram, Andhra Pradesh, India.*
[3]*Assistant Professor, Department of Pathology, Government Medical College, Rajamahendravaram, Andhra Pradesh India.*
[4]*Assistant Professor, Department of Pathology, Government Medical College, Rajamahendravaram, Andhra Pradesh, India.*
[5]*Senior Resident, Department of Pathology, Government Medical College, Rajamahendravaram, Andhra Pradesh, India.*
[6]*Professor & Head of Department, Department of Pathology, Government Medical College, Rajamahendravaram, Andhra Pradesh, India.*

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Corresponding Author:
***Dr.A.Venkatalakshmi**
Professor & Head of Department, Department of Pathology, Government Medical College, Rajamahendravaram, Andhra Pradesh, India.
Email: dravlakshmi26@gmail.com

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ABSTRACT

Background: Thrombocytopenia results from four processes: Artifactual Thrombocytopenia, Deficient platelet Production, Accelerated platelet destruction and Abnormal distribution or pooling of platelets within the body. Platelet indices (PI) are markers that indicate platelet activation and volume and can help predict platelet size, morphology and proliferation.

Material and Methods: This is a 3-month prospective study from January 2024 to March 2024 in which 275 case were found to have Thrombocytopenia. Blood samples collected were analysed in 5-part Aspen 5000 Auto Analyzer. The study was done in the newly established Government Medical College, Rajamahendravaram, Andhra Pradesh, India. Total Platelet Count and Platelet Indices (PI) of all cases were studied and inference was drawn.

Results: A Total of 275 cases were analysed. Most of the cases were in the age group of 0-10 years, males were more affected than females. Moderate Thrombocytopenia was found in most of the cases and Sepsis was the most common cause of Thrombocytopenia. Mean Platelet Volume (MPV) and Platelet Distribution Width (PDW) showed alteration in most of the cases of Sepsis, whereas Plateletcrit (PCT) was decreased in most cases of Dengue.

Conclusion: Platelet indices (PI) are helpful in diagnosing the etiology of thrombocytopenia and also determine the diagnosis and progrosis of a case. They are simple and economical procedures for evaluation of there cases. However, investigations like Reticulated platelets and immature platelet fraction may be more helpful for evaluation of cases of Thrombocytopenia.

Keywords: Platelets, Thrombocytopenia, Sepsis, Dengue.

INTRODUCTION

Platelets or Thrombocytes are one of the blood cellular elements, with the size ranging from 2-4 micrometers. They are anucleate cells produced in the bone marrow by Megakaryocytes.

The process of platelet production is called Thrombopoiesis. The life span of platelets ranges from 7-10 days. The normal platelet count ranges between 1.5 lakhs to 4 lakhs per cubic millimeter. Platelets are formed by detachment of the megakaryocyte membrane as pseudopods. Thrombocytopenia results from four processes. Artifactual Thrombocytopenia, Deficient platelet production, Accelerated platelet destruction and Abnormal distribution or pooling of platelets within the body.[1] A count less than 1,50,000/ cumm is generally considered as Thrombocytopenia. Only when the platelets counts fall below 20,000 to 50,000/cumm is there an increased risk of post traumatic bleeding. Spontaneous bleeding is unlikely until counts fall below 5000 / cumm.[2] Platelets indices (PI) are markers that indicate platelet volume and activation and can help predict platelet size, morphology and proliferation. Common Platelets Indices evaluated included Mean Platelet Volume

(MPV), Platelet Distribution Width (PDW) and Plateletcrit (PCT). This study was done to evaluate the Platelet Indices (PI) in all cases of Thrombocytopenia to predict the volume, distribution and proliferation of Platelets in Cases of Thrombocytopenia.

