Immature Platelet Fraction (IPF) As a Screening Test to Identify the Cause for Thrombocytopenia

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Abstract

Thrombocytopenia is a common finding in haematology practice and most often requires many tests to identify the cause. The study was done to evaluate IPF as a screening test for thrombocytopenia, to evaluate IPF as a diagnostic test for thrombocytopenia with associated increased thrombopoietic activity and to evaluate the difference in the IPF according to the age and sex of patients A peripheral blood sample was analyzed by the FBC analyzer and (IPF) obtained. SPSS 20 was used for the statistical analysis. A P-value ≤ 0.05 was considered statistically significant. The value of IFP percentage to diagnose thrombocytopenia with increased thrombopoietic activity was determined using the receiver operating characteristic (ROC) curve. **Results:** The mean IPF value in 62 patients with thrombocytopenia and without increased thrombopoietic activity was 5.6% (CI for 95%: 3.4–7.8.) The mean IPF value in those thrombocytopenic patients (38) with increased thrombopoietic activity was 14.4% (CI for 95%: 9.4–19.4). The P-value was 0.00. The IPF cut-off for a diagnosis of thrombocytopenia with increased thrombopoietic activity was 08% [sensitivity 100%, specificity 87%, positive predictive value (PPV) 82%, negative predictive value (NPV) 100. %]. No statistical significance was made in respect of age and sex of patients.
Conclusions: IPF value derived by the analyzer is a useful screening test to differentiate between thrombocytopenia with high or low thrombopoietic activity. An IPF percentage in excess of 08%, has a high sensitivity and good specificity for a diagnosis of thrombocytopenia with increased thrombopoietic activity.

Index terms. Thrombocytopenia, IPF, thrombopoeitic activity

Introduction

Thrombocytopenia is a common finding in haematology practice and most often requires many tests to diagnose.

They can be broadly classified as:

1. Thrombocytopenia occurring due to peripheral destruction/consumption/pooling
2. Those occurring as a result of production failures.

Identifying the cause in clinical setup is very time consuming and delays the initiation of the management Example; Immune thrombocytopenia. In those with suspected peripheral destruction/consumption of platelets a bone marrow examination is not done due to the invasive nature of the investigation. It also cannot be done to follow up the patient. In this regard the immature platelet fraction(IPF) also described as reticulated platelets(RP) is a very rapid and simple test which can be utilized to differentiate the cause for thrombocytopenia as per the classifications stated above.

Objective:

To evaluate the significance of IPF as a screening test for thrombocytopenia

Specific Objectives:

1. To evaluate sensitivity and specificity of IPF as a diagnostic test for thrombocytopenia with increased thrombopoietic activity.
2. To establish any significance in the IPF according to the age and sex of patients.

Study Design

A prospective observational study in patients with thrombocytopenia

Setting

The haematology department at Sri Jaywardenepura General Hospital(SJGH)

Study period

From September 2018 till the required samples were obtained.

Methodology

Prospective observational study in thrombocytopenic patients was done. 100 patients with thrombocytopenia were selected randomly from the samples that were sent to the laboratory for routine full blood counts (FBC) A blood film was done to confirm thrombocytopenia. The sample was analyzed by the six - part automated analyzer and the (IPF) was obtained (one patient from the group with peripheral consumption was excluded due to incompatible result)

Patient group included,

A. Patients with low platelets due to decreased production included infection, sepsis, chronic liver cell disease, early stage of dengue infection, bone marrow failure syndromes, Drugs causing bone marrow suppression
B. Patients with low platelets due to immune destruction/consumption/pooling of platelets such as ITP
C. Patients with low platelets due to non – immune destruction/consumption of platelets

Control group included 100 samples of patients with no thrombocytopenia. patients with normal or high platelet counts (these patients with the high platelet counts were selected to prove that the IPF is not affected by the platelet count)

Study tool

A data extraction sheet was used to enter the investigations with the results.

