



PLATELET DISTRIBUTION WIDTH AS A PROGNOSTIC FACTOR IN THROMBOLYSED ISCHEMIC STROKE

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Guide.

ABSTRACT

Background: Platelet distribution width is one of the routine parameters in platelet indices, and indicates about the volume variability of the platelet size. Platelet distribution width is one of the routine parameters in platelet indices, and indicates about the volume variability of the platelet size. It is measured in percentage. Among the platelet indices, PDW is a better indicator of platelet reactivity than MPV. The clinical examinations and studies have shown that PDW has been a prognostic indicator in thrombolysed ischemic stroke patients. The present study has been aimed to observe PDW as a prognostic indicator in thrombolysed ischemic stroke patients. **Methods:** A Prospective, Single arm observation study was conducted at MGM Institute of Health Sciences, Navi Mumbai where in a total of 60 patients of thrombolysed ischemic stroke satisfying inclusion and exclusion criteria visiting casualty and admitted in medical ICU of MGM Medical College and Hospital, Kamothe, Navi Mumbai were selected for the study. **Results:** Data analysed showed thrombolysis was done with Alteplase in 49 patients and with Tenecteplase in 11 patients. Hence, data showed that a greater number of patients were thrombolysed with Alteplase. The study showed that 4 died out of 49 thrombolysed with alteplase which equals to 8.16%. 1 died among 11 thrombolysed with tenecteplase which equals to 9.09%. Total 5 died among 60 patients who got thrombolysed which equals to 8.33%. The analysis suggested that 50 out of 60 patients recovered post thrombolysis (83.3%), while 3 out of 60 died (5%). Total 7 patients out of 60 had hemorrhagic transformation post thrombolysis, out of which 5 recovered (8.4%) and remaining 2 out of 7 died (3.3%). **Conclusion:** The study concluded that since, p-value less than that of 0.05 indicates significant change in PDW when compared between on day of admission to on the day of outcome of all the patients, study concluded that over all there was an increment in PDW. The analysis concluded that majority of the patients had a good outcome post thrombolysis (83.3%).

KEYWORDS : Platelet distribution & thrombolysed ischemic stroke.

INTRODUCTION

Complete blood count (CBC) is a common test requested by clinicians in clinical laboratories. It consists of parameters such as platelet indices, mean platelet volume (MPV), plateletcrit (PCT), and platelet distribution width (PDW); these are determined altogether in automatic CBC profile.

Platelet distribution width is one of the routine parameters in platelet indices, and indicates about the volume variability of the platelet size. It is measured in percentage.¹ It ranges from 8.3% to 56.6% with marked variability.^{2,3} It changes with platelet anisocytosis, having a linear relationship with the same. When platelet production is decreased, the young platelets become more active and increase in size, involving pseudopodia formation and spherical shape formation, hence increasing the PDW and altering the other platelet parameters.

Stroke or cerebrovascular accident (CVA) is a catastrophe in which blood supply to the brain is reduced or interrupted due to rupturing or blockage of the blood vessel in the brain, leading to haemorrhagic or non-haemorrhagic strokes, respectively.

It produces characteristic signs and symptoms indicating focal neurological deficit, which should be identified rapidly so as to initiate treatment as soon as possible, especially in ischemic strokes, which carry an opportunity to interrupt blood supply to the brain through bursting of a blood vessel or by formation of a clot. Drugs to break the blood clots or thrombolytics are used to restore blood supply to the affected part of the brain but within 3 to 4 and a half hours of symptom onset.

The clinical examinations and studies have shown that PDW has been a prognostic indicator in thrombolysed ischemic stroke patients. The present study has been aimed to observe PDW as a prognostic indicator in thrombolysed ischemic stroke patients.

OBJECTIVES

1. To study whether Platelet Distribution Width can predict the

outcome after thrombolysis in patients of ischemic stroke.

METHODS

The study was conducted at MGM Institute of Health Sciences, Navi Mumbai. 60 patients of thrombolysed ischemic stroke satisfying inclusion and exclusion criteria visiting casualty and admitted in medical ICU of MGM Medical College and Hospital, Kamothe, Navi Mumbai were selected for the study.