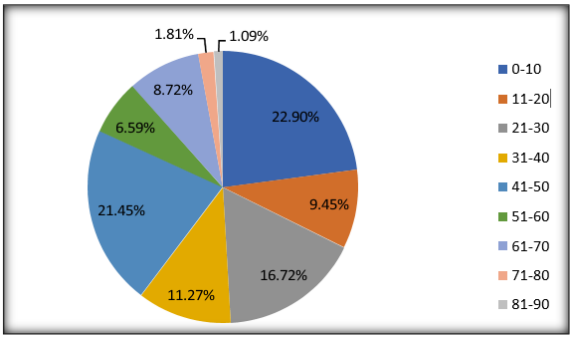
MATERIAL AND METHODS

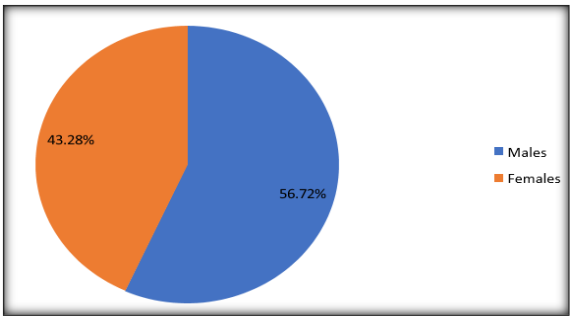
This is a 3 months prospective study from January 2024 to March 2024 by collecting 2ml of patient's blood sample in K3 EDTA Vial: the samples were analyzed in 5 part Aspen 5000 Auto Analyzer and all the findings: Platelet Count, MPV, PDW and PCT were noted, along with Haemoglobin, Total and Differential count, in the newly established Government Medical College and Hospital, Rajamahendravaram, Andhra Pradesh, India.

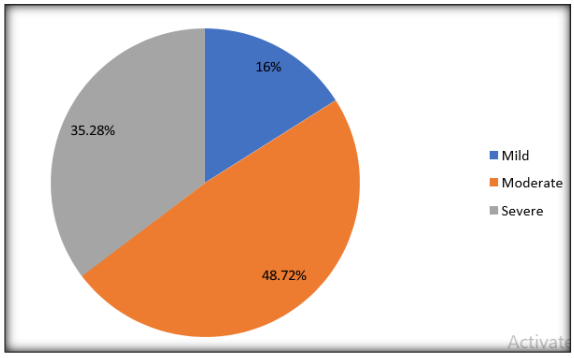
A total of 275 cases were found to have thrombocytopenia. After taking history, general examination and local examination was done in all cases. A written informed consent was taken from all patients.

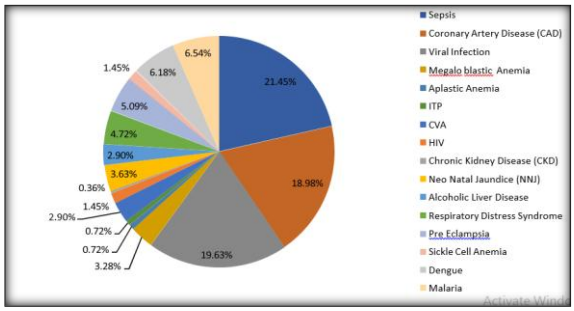
Peripheral Smears were prepared in all the cases showing thrombocytopenia by Auto Analyzer and stained by Leishman stain according to the standard protocol followed for staining the smears. The stained smears were studied under microscope to compare the platelet count with that obtained from the Auto Analyzer. The findings thus obtained were classified as Mild, Moderate and Severe Thrombocytopenia and the Platelet Indices obtained were evaluated accordingly. The cut off value above which MPV was considered high was 11.5 fl. PDW value above 16.5% was considered high and PCT below 0.22-0.24% was considered low.

