

Prognostic Significance of Mean Platelet Volume in Acute Ischemic Stroke

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Abstract

Background: Platelet size indexes reflect platelet reactivity and thrombotic potential. Mean platelet volume (MPV) may relate to stroke severity and functional disability. This study assessed the association between MPV and Modified Rankin Scale (mRS) scores in acute ischemic stroke (AIS). **Materials and Methods:** In a prospective observational study at a tertiary-care hospital, adults (≥ 18 years) presenting within 48 h of AIS were enrolled. Exclusions were hemorrhagic stroke, known platelet disorders, hematological malignancy/procoagulant disease, prior thrombolysis or thrombocytopenia-inducing drugs, autoimmune/systemic malignancy/active infection, TIA, chronic kidney/liver disease, prior stroke, aphasia/dementia or reduced sensorium precluding consent, and symptom onset >48 h. Demographics, risk factors, and MPV were recorded; functional status was assessed by mRS at admission. One-way ANOVA tested MPV across mRS categories. **Results:** Sixty-nine AIS patients were included (mean age 53.99 ± 11.19 years; 71.01% male). Comorbidities included type 2 diabetes (21.74%) and hypertension (15.94%); 53.62% reported addictions (smoking and/or tobacco chewing). Overall mean MPV was 11.05 fL. mRS distribution at admission: 3 in 59.42% ($n=41$), 4 in 17.39% ($n=12$), and 5 in 23.19% ($n=16$). MPV rose stepwise with severity: mRS 3, 9.66 ± 0.89 fL; mRS 4, 11.98 ± 0.58 fL; mRS 5, 13.91 ± 0.83 fL (ANOVA $p < 0.05$). **Conclusion:** Higher MPV at presentation is associated with greater functional disability by mRS in AIS. MPV may aid early risk stratification and triage in resource-constrained settings.

Keywords: Mean Platelet Volume; Acute Ischemic Stroke; Modified Rankin Scale; Prognosis; Disability.

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INTRODUCTION

Acute ischemic stroke (AIS) is driven by thrombo-occlusive events in cerebral vessels. Platelets especially larger, more reactive platelets contribute to thrombosis; MPV serves as a readily available surrogate of platelet size/activity.^[1,2] Prior literature links elevated MPV to worse outcomes after ischemic stroke. This study evaluated whether MPV at admission tracks with functional disability on mRS among AIS patients in a real-world tertiary setting.

MATERIALS AND METHODS

Study Design and Setting: Prospective observational study conducted over ~18 months at a tertiary-care medicine department.

Participants: Adults (≥ 18 years) presenting within 48 hours of AIS were eligible. Exclusion criteria included hemorrhagic stroke; known/familial platelet disorders; hematologic malignancy/procoagulant disease; prior thrombolysis or drugs leading to thrombocytopenia; autoimmune disease, systemic malignancy, or active infections; TIA; chronic kidney/liver disease; prior stroke; aphasia/dementia or low sensorium precluding consent; and presentation beyond 48 h. Sampling was convenience-based; final sample size $n=69$ (sample size derivation $n \approx 69$). Written informed consent was obtained.

Data collection and variables: Demographic factors (age, sex), comorbidities (diabetes, hypertension, others), family

history, and addiction history (smoking, tobacco chewing) were recorded. Functional disability was graded using the Modified Rankin Scale (mRS) at admission. Venous blood sampling was performed for complete blood count including MPV (fL).

Outcomes: Primary outcome was association between MPV and functional disability (mRS categories). Secondary outcomes included descriptive distribution of demographics, comorbidities, and addictions.

Statistical analysis: Continuous variables were summarized as mean $\pm$ SD; categorical variables as frequency (percentage). One-way ANOVA compared MPV across mRS 3, 4, and 5. Analyses used standard statistical software.

Ethics: Institutional approval was obtained; all participants provided informed consent.

RESULTS

Participant characteristics: We included 69 adults with acute ischemic stroke; mean age 53.99 ± 11.19 years (range 34–76).

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Age groups were 30–44 y: 10 (14.49%), 45–59 y: 33 (47.83%), 60–74 y: 23 (33.33%), and >75 y: 3 (4.35%) [Figure 1]. Males 49 (71.01%) and females 20 (28.99%) comprised the cohort.

