

Role of mean platelet volume (MPV), platelet distribution width (PDW) and platelet large cell ratio (P-LCR) value in the diagnosis of immune thrombocytopenic purpura

Abstract

A cross-sectional retrospective study was carried out at the Bangabandhu Sheikh Mujib Medical University, Dhaka to determine the diagnostic significance of platelet indices in ITP. Total 60 cases were included in this study. Complete history was taken either from patient or accompanying attendants. Thorough clinical examination was done. Mean age of the study population of aplastic anaemia (AA) was 36.66(\pm 17.04) years and immune thrombocytopenic purpura (ITP) was 29.70(\pm 13.99) years. Mean platelet count was 38.73(\pm 15.99) \times 10⁹/L and 30.46(\pm 14.17) \times 10⁹/L in AA and ITP respectively and that was not statistically significant. In AA mean platelet volume was 9.75(\pm 1.15)fl and in ITP mean platelet volume was 12.01(\pm 1.23)fl. In AA mean platelet distribution width was 11.75(\pm 2.13)fl and in ITP mean platelet distribution width was 18.07(\pm 2.52)fl. In AA mean platelet large cell ratio was 21.07(\pm 5.51)% and in ITP mean platelet large cell ratio was 36.68(\pm 7.91)% and that was statistically significant. Sensitivity and specificity of platelet indices to make a diagnosis of ITP was calculated under various cut-off ranges. MPV cut of value >11fl sensitivity was 73.33% and Specificity was 80.0%, MPV cut of value >12fl sensitivity was 53.3% and Specificity was 96.7%, MPV cut of value >13fl sensitivity was 26.7% and Specificity was 100%. PDW cut of value >14fl sensitivity was 86.67% and Specificity was 93.3%. PDW cut of value >15fl sensitivity was 100% and Specificity was 83.0%. P-LCR cut of value >40% sensitivity was 100% and Specificity was 63.0%. These indices could help to distinguish hyper-destructive thrombocytopenia and hypo-productive thrombocytopenia very easily and it is also cost effective. Platelet indices, if reported, provide a lot of clinical information about the underlying conditions of thrombocytopenia.

Keywords: mean platelet volume, platelet distribution width, platelet large cell ratio, immune thrombocytopenic purpura

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Shafiqul Islam,¹ Md Saiful Islam,² Mesbah Uddin Ahmed,³ Md Abdul Aziz,¹ Masuda Begum¹

¹Department of Haematology, Bangabandhu Sheikh Mujib Medical University, Bangladesh

²Department of Clinical Pathology, Bangabandhu Sheikh Mujib Medical University, Bangladesh

³Bangladesh University of Health Sciences (BUHS), Bangladesh

Correspondence: Mesbah Uddin Ahmed, MS in Microbiology, Bangladesh University of Health Sciences (BUHS), Bangladesh, Email mesba.lab@gmail.com

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Abbreviations: ITP, immune thrombocytopenic purpura; AA, aplastic anaemia; PAIgG, platelet-associated immunoglobulin G; MPV, mean platelet volume; PDW, platelet distribution width; P-LCR, platelet large cell ratio

Introduction

Immune thrombocytopenic purpura (ITP) is an autoimmune disorder characterized by persistent thrombocytopenia (peripheral blood platelet count <150 \times 10⁹/l) due to autoantibody binding to platelet antigen(s) causing their premature destruction by the reticuloendothelial system and particularly in the spleen.¹ In Bangladesh we have no data regarding the incidence of adult chronic immune thrombocytopenia. But its incidence is 58-66 new cases per million populations per year (5.8-6.6 per 100000) in the US² with similar incidence in the UK. The diagnosis of ITP remains on exclusion. There is no diagnostic test to absolutely say a patient has ITP.³ Platelet-associated immunoglobulin G (PAIgG) is often elevated in ITP, but it is not specific to ITP and an increased PAIgG level is often found in many other diseases.⁴ In fact, the necessity for both bone marrow aspiration and PAIgG in ITP is not accepted in the recent guideline.⁵ Recent advances in automated blood cell analyzers had made it possible to measure various blood cell parameters

automatically. Among these parameters, platelet indices, such as mean platelet volume (MPV), platelet distribution width (PDW), platelet large cell ratio (P-LCR), provide some important information⁶⁻⁸ but are not accepted for routine clinical use. If these indices are really informative regarding platelet kinetics, they might become very useful laboratory measures for thrombocytopenia. So I wish to investigate the significances of these platelet indices in the diagnosis of thrombocytopenia by comparing the level of hypo-productive and hyper-destructive thrombocytopenia. The sensitivity and specificity of platelet indices to enable the diagnosis of ITP were also evaluated.