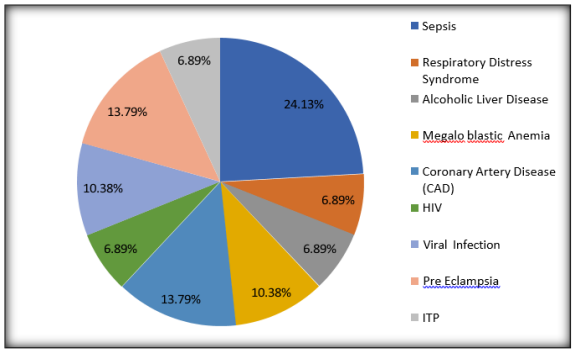
RESULTS

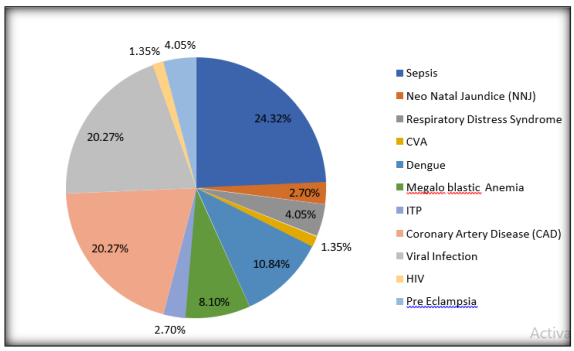












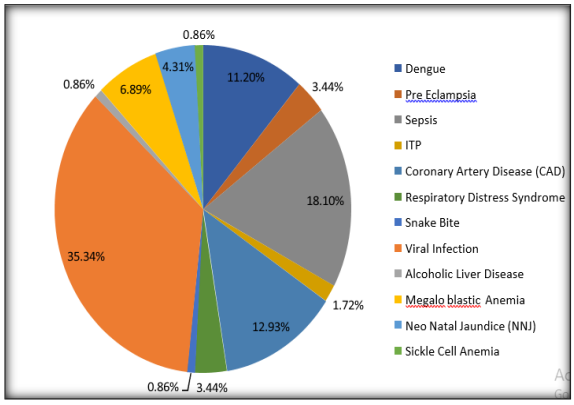


Table 1: Most of the cases were in the age group of 0-10 years (22.90%) followed by age group of 41-50 yrs (21.45%)

Ageinyears										
Numberofcases	0-10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	Total
	63	26	46	31	59	18	24	5	3	275
Percentage%	22.90%	9.45%	16.72%	11.27%	21.45%	6.59%	8.72%	1.81%	1.09%	100%

Table 2: Most of the cases were Males (56.72%) where as Females formed 43.28% of all cases

Sex Distribution			
Number of cases	Males	Females	Total
	156	119	275
Percentage %	56.72 %	43.28 %	100 %

Table 3: Most of the cases in our study were Moderate Thrombocytopenia accounting to 48.72% of all cases

Distribution of cases of Thrombocytopenia				
Number of cases	Mild	Moderate	Severe	Total
	44	134	97	275
Percentage	16	48.72	35.28	100
%	%	%	%	%

Table 4: Most Common Cause of Thrombocytopenia was Sepsis followed by Viral Infection

No. of Cases	Diagnosis															
	Sepsis	Coronary Artery Disease (CAD)	Viral Infection	MegaloblasticAnemia	Aplastic Anemia	ITP	CVA	HIV	Chronic Kidney Disease (CKD)	Neo Natal Jaundice (NNJ)	Alcoholic Liver Disease (ALD)	Respiratory Distress Syndrom e (RDS)	Pre Eclampsia	Sickl e Cell Anemia (SCA)	Dengue	Malaria
	59	52	54	9	2	2	8	4	1	10	8	13	14	4	17	18
Percentage %	21.45 %	18.98 %	19.63 %	3.28 %	0.72 %	0.72 %	2.90 %	1.45 %	0.36 %	3.63 %	2.90 %	4.72%	5.09%	1.45 %	6.18 %	6.54 %

Table 5: Mean Platelet Volume (MPV) was increased in 29 cases, out of which 7 cases (24.13 %) were of Sepsis

Number of Cases with increased MPV	Diagnosis									Total
	Sepsis	Respiratory Distress Syndrome (RDS)	Alcoholic Liver Disease (ALD)	Megaloblastic Anemia	Coronary Artery Disease (CAD)	HIV	Viral Infection	Pre Eclampsia	ITP	
	7	2	2	3	4	2	3	4	2	29
Percentage	24.13	6.89	6.89	10.38	13.79	6.89	10.38	13.79	6.89	100
%	%	%	%	%	%	%	%	%	%	%

Table 6: Platelet Distribution Width (PDW) was increased in 74 Cases, out of which 18 cases (24.32%) were of Sepsis