Inclusion criteria:

1. Age group of 18 years or older.
2. Patients with clinical diagnosis of ischemic stroke during the window period.
3. Patients with ischemic stroke who have been thrombolysed with thrombolytic agents like alteplase, Tenecteplase.

Exclusion criteria:

1. Age less than 18 years
2. Evidence of haemorrhagic stroke on NCCT.
3. Patients with platelet and bleeding disorders.
4. Patients with contraindications to thrombolysis.

Investigations Required:

Following set of investigations were conducted for the selected patients:

- HEMOGRAM and platelet indices details at the time of admission, post thrombolysis, on day of final outcome were taken from central lab of MGM Medical College and Hospital.
- Prothrombin time, renal function tests.
- CT brain + neck vessels angiography.
- MRI brain + angiography

Along with the above mentioned, details of clinical history including age, sex, chief complaints, history of medication, co-morbid condition of diabetes, hypertension, ischemic heart

diseases, HIV, TB, and addiction history of smoking, alcohol, tobacco, were also collected.

Statistical analysis

The data was analysed using statistical software (IBM SPSS, IBM Corporation, Armonk, NY, USA).

PDW:

Table-1: Descriptive statistics for comparison of PDW

	Mean	Standard Deviation
PDW-ON ADMISSION (OA)	11.93	2.27
PDW-POST THROMBOLYSIS (PT)	12.30	2.13
PDW-ON DAY OF DISCHARGE/DEATH (OD)	12.43	2.60

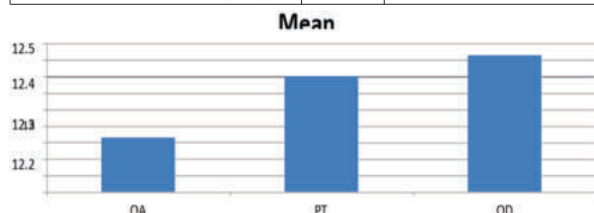


Figure-1: Graphical representation of distribution of patients on the basis of PDW

Comparison of PDW:

Table-2: Descriptive statistics for comparison of PDW

	t-test	d.f.	p- value	Interpretation
Pair 1 PDW ON ADMISSION to PDW POST THROMBOLYSIS	-1.899	59	.062	NS
Pair 2 PDW ON ADMISSION to PDW ON DEATH/ DISCHARGE	-2.523	59	.014	SIGNIFICANT
Pair 3 PDW POST THROMBOLYSIS to PDW ON DISCHARGE/ DEATH	-.593	59	.555	NS

Interpretation:

1. P-value greater than that of 0.05 indicates No Significance (NS) when compared between ON ADMISSION (OA) and POST THROMBOLYSIS (PT).
2. P-value less than that of 0.05 indicates significant change in PDW when compared between OA and ON DISCHARGE/DEATH (OD).
3. P-value greater than that of 0.05 indicates No Significance (NS) when compared between PT and OD.

Comparison Of Pdw -

Table-3: Descriptive statistics for comparison of PDW

	Improved		Died	
	Mean	SD	Mean	SD
PDW- ON ADMISSION (OA)	11.85	2.19	12.80	3.19
PDW-POST THROMBOLYSIS (PT)	12.22	2.12	13.20	2.28
PDW-ON DISCHARGE/DEATH (OD)	12.20	2.41	15.00	3.46

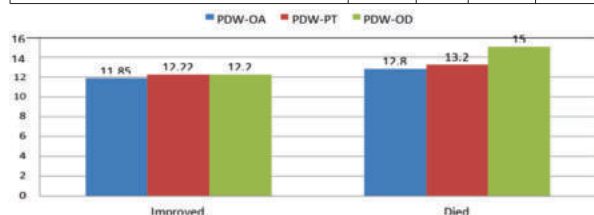


Figure-2: Graphical representation of descriptive statistics

for comparison of PDW

Table-4: Descriptive statistics for comparison of PDW

		t-test	d.f.	p-value	Interpretation
Improved	Pair 1 PDW-OA - PDW-PT	-1.76	54	0.084	NS
	Pair 2 PDW-OA - PDW-OD	-1.842	54	0.071	NS
	Pair 3 PDW-PT - PDW-OD	.080	54	0.936	NS
Died	Pair 1 PDW-OA - PDW-PT	-0.784	4	0.477	NS
	Pair 2 PDW-OA - PDW-OD	-2.269	4	0.086	NS
	Pair 3 PDW-PT - PDW-OD	-2.449	4	0.070	NS