Methodology

Place of study: Department of Haematology, BSMMU

Period of study: January 2011 to December 2011

Study design: Retrospective cross sectional study

Study population

All patient with thrombocytopenia (platelet count below 100000/cu mm with 30 patients was immune thrombocytopenic purpura and 30 patients was aplastic anaemia) of both sexes of 5-70 years of age.

Sample size

60, among them 30 patients were hypo-productive thrombocytopenia (Aplastic Anaemia) and 30 patients were hyper-destructive thrombocytopenia (Immune thrombocytopenic purpura).

Sampling method

Purposive type non-probability sampling technique was applied to enroll the study.

Inclusion criteria

All patients who were diagnosed case of ITP and AA and whose platelet count was below 100000/cu mm.

Exclusion criteria

- i. Those who disagreed to participate in the study.
- ii. Those patient whose other causes of thrombocytopenia (like SLE, RA, lymphoproliferative disorder, infection, medications etc) had been excluded.
- iii. Those patient(s) who had transfused platelet within 7 days.

Procedure of data collection

Patients suffering from bleeding manifestation were determined by using pre-formed questionnaires. Then patients suffering from immune thrombocytopenic purpura and aplastic anaemia were sorted out from those patients having bleeding manifestation. Then from complete blood count of those patients and data of platelet indices

(mean platelet volume, platelet distribution width and platelet large cell ratio) was taken.

Equipment: Automated hematology analyzer (Sysmex 2000i, kobe, Japan)

Data analysis: Data were processed and analyzed using software SPSS (Statistical Package for Social Sciences).

Ethical implication: Participants were volunteered. Consent was obtained after a brief of the study in Bengali to all patients. They were free to take part or can refuse any part of the study.

Results

Table 1 shows mean age of the study population of aplastic anaemia was 36.66(±17.04) years and immune thrombocytopenic purpura was 29.70(±13.99) years. In aplastic anaemia male were 13(43.3%) and female were 17(56.7%), in immune thrombocytopenic purpura male were 06(20%) and female were 24(80%).

Table 2 shows platelet count and indices, in AA mean platelet count was 38.73(±15.99)×10⁹/L and in ITP mean platelet count was 30.46(±14.17)×10⁹/L. (p>05) that was not statistically significant. In AA mean platelet volume was 9.75(±1.15)fl and in ITP mean platelet volume was 12.01(±1.23)fl. In AA platelet distribution width was 11.75(±2.13)fl and in ITP platelet distribution width was 18.07(±2.52) fl. In AA platelet large cell ratio was 21.07(±5.51)% and in ITP platelet large cell ratio was 36.68(±7.91)%. (p<0.05) that was statistically significant.

Table 1 Age and sex distribution of the study population

Age group in years	Aplastic anaemia	Immune thrombocytopenic purpura
Nov-20	6(20%)	09(30%)
21-30	8(26.7%)	15(50%)
31-40	5(16.7%)	03(10%)
41-50	5(16.7%)	02(6.7%)
51-60	3(10%)	01(3.3%)
61-70	3(10%)	0(0)
Total	30(100)	30(100)
Mean (±SD)	36.66(±17.04)	29.70(±13.99)
Sex		
Male	13(43.3%)	06(20%)
Female	17(56.7%)	24(80%)

Table 2 Platelet count and indices

Items	Study group		t	p value
	AA Mean(±SD)	ITP Mean(±SD)		
Platelet count x 10 ⁹ /L	38.73(±15.99)	30.46(±14.17)	2.11	0.11
Mean platelet volume (fl)	9.75(±1.15)	12.01(±1.23)	-7.31	<0.001
Platelet distribution width (fl)	11.75(±2.13)	18.07(±2.52)	-10.45	<0.001
Platelet large cell ratio (%)	21.07(±5.51)	36.68(±7.91)	-8.86	<0.001

Table 3 shows platelet count between the study group, Platelet count 8-20x10⁹/L in AA was 04(13.3%) and in ITP was 09(30%), platelet count 21-40x10⁹/L in AA was 12(40%) and in ITP was 13(43.3%), Platelet count 41-60x10⁹/L in AA was 10(33.3%) and in ITP was 06(20%), Platelet count 61-80x10⁹/L in AA was 04(13.3%) and in ITP was 02(6.7%).