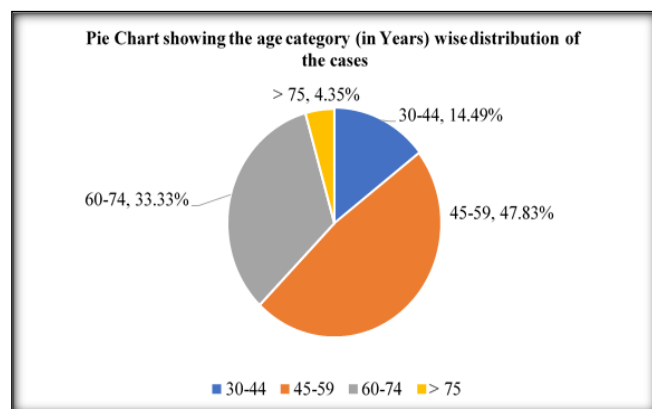


Figure 1: Patients categorized by age group (years)

Past and family history: All patients reported no significant systemic past history (69/69, 100%). Family history was absent in 49 (71.01%) and present in 20 (28.99%).

Personal comorbidities and addictions: Nearly half had no recorded systemic disease 34 (49.28%). Comorbidities included type 2 diabetes 15 (21.74%), hypertension 11 (15.94%), T2DM+HTN 3 (4.35%), hypothyroidism 3 (4.35%), hypothyroidism+HTN 1 (1.45%), and bronchial asthma 2 (2.90%) [Table 1]. Addictions were absent in 32 (46.38%); smoking 13 (18.84%); tobacco chewing 8 (11.59%); and both smoking+chewing 16 (23.19%) [Figure 2].

Table 1: Distribution of cases based on the Systemic Disease

Personal History	No. of Patients	Percentage
No history reported	34	49.28%
Bronchial Asthma	2	2.90%
Diabetes Mellitus Type 2	15	21.74%
Diabetes Mellitus Type 2 with Hypertension	3	4.35%
Hypertension	11	15.94%
Hypothyroidism	3	4.35%
Hypothyroidism with Hypertension	1	1.45%
Grand Total	69	100.00%

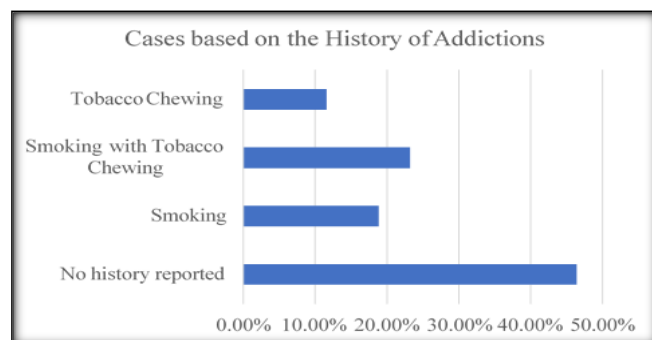


Figure 2: Distribution of cases based on the History of Addictions

General and systemic examination: Pallor was present in 15 (21.74%); icterus, cyanosis, and lymphadenopathy were absent in all (100%); edema was present in 10 (14.49%). CNS: all patients were alert, conscious, and oriented (100%). CVS: S1/S2 normal, no murmur in 49 (71.01%); variable S1 with S2 heard, no murmur in 20 (28.99%). Respiratory: bilateral equal air entry without wheeze/rhonchi in 50 (72.46%); rhonchi 17 (24.64%); wheeze+rhonchi 1 (1.45%) [Table 2]; wheeze 1 (1.45%). Per- abdomen: soft, non-tender, no organomegaly in all (100%).

Table 2: Distribution of cases based on the Respiratory findings

Respiratory	No. of Patients	Percentage
B/L Equal Air entry, No Wheeze or Rhonchi	50	72.46%
B/L Equal Air entry, Rhonchi Present	17	24.64%
B/L Equal Air entry, Wheeze and Rhonchi Present	1	1.45%
B/L Equal Air entry, Wheeze Present	1	1.45%
Grand Total	69	100.00%

Functional status at admission (mRS): mRS distribution was 3 in 41 (59.42%), 4 in 12 (17.39%), and 5 in 16 (23.19%) [Figure 3]. By age, all 30–44 y (n=10) had mRS 3; 45–59 y: 31 mRS 3 / 1 mRS 4 / 1 mRS 5; 60–74 y: 9 mRS 4 / 14 mRS 5; >75 y: 2 mRS 4 / 1 mRS 5 [Table 3]. By gender, females: 12 mRS 3 / 4 mRS 4 / 4 mRS 5; males: 29 mRS 3 / 8 mRS 4 / 12 mRS 5.