Where OA - ON ADMISSION, PT - POST THROMBOLYSIS, OD- ON DISCHARGE/DEATH

Interpretation:

1. P-value greater than that of 0.05 indicates No Significance (NS) when compared between ON ADMISSION (OA) and POST THROMBOLYSIS (PT) in patients improved post thrombolysis.
2. P-value greater than that of 0.05 indicates No Significance (NS) when compared between PT and ON DISCHARGE/DEATH (OD) in patients who had recovered after thrombolysis.
3. P-value more than that of 0.05 indicated No Significance (NS) when compared between OA and OD in the 55 patients who had improved after thrombolysis (including the ones who had haemorrhagic transformation).
4. P-value greater than that of 0.05 infers No Significance (NS) when compared between OA and PT in patients who died post thrombolysis.
5. P-value more than 0.05 indicates No Significance (NS) when compared between PT and OD in patients who died after thrombolysis.
6. P-value more than that of 0.05 indicated No Significance (NS) when compared between OA and OD in the 5 patients who had improved after thrombolysis (including the ones who had haemorrhagic transformation).

Comparison of PDW against Outcome:

Table-5: Distribution of patients on the basis of association of PDW and outcome

	Count	%
Improved	50	83.3%
Died	3	5.0%
Hemorrhagic Transformation (HT) & Improved	5	8.4%
Hemorrhagic Transformation (HT) & Died	2	3.3%

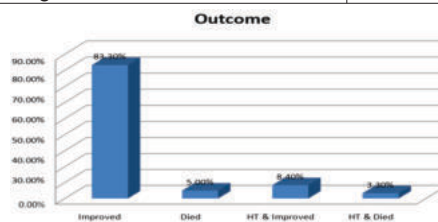


Figure-3: Descriptive statistics based on association of PDW and outcome

Table-6: Descriptive statistics based on association of PDW and outcome

	Improved		Died		HT & Improved		HT & Died	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
PDW-OA	11.85	2.19	12.80	3.19	12.22	2.12	13.20	2.28
PDW-PT	12.22	2.12	13.20	2.28	12.20	2.41	15.00	3.46
PDW-OD	12.20	2.41	15.00	3.46				

PDW-ON ADMISSION	11.84	2.29	14.33	3.06	12.00	.71	10.50	2.12
PDW-POST THROMBOLYSIS	12.14	2.18	14.00	2.65	13.00	1.41	12.00	1.41
PDW-ON DISCHARGE/ DEATH	12.04	2.39	15.33	4.62	13.80	2.28	14.50	2.12

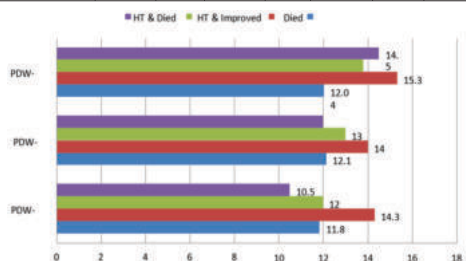


Figure-4: Descriptive statistics based on association of PDW and outcome



Figure-5: Graphical representation of distribution of patients on the basis of association of PDW and prognosis

Comparison of PDW against Better, Died and HT cases only (Considering HT & Better as Better, HT and Died as Died):

Table - 7: Distribution of patients on the basis of association of PDW and prognosis

	Better		Died	
	Mean	SD	Mean	SD
PDW-ON ADMISSION (OA)	11.85	2.19	12.80	3.19
PDW-POST THROMBOLYSIS (PT)	12.22	2.12	13.20	2.28
PDW-ON DISCHARGE/DEATH (OD)	12.20	2.41	15.00	3.46

Figure - 6: Graphical representation of distribution of patients on the basis of association of PDW and prognosis