Statistical Analysis

IPF value was derived in all samples. Results were expressed as mean and 95% mean confidence interval (CI), unless differently indicated. Differences between groups were compared by means of the Student's t-test. A P-value equal or lesser than 0.05 was considered statistically significant. To determine the accuracy of the IPF value in discriminating thrombocytopenia with increased thrombopoietic activity from thrombocytopenia with normal or decreased thrombopoietic activity, a receiver operating characteristic (ROC) curve was used. The cutoff value of RP percentage with the best sensitivity and specificity to diagnose thrombocytopenia with increased thrombopoietic activity, was determined. SPSS 20 for Windows computer software was used for the statistical analysis.

Ethical consideration

Approval was obtained from ethical review committee of SJGH.

The samples were those sent for routine analysis. No additional cost to the patient nor additional samples were obtained.

Results

Table 1 - Control Group – IPF upper and lower values with the mean

	N	Minimum	Maximum	Mean	Std. Deviation
Q7_IPF	100	0.7	7.7	2.834	1.5677
Valid N (listwise)	100				

Table 11 - Cases – IPF upper and lower values with the mean

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q7_IPF	99	0.9	29.3	8.882	5.5072
Valid N (listwise)	99				

Table 111 - The IPF value in the group with the production defect

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Q7_IPF	62	0.9	10.9	5.596	2.2388
Valid N (listwise)	62				

Table 1V - IPF of the group with peripheral destruction, consumption and pooling

	N	Minimum	Maximum	Mean	Std. Deviation
Q7_IPF	37	8.1	29.3	14.389	4.9292
Valid N (listwise)	37				

Table V – IPF was significant as a screening test with a P value of < 0.05

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	70.897[a]	1	P value .000		
Continuity Correction[b]	67.427	1	.000		
Likelihood Ratio	88.741	1	.000		
Fisher's Exact Test				.000	.000
Linear-by-Linear Association	70.181	1	.000		
N of Valid Cases[b]	99				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 16.82.

b. Computed only for a 2x2 table

Figure 1 - Female to male ratio was 1:1

uency of male and female in case group

Q2_sex

	Frequency	Percent %	Valid Percent	Cumulative Percent
male	51	51.5%	51.5	51.5
female	48	48.5%	48.5	100.0
Total	99	100.0	100.0	

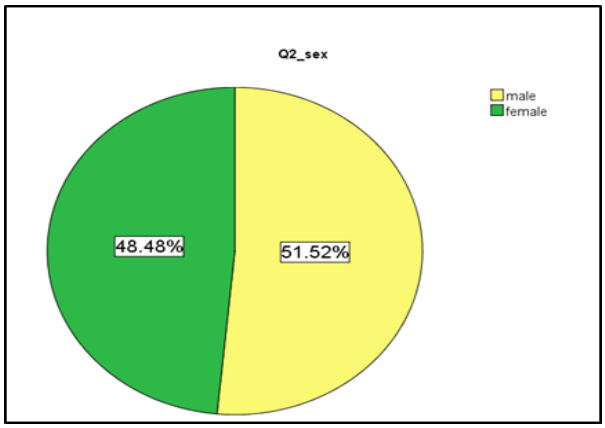


Table V1 - No statistical significance with age

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.006[a]	1	P value 0.940		
Continuity Correction[b]	.000	1	1.000		
Likelihood Ratio	.006	1	.940		
Fisher's Exact Test				1.000	.552
Linear-by-Linear Association	.006	1	.941		
N of Valid Cases[b]	99				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 18.18.

b. Computed only for a 2x2 table

Table V11 - No statistical significance for the sex

Chi-Square Tests

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.776[a]	1	P value 0.378		
Continuity Correction[b]	.461	1	.497		
Likelihood Ratio	.777	1	.378		
Fisher's Exact Test				.423	.249
Linear-by-Linear Association	.769	1	.381		
N of Valid Cases[b]	99				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 21.82.