Table 3 Platelet count between the study group

Items	Study group		Total
	AA	ITP	
8-20 x10 ⁹ /L	04(13.3)	09(30.0)	13(21.7)
21-40 x10 ⁹ /L	12(40.0)	13(43.3)	25(41.7)
41-60 x10 ⁹ /L	10(33.3)	06(20.0)	16(26.7)
61-80 x10 ⁹ /L	04(13.3)	02(6.7)	06(10.0)
Total	30(100)	30(100)	60(100)

Table 4 shows that various platelet indices, MPV>11 cut of value 06(20%) were in AA and 22(73.3%) were in ITP. MPV>12 cut of value 01(3.3%) was in AA and 16(53.3%) were in ITP. MPV>13 cut of value 08(26.7%) were in ITP. PDW>14 cut of value 05(16.7%) were in AA and 30(100%) were in ITP. PDW >15 cut of value 02(6.7%) were in AA and 26(86.7%) were in ITP. P-LCR>25 cut of value 07(23.3%) were in AA and 28(93.3%) were in ITP. P-LCR >30 cut of value 03(10%) were in AA and 22(73.3%) were in ITP. P-LCR>40 cut of value 13(43.3%) were in ITP.

Table 4 Various cut of value in MPV, PDW and P-LCR of the study population

Items	AA n=30	ITP n=30	Total
MPV (fl)			
>11	06(20%)	22(73.3%)	28
>12	01(3.3%)	16(53.3%)	17
>13	0	08(26.7%)	8
PDW (fl)			
>14	05(16.7%)	30(100%)	35
>15	02(6.7%)	26(86.7%)	28
P-LCR (%)			
>25	07(23.3%)	28(93.3%)	35
>30	03(10%)	22(73.3%)	25
>40	0	13(43.3%)	13

The sensitivity and specificity of platelet indices to make a diagnosis of ITP was calculated under various cut-off ranges. MPV cut of value>11 sensitivity was 73.33% and Specificity was 80.0%, MPV cut of value>12 sensitivity was 53.3% and Specificity was 96.7%, MPV cut of value>13 sensitivity was 26.7% and specificity was 100%. PDW cut of value>14 sensitivity was 86.67% and specificity was 93.3%. PDW cut of value >15 sensitivity was 100% and specificity was 83.0%. P-LCR cut of value>25 sensitivity was 93.33% and specificity was 76.67%. P-LCR cut of value>30 sensitivity was 73.33% and specificity was 90.0%. P-LCR cut of value>40 sensitivity was 100% and specificity was 63.0% (Table 5).

Table 5 Sensitivity and specificity for the diagnosis of ITP under various cut-off ranges

Cut of value	Sensitivity	Specificity
MPV (fl)		
>11	73.33%	80.00%
>12	53.30%	96.70%
>13	26.67%	100%
PDW (fl)		
>14	86.67%	93.30%
>15	100%	83.00%
P-LCR (%)		
>25	93.33%	76.67%
>30	73.33%	90.00%
>40	100%	63.00%