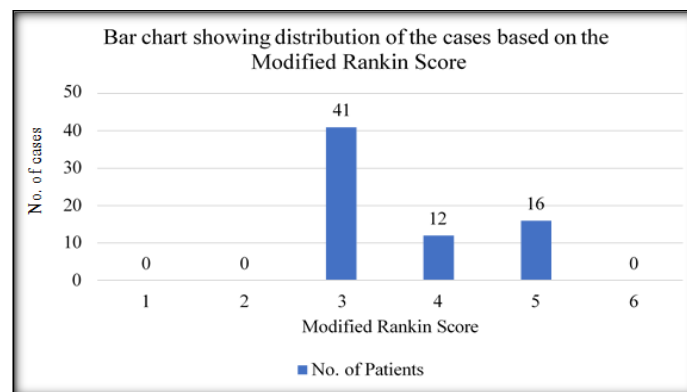


Figure 3: Case based distribution of mRS-Score

Table 3: Distribution of cases based on age category and the Modified Rankin Score

Age category	Modified Rankin Scale			Total
	3	4	5	
30-44	10	0	0	10
45-59	31	1	1	33
60-74	0	9	14	23
>75	0	2	1	3
Total	41	12	16	69

Mean platelet volume (MPV): Overall MPV = 11.05 fL. By age, 30–44 y 9.6 ± 1.0 fL, 45–59 y 9.9 ± 1.1 fL, 60–74 y 13.2 ± 1.2 fL, >75 y 12.5 ± 1.3 fL. By gender, female 10.9 ± 2.1 fL and male 11.1 ± 2.0 fL.

Association of MPV with mRS: MPV increased stepwise with higher disability: mRS 3: 9.656 ± 0.8936 fL (95% CI 9.374–9.938; n=41); mRS 4: 11.983 ± 0.5766 fL (95% CI 11.617–12.350; n=12); mRS 5: 13.906 ± 0.8298 fL (95% CI 13.464–

14.348; n=16). ANOVA $p < 0.05$, with post-hoc pairwise differences $p < 0.05$ between all categories [Table 4].

Table 4: Mean of MPV for Modified Rankin Scale Score

mRS Score	Number of cases	Mean of MPV (in fL)	SD	95% Confidence Interval	P- Value
Score 1	0	-	-	-	< 0.05
Score 2	0	-	-	-	
Score 3	41	9.656	0.8936	(9.374 - 9.938)	
Score 4	12	11.983	0.5766	(11.617 - 12.350)	
Score 5	16	13.906	0.8298	(13.464 - 14.348)	
Score 6	0	-	-	-	

DISCUSSION

In this prospective, hospital-based cohort of acute ischemic stroke (AIS) patients (n = 69), Mean Platelet Volume (MPV) showed a clear, graded association with functional disability at admission: MPV rose from 9.66 ± 0.89 fL in mRS 3 to 11.98 ± 0.58 fL in mRS 4 and 13.91 ± 0.83 fL in mRS 5 (ANOVA $p < 0.05$). The overall mean MPV was 11.05 fL. Most participants were male (71%) and clustered in the 45–59 and 60–74 year groups; comorbid type 2 diabetes (21.7%) and hypertension (15.9%) and a high prevalence of tobacco/smoking exposure (53.6%) provided a vascular risk background that is consistent with more severe presentation.

These patterns are biologically plausible. Larger platelets are metabolically and enzymatically more active, releasing greater amounts of thromboxane A_2 and β -thromboglobulin, promoting endothelial dysfunction and a prothrombotic state; accordingly, MPV tends to be higher in AIS than in healthy controls.^[3,4] The age gradient (higher disability in ≥ 60 years) and the burden of cardiometabolic risks in our sample align with mechanisms that amplify platelet reactivity and thrombus formation. Taken together, the data support MPV as a practical adjunct for early triage when patients first present with AIS.^[5]

Our findings parallel prior reports that link elevated MPV with greater clinical severity and poorer outcomes in ischemic stroke, including studies demonstrating higher MPV across increasing mRS strata and meta-analytic evidence for adverse prognostic associations in non-thrombolysed AIS.^[6,7] These observations also echo work identifying MPV as an independent predictor of recurrent vascular events and 90-day outcomes.^[8,9] Strengths of the present study include predefined eligibility, standardized mRS assessment at admission, and uniform measurement of MPV. Limitations include the single-center design, modest sample size, reliance on cross-sectional admission data (no longitudinal outcomes), and lack of routine mycological/biomarker or imaging correlation for mechanistic confirmation; multicenter validation with serial MPV measurements and outcome tracking is warranted.

CONCLUSION

Higher MPV at presentation is associated with greater functional disability (higher mRS) in AIS. MPV is

inexpensive and widely available and may be incorporated into initial assessment to assist risk stratification and inform early management and counseling; larger multicenter studies should refine cut-points and evaluate prognostic performance against longitudinal outcomes.

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Conflicts of interest

There are no conflicts of interest.

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