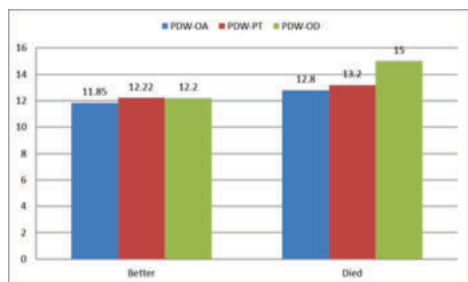


Table - 8: Distribution of patients on the basis of association of PDW and prognosis

	outcome	Kolmogorov-Smirnov		
		Statistic	d.f.	Sig.
PDW-ON ADMISSION(OA)	Improved	.164	55	.001
	Died	.199	5	.200*
PDW-POST THROMBOLYSIS(PT)	Improved	.195	55	.000
	Died	.233	5	.200*
PDW-ON DISCHARGE/ DEATH(OD)	Improved	.146	55	.005
	Died	.214	5	.200*

Interpretation:

P-value for K-S test in at least one of the groups is less than that of 0.05 indicates that the data is not distributed normally. Therefore, we used Non-Parametric Mann-Whitney U test to compare the significance of difference of average PDW between two groups (Better and Died).

PDW-on Admission:

Table - 9: Distribution of patients on the basis of association of PDW and prognosis

	Outcome			
	Improved		Died	
	Mean	SD	Mean	SD
PDW-ON ADMISSION(OA)	11.85	2.19	12.80	3.19

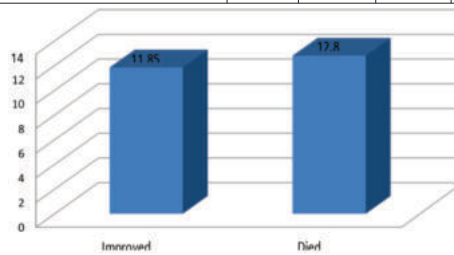


Figure - 7: Descriptive statistics based on association of PDW - ON ADMISSION and outcome

Table - 10: Mann-Whitney U test

	value
Mann-Whitney U	113.500
Wilcoxon W	1653.500
Z	-.650
p-value	.516

Interpretation:

p-value greater than that of 0.05 indicates no significance of difference between average PDW when compared between Improved and Died at OA.

PDW-POST Thrombolysis:

Table - 11: Descriptive statistics based on association of PDW - POST THROMBOLYSIS and outcome

	Outcome			
	Improved		Died	
	Mean	SD	Mean	SD
PDW-POST THROMBOLYSIS (PT)	12.22	2.12	13.20	2.28

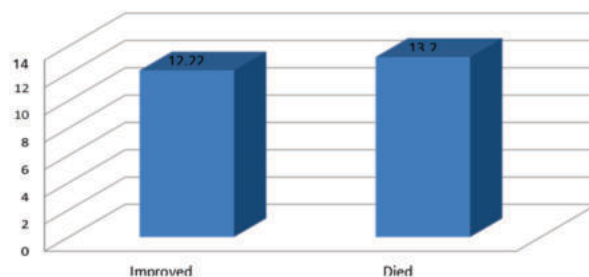


Figure - 8: Descriptive statistics based on association of PDW - PT and outcome

Table - 12: Mann-Whitney U test

	value
Mann-Whitney U	101.000
Wilcoxon W	1641.000
Z	-.998
p-value	.318

Interpretation:

p-value greater than that of 0.05 indicates no significance of

difference between average PDW when compared between Improved and Died at PT.

PDW-ON Discharge / Death

Table – 13: Descriptive statistics based on association of PDW – ON DISCHARGE/DEATH and outcome

	Outcome			
	Improved		Died	
	Mean	SD	Mean	SD
PDW-ON DISCHARGE/ DEATH(OD)	12.20	2.41	15.00	3.46

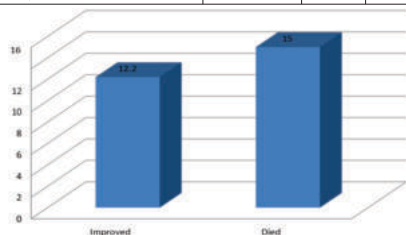


Figure - 9: Descriptive statistics based on association of PDW – ON DISCHARGE/DEATH (OD) and outcome

Table – 14: Mann-Whitney U test

Mann-Whitney U	value
Wilcoxon W	69.500
Z	1609.500
p-value	-1.836
	.066

Interpretation:

p-value greater than that of 0.05 indicates no significance of difference between average PDW when compared between Improved and Died at OD.