b. Computed only for a 2x2 table

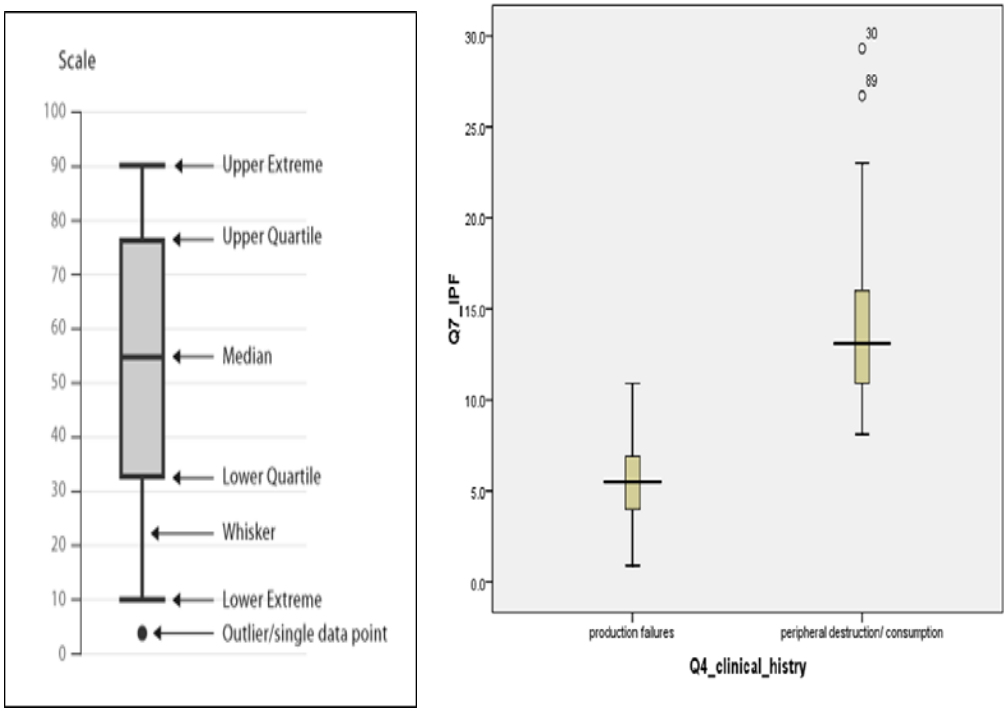
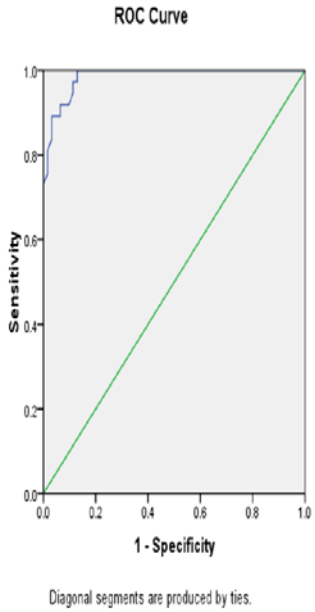


Figure 11 - Box chart depicting the IPF values in both case groups

The IPF value with the best sensitivity and specificity to diagnose thrombocytopenia with increased thrombopoietic activity was confirmed using the receiver operating characteristic (ROC) curve

Figure 111 - The ROC curve using 08% as the cut off IPF value



Area Under the Curve

Test Result Variable(s):Q7_IPF

Area	Std. Error[a]	Asymptotic Sig.[b]	Asymptotic 95% Confidence Interval	
			Lower Bound	Upper Bound
.985	.008	P value .000	0.969	1.001

The test result variable(s): Q7_IPF has at least one tie between the positive actual state group and the negative actual state group. Statistics may be biased.

a. Under the nonparametric assumption

b. Null hypothesis: true area = 0.5

Table V111 - For the cut off value of IPF 8% - specificity, sensitivity, PPV and the NPV

Positive Predictive Value (PPV) - 82%

Negative Predictive value (NPV) -100%

			IPF_2gp7		
			IPF =<8	IPF>8.0	Total
Q4_clinical_histry	production failures	Count	54	8	62
		% within Q4_clinical_histry	Specificity 87.1%	12.9%	100.0%
	peripheral destruction/ consumption	Count	0	37	37
		% within Q4_clinical_histry	.0%	Sensitivity 100.0%	100.0%
Total		Count	54	45	99
		% within Q4_clinical_histry	54.5%	45.5%	100.0%

Conclusion

IPF value derived by the analyzer is a useful screening test to differentiate between thrombocytopenia with high or low thrombopoietic activity. Our study concluded that an IPF percentage in excess of 08%, has a 100% sensitivity and negative predictive value for a diagnosis of thrombocytopenia with increased thrombopoietic activity.

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