No. of Cases with increased PDW	Diagnosis											Tot
	Sepsis	Neo Natal Jaundice (NNJ)	Respiratory Distress Syndrome (RDS)	CVA	Dengue	Megaloblastic Anemia	ITP	Coronary Artery Disease (CAD)	Viral Infection	HIV	Pre Eclampsia	
	18	2	3	1	8	6	2	15	15	1	3	74
Percentage	24.32	2.70	4.05	1.35	10.84	8.10	2.70	20.27	20.27	1.35	4.05	10
%	%	%	%	%	%	%	%	%	%	%	%	%

Table 7: Plateletcrit (PCT) was decreased in 116 cases, out of which most the cases (35.34%) were of Viral Infection followed by Sepsis and Dengue

Number of cases with decreased Plateletcrit	Diagnosis												Total
	Dengue	Pre-Eclampsia	Sepsis	ITP	Coronary Artery Disease (CAD)	Respiratory Distress Syndrome (RDS)	Snake Bite	Viral Infection	Alcoholic Liver Disease (ALD)	Megaloblastic Anemia	Neo Natal Jaundice (NNJ)	Sickle Cell Anemia (SCA)	116
	13	4	21	2	15	4	1	41	1	8	5	1	
Percentage	11.20	3.44	18.10	1.72	12.93	3.44	0.86	35.34	0.86	6.89	4.31	0.86	100
%	%	%	%	%	%	%	%	%	%	%	%	%	%

DISCUSSION

Platelet Indices (PI) included in our study were, Mean Platelet Volume (MPV), Platelet Distribution Width (PDW) and Plateletcrit (PCT). These parameters are available in many of the routinely used Auto Analyzers but their importance and exact role in both diagnosis and prognostic value of the disease is under appreciated and not fully established. These values can be obtained by very simple procedure from Auto Analyzer and we also get quick results which are inexpensive.[3]

Most of the in cases in our study were in the age group of 0-10yrs (22.90%) followed by 41-50 yrs (21.45%); whereas study by Sangeeta Borkataky et al,[4] showed most cases in the age group of 31-40 yrs. Study by SushmaYalavarthi et al,[5] showed most cases in the age group of 11-20 yrs and 21-30 yrs. Study by Vani Mittal et al,[9] showed most cases in the age group of 21-30 yrs whereas study by MD Hamed Altaf Mali,[10] Showed most cases in age group of 30-40 yrs.

Most of the cases in our study were Males, who formed 56.72% of all cases. Similar findings were found in studies by SangeetaBorkataky et al,[4]SushmaYalavarthi et al,[5]Rupal J Shah et al,[7] Vani Mittal et al,[9] and MD HamedAltaf Mali,[10] where males formed 53.33%, 53.10%, 60%, 65%, 53.33%, 37.50% of cases respectively, but study by Liqaa M Majeed A Sharifi,[11] showed only 37.5% of cases of Males.

In our study, most of the cases were Moderate Thrombocytopenia, forming 48.72% of all cases, followed by severe Thrombocytopenia which formed 35.27% of all cases. Most of the cases of severe Thrombocytopenia were due to Sepsis and Dengue.

Causes of Thrombocytopenia in most the cases in our study were due to Sepsis in (21.45%) of cases followed by Viral Infections in (19.63%) of cases. Coronary Artery Disease accounted for 18.98% of all cases.

Study by Shashwat Vidhyadhar,[3] showed most common etiology of Thrombocytopenia as Dengue in 35.71% of cases followed by Malaria in 22.85% of cases and Megaloblastic Anemia in 17.14% of cases, were as study by SangeetaBorkataky et al,[4] showed Megaloblastic Anemia as the most common cause of Thrombocytopenia in 28.33% of cases, followed by Dengue in 20.00% of cases and Malaria in 10.00% of cases.

Study by Khushboo Saran et al,[6] showed Dengue as most common cause of Thrombocytopenia with 25.07% of cases, followed by Megaloblastic Anemia in 18.65% and Acute Leukemia in 13.43% of cases, whereas study by Vani Mittal et al,[9] showed Dengue as the most common cause of Thrombocytopenia in 18.06% of cases followed by Malaria in 10.32% and Viral Infections in 7.74% of cases.

Common causes of Thrombocytopenia used to be Immune Thrombocytopenia Purpura (ITP), Megaloblastic Anemia and Aplastic Anemia. But in the recent times, certain changing trends have been observed and more common causes of Thrombocytopenia now detected are Sepsis, Viral Infections, Dengue, Coronary Artery Disease (which includes Myocardial Infarction and Severe Hypertension) and Pre-Eclampsia.