RESULT AND DISCUSSION

Data analysed showed thrombolysis was done with Alteplase in 49 patients and with Tenecteplase in 11 patients. Hence, data showed that a greater number of patients were thrombolysed with Alteplase. The study showed that 4 died out of 49 thrombolysed with alteplase which equals to 8.16%. 1 died among 11 thrombolysed with tenecteplase which equals to 9.09%. Total 5 died among 60 patients who got thrombolysed which equals to 8.33%. It was evident that there was not much difference in the results of both the drugs post thrombolysis. Hence the study concludes that thrombolysis agent as a cause of death. Study “Tenecteplase versus Alteplase before Thrombectomy for Ischemic Stroke” done by Bruce C V Campbell⁴, suggested that Tenecteplase had better functional outcomes and increased rate of reperfusion as compared to Alteplase when patients with ischemic stroke were thrombolysed within 4.5 hours of its onset.

The analysis suggested that 50 out of 60 patients recovered post thrombolysis (83.3%), while 3 out of 60 died (5%). Total 7 patients out of 60 had hemorrhagic transformation post thrombolysis, out of which 5 recovered (8.4%) and remaining 2 out of 7 died (3.3%). Hence, the analysis concluded that majority of the patients had a good outcome post thrombolysis (83.3%). Despite a hemorrhagic transformation after thrombolysis, most of the patients recovered (8.4%) as compared to the ones who died (3.3%).

Study “Long-term Outcomes After Thrombolytic Therapy for Acute Ischemic Stroke” by Christopher C. Muth⁵ concluded better long-term outcomes in patients who were given thrombolytic therapy than the ones who weren't given.

The study conducted showed that on admission, PDW was high with a mean of 14.33 of the patients who died later during the study. PDW was still high post thrombolysis in these patients and kept increasing thereafter till death (PDW with a

mean of 15.33), leading to a result suggestive of PDW persistently on a higher side in patients who died amongst the 60 cases. The patients who became better post thrombolysis had a relatively low PDW with an average of 11.84 on admission, with not much variation in PDW post thrombolysis (12.14) and at the time of their discharge (12.04). The study showed that PDW was slightly reduced at the time of discharge in patients who recovered (mean 12.04 on discharge). It thus concluded that patients with low PDW, without much variation in PDW during their treatment course, had a better prognosis post thrombolysis.

The analysis showed in patients who had hemorrhagic transformation, the ones who died had significant variation in PDW from time of admission to death with a mean of 10.5 OA, 12 PT, 14.5 OD. While those who became better even after HT, had not much variation in PDWs with a mean of 12 OA, 13 PT, 13.8 OD, although it kept progressively increasing in patients having HT from the day of their admission. Study showed that on comparing PDWs of patients who died and who got better, there was more variation in PDW of the ones who died while not much in the latter group.

P-value greater than that of 0.05 indicates no significance of difference between average PDW when compared between Better and Died at OA. P-value greater than that of 0.05 indicates no significance of difference between average PDW when compared between Better and Died at PT. P-value greater than that of 0.05 indicates no significance of difference between average PDW when compared between Better and Died at OD.

CONCLUSION

The study concluded that since, p-value less than that of 0.05 indicates significant change in PDW when compared between on day of admission to on the day of outcome of all the patients, study concluded that over all there was an increment in PDW. The patients with low PDW, who did not have much variation in PDW during their treatment course, had a better prognosis post thrombolysis. Despite a haemorrhagic transformation after thrombolysis, most of the patients recovered (8.4%) as compared to the ones who died (3.3%). The analysis concluded that majority of the patients had a good outcome post thrombolysis (83.3%).

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