Discussion

In this study mean age of the study population aplastic anaemia were 36.66(±17.04) years and immune thrombocytopenic purpura was 29.70(±13.99) years. In Aplastic anaemia male were 13(43.3%) and female were 17(56.7%), in immune thrombocytopenic purpura male were 06(20%) and female were 24(80%). In Memon study, 65 ITP patients were selected and the mean age of these patients was 32.5years, 45 were female and 20 were male. Female to male ratio was 2.25:1.⁹ In another Neylon study reported, the age range of the patients presenting with confirmed ITP was 16–91years, with a median age at diagnosis of 56years of age. There was a female to male ratio of 1.2:1(134females to 111males).¹⁰ In this study shows platelet count and indices, in AA mean platelet count was 38.73(±15.99) x10⁹/L and in ITP mean platelet count was 30.46(±14.17)x10⁹/L and was not statistically significant. In AA mean platelet volume was 9.75(±1.15)fl and in ITP mean platelet volume was 12.01(±1.23)fl. In AA mean platelet distribution width was 11.75(±2.13)fl and in ITP mean platelet distribution width was 18.07(±2.52)fl. In AA mean platelet large cell ratio was 21.07(±5.51)% and in ITP mean platelet large cell ratio was 36.68(±7.91)% and was statistically significant. Kaito et al.¹¹ study reported that, the platelet count was similar in both groups. All platelet indices were significantly higher in ITP than in AA (p<0.001). In particular, PDW and P-LCR showed marked differences between the two types of thrombocytopenia. That result is similar to our study. Ntaios et al.¹² and Rui-Long Xu et al.¹³ study also found statistically significant differences were observed in the MPV, PDW (p<0.05). Recent advances in technology have made it possible to record various platelet indices, such as MPV, PDW and P-LCR, with an automated haematology analyser. There have been some reports about these platelet indices and platelet disorders.^{14,15} However, they are not clinically accepted as conventional checkpoints for thrombo-cytopenia. We evaluated the efficacy of these indices by comparing their values between hypo-productive thrombocy-topenia (AA) and hyper-destructive thrombocytopenia (ITP). MPV and PDW were elevated in ITP.¹⁶ Increasing the number of megakaryocytes and supporting the diagnosis of ITP was associated with larger MPV.¹⁷ However, little is known about P-LCR and thrombocytopenia and whether platelet indices are satisfactory laboratory tests for

thrombocytopenia has not fully been discussed. In our evaluation, not only MPV and PDW, but also P-LCR was significantly higher in ITP than in AA. Therefore, these indices were effective in distinguishing these two types of thrombocytopenia. In this study shows platelet count between the study group, Platelet count $8-20 \times 10^9/L$ in AA was 04(13.3%) and in ITP was 09(30%), platelet count $21-40 \times 10^9/L$ in AA was 12(40%) and in ITP was 13(43.3%), Platelet count $41-60 \times 10^9/L$ in AA was 10(33.3%) and in ITP was 06(20%), Platelet count $61-80 \times 10^9/L$ in AA was 04(13.3%) and in ITP was 02(6.7%). Sensitivity and specificity of platelet indices to make a diagnosis of ITP was calculated under various cut-off ranges. The sensitivity and specificity of platelet indices to make a diagnosis of ITP was calculated under various cut-off ranges. MPV cut of value >11 sensitivity was 73.33% and Specificity was 80.0%, MPV cut of value >12 sensitivity was 53.3% and Specificity was 96.7%, MPV cut of value >13 sensitivity was 26.7% and Specificity was 100%. PDW cut of value >14 sensitivity was 86.67% and Specificity was 93.3%. PDW cut of value >15 sensitivity was 100% and Specificity was 83.0%. P-LCR cut of value >25 sensitivity was 93.33% and specificity was 76.67%. P-LCR cut of value >30 sensitivity was 73.33% and specificity was 90.0%. P-LCR cut of value >40 sensitivity was 100% and specificity was 63.0%. Kaito et al. [11] study the sensitivity and specificity of platelet indices to make a diagnosis of ITP was calculated under various cut-off ranges. The referential ranges at their institute were 8.4–12 fl for MPV, 8–14 fl for PDW and 10–30% for P-LCR. Under these cut-off ranges, platelet indices, especially PDW and P-LCR, showed favorable sensitivity and specificity, they found MPV (fl) cut of value >11, >12 and >13, sensitivity 87%, 59% and 11% respectively, specificity were 80%, 95% and 100% respectively. PDW (fl) cut of value >13, >14 and >15 sensitivity was 92%, 76% and 71% respectively, specificity was 75%, 90% and 95% respectively. P-LCR cut of value were >25, >30 and >40 sensitivity was 100%, 91% and 62% respectively, specificity were 45%, 73% and 100% respectively. That result is similar to in this study.

Conclusion

Our results suggested that these indices could help to distinguish hyper-destructive thrombocytopenia and hypo-productive thrombocytopenia very easily and it is also cost effective. Platelet indices, if reported, provide a lot of clinical information about the underlying conditions of thrombocytopenia. Whether platelet indices are useful in other conditions that cause thrombocytopenia, except ITP and AA, remains unknown. More attention should be paid to these indices for the diagnosis of thrombocytopenia.

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None.

Conflict of interest

The author declares no conflict of interest.

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