In our study, it was found that MPV was high in most cases of Sepsis, Coronary Artery Disease, Megaloblastic Anemia, Viral infection, ITP and Pre Eclampsia. These findings are similar to studies by ShashwatVidhyadhar,[3] which showed that MPV was more in Hyper destructive type of Thrombocytopenia.

When there is peripheral destruction of platelets, the bone marrow compensates actively for the platelet loss and starts releasing younger, larger platelets which tend to decreased in size in their 7-10 days life span.[3]

An increase in MPV indicates that the platelet diameter is increased which is due to increased production of platelets. Similar findings were found in study by SushmaYalavarthi et al,[5] which showed increased MPV in cases of Viral Infections, Diabetes Mellitus, Malaria and Dengue. Study by Khushboo Saran et al,[6] had shown increased MPV in cases of ITP, Dengue and Malaria. Similarly cases of Viral Infection, Malaria and Dengue showed an increase in MPV in study by Vani Mittal et al.[9] Study by Liqua M Mazeed Al Shariff,[11] showed increased MPV in all cases of Immune Thrombocytopenic Purpura.

In our study, all,[17] cases of Dengue had low MPV initially at the time of diagnosis, but serial examination of samples showed an increase in MPV with improvement of patient's condition which indicates release of young platelets from bone marrow and reduced immune mediated destruction of platelets. Thus MPV provides a clue about Etiology of Thrombocytopenia and its categorization and also to evaluate the activity of bone marrow in disorders of platelets. Increased MPV in Megaloblastic Anaemia may be due to Ineffective Thrombopoiesis.

Increased MPV was found in cases of coronary artery disease in our study. This may be due to activation of platelets at the sites of vascular injury as platelets express a large number of substances that are crucial mediators of coagulation, inflammation, thrombosis and atherosclerosis. Thus MPV is a useful marker of platelet activity in Cardio Vascular Disease. Increased MPV has also been associated with obesity, smoking and Hyperlipidemia.

Increased MPV was seen in cases of Neonatal Jaundice, the cause is attributed to increased platelet turnover and injury during Phototherapy, as photo chemical reactions occur in the platelet membrane causing their destruction, leading to compensatory increased production of young platelets by the bone marrow.

In our study, PDW was high in most cases of Sepsis, Viral Infections, Coronary Artery Disease, Dengue and ITP. This may be due to peripheral destruction of platelets resulting in release of heterogeneous population of platelets which vary in their size. Some

cases of Megaloblastic Anaemia also showed increased PDW which may be due to Ineffective Thrombopoiesis. PDW shows the variability of platelet size which change with platelet activation.[5]
Similar findings were seen in studies by ShashwatVidyadhar,[3] which showed increased PDW in cases of Dengue and Megaloblastic Anaemia. Study by SangeetaBorkataky et al,[4] also showed an increase in PDW in cases of Megablostic Anaemia.
Similar findings were seen in study by Khushboo Saran et al,[6] which showed increase in PDW in cases of Dengue and ITP. Study by TejaswiPeddavennagari et al,[8] showed increase in PDW in cases of ITP, Viral Infection and Disseminated Intravascular Coagulation. Similar findings were seen in studies by MD Hameed Altaf Mali et al,[10] which showed an increase in PDW in cases of ITP, Dengue and Viral Hepatitis.
Study by Liqua M. Majeed Al Sharifi,[11] also showed increase in PDW in cases of ITP.
Thus, Increase in PDW values, which denotes heterogenecity of size of platelets, can be useful in detecting the etiology of various types of Thrombocytopenias.
In our study Plateletcrit (PCT) was found to be decreased in most cases of Viral Infections, Sepsis, Dengue and Coronary Artery Disease and all cases of ITP. Plateletcrit is a representation of volume percent of platelets.[3]
Similar findings were seen in study by Khushboo Saran et al,[6] which showed decrease in Platelet crit in cases of ITP, Dengue and Acute Leukemia. Study by Tejaswi Peddaverannagari et al,[8] showed decreased PCT in cases of ITP and Viral Infections, similar to our study.
PCT measures the total platelets mass, so it can be a useful marker in platelets with bleeding diathesis.[9]
Study by Liqua M Majeed Al-Sharifi,[11] also showed a low PCT in cases of ITP. Low Plateletcrit indicates low platelets activity, hence it plays an effective role in screening for Platelet Quantitative Abnormalities. Thus, serial monitoring of PCT is of prognostic value in cases of Thrombocytopenia.

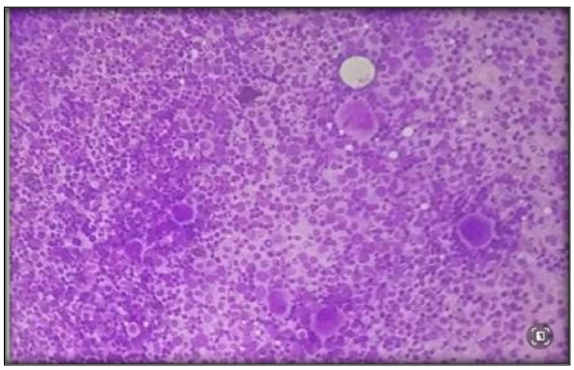


Figure 1: Bone Marrow Aspiration Smear in ITP: Leishman Stain: 4 X

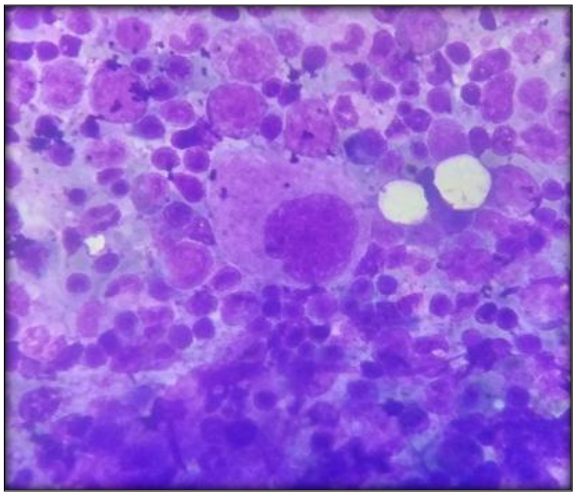


Figure 2: Bone Marrow Aspiration Smear in ITP: Leishman Stain: 10X

Study	AgeGroup
Sangeeta Borkatakyet al(4)	31-40yrs
SushmaYalavarthi et al(5)	11-20yrsand21-30yrs
VaniMittaletal(9)	21-30yrs
MD Hamed AltafMali(10)	30-40yrs
PresentStudy	01-10yrs

Sangeeta Borkataky et al(4)	53.33%
SushmaYalavarthietal(5)	53.10%
Rupal JShahetal(7)	60%
Vani Mittal et al(9)	65%
MD HamedAltaf Mali(10)	53.33%
Liqaa MMajeed ASharifi(11)	37.50%
Present Study	56.72%

Study	Number of Cases of according of Thrombocytopenia
Shashwat Vidhyadhar(3)	Dengue:35.71% Malaria:22.85% MegaloblasticAnaemia:17.14%
Sangeeta Borkatakyetal(4)	MegaloblasticAnaemia:28.33%Dengue : 20.00% Malaria:10.00%

Khushboo Saranetal[6]	Dengue:25.07% MegaloblasticAneamea:18.65%AcuteLeukemia:13.43%
Vani Mittaletal[9]	Dengue:18.06% Malaria:10.32% ViralInfection:7.74%
Present Study	Sepsis:21.45% ViralInfection:19.65%CoronaryArteryDisease:18.98%

CONCLUSION

Platelets Indices are helpful in determining the etiology of Thrombocytopenia, during evaluation of cases of Thrombocytopenia. These values can be obtained by simple and economical procedure by using Auto Analyzer. Platelets Indices give a clue to start the initial management of patient and serial measurement of Platelets Indices help in determining prognosis of a case and also to avoid painful procedures like Bone Marrow Aspiration. However, investigations like Reticulated Platelets and Immature Platelet Fraction would be more useful for evaluation and determination of the etiology of Thrombocytopenia.

Conflict of Interest: None
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