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ROLE OF MEAN PLATELET VOLUME IN PATIENTS WITH ACUTE KIDNEY INJURY: A CROSS-SECTIONAL STUDY

Sinega NS*

Department of Pathology, Saveetha Medical College and Hospital, Saveetha Institute of Medical and Technical Sciences, Chennai - 602105, TamilNadu, India. Email: sinegasivasamy95@gmail.com; ORCID ID:https://orcid.org/0009-0005-1788-5401

ABSTRACT

Background: Acute kidney injury (AKI) has been a significant clinical challenge in hospitalized patients. Early identification of individuals likely to deteriorate remains difficult. Mean platelet volume (MPV), a routinely available haematological parameter, reflects platelet reactivity and has drawn interest as a possible indicator of disease burden. However, its relevance in AKI remains unclear.

Objective: To evaluate mean platelet volume in acute kidney injury patients and to examine its variation with disease severity.

Materials and Methods: This study was conducted at the Department of Pathology of a tertiary care center and included 100 patients with AKI. Demographic and laboratory parameters, including MPV, platelet count, and serum creatinine, were recorded at admission. Patients were stratified into favourable and unfavourable outcome groups based on clinical course. Appropriate statistical tests were performed, with a p-value <0.05 considered significant.

Results: Of the 100 patients, 68 had favourable outcomes, while 32 experienced unfavourable outcomes. MPV values were notably higher among patients with unfavourable outcomes. An increase in MPV was also observed, along with higher serum creatinine levels and greater disease severity. Patients with elevated MPV tend to require dialysis or have adverse clinical outcomes.

Conclusion: Elevated mean platelet volume appears to be associated with poorer outcomes in acute kidney injury settings. Given its routine availability and low cost, MPV was useful in early risk assessment in this population.

KEYWORDS: Acute kidney injury; mean platelet volume; prognosis; platelet indices; biomarkers.

INTRODUCTION

Acute kidney injury (AKI), defined by Kidney Disease Improving Global Outcomes (KDIGO) criteria using changes in serum creatinine and/or urine output, remains a frequent complication among hospitalized and critically ill patients. It often accompanies sepsis, haemodynamic instability, and multiorgan dysfunction, and is consistently linked with prolonged hospitalisation, greater resource use, and adverse in-hospital outcomes. Despite advances in supportive care, early identification of patients likely to follow a complicated clinical course remains clinically important. [1,2]

MPV, a routinely reported parameter in complete blood counts, reflects platelet size and indirectly indicates platelet reactivity. Larger platelets tend to exhibit greater enzymatic activity and are more actively involved in thrombotic and inflammatory pathways. Platelet indices have been explored in critical care settings as potential indicators of systemic illness burden, with several reports noting that higher MPV values often parallel worsening clinical status. [3–5]

Although interest in MPV has expanded across a range of acute conditions, evidence specific to AKI remains limited. Available studies suggest that elevated MPV, particularly in patients requiring renal replacement therapy, may be seen alongside more severe disease and poorer short-term outcomes. These observations raise the possibility that platelet activation reflects underlying disease processes contributing to progression rather than acting as an isolated laboratory finding. [6–8]

Given that MPV is inexpensive, widely available, and routinely measured, it may be useful for early risk assessment, especially in resource-constrained settings. However, its role in AKI remains unclear. This study was done to evaluate MPV in acute kidney injury patients, with additional emphasis on its behaviour across different outcome groups and varying degrees of disease severity.

MATERIALS AND METHODS

Study Design and Setting

This study was undertaken in the Department of Pathology at a tertiary care hospital between February 2024 and August 2025.

Study Population

All consecutive adult patients meeting the AKI criteria were considered for inclusion. A total of 100 patients were enrolled after applying predefined inclusion and exclusion criteria as per the Kidney Disease Improving Global

Outcomes (KDIGO) guidelines, defined by serum creatinine rise of ≥0.3 mg/dL within 48 hours, an increase to ≥1.5 times baseline within 7 days, or urine output <0.5 mL/kg/h for at least 6 hours.[1]

Sample Size Calculation

The sample size was calculated based on a previous study by Han et al., which reported a difference in MPV based on outcomes in acute kidney injury.[6] Using this as a reference and assuming a 95% confidence level and 80% power, the minimum sample size required was approximately 92 patients. Hence, 100 patients were included to improve statistical validity and maintain uniformity(**Figure 1)**.

Inclusion Criteria

Patients aged more than 18 years diagnosed with acute kidney injury according to KDIGO criteria were included in the study.

Exclusion Criteria

Patients with chronic kidney disease, haematological disorders, chronic liver disease, malignancy, platelet disorders, or those receiving antiplatelet therapy were excluded. Patients with missing laboratory values were also excluded from the study.

Data Collection

Demographic and clinical data, including age and sex, were recorded. Laboratory parameters, including platelet count, serum creatinine, and blood urea, were obtained from hospital records. Mean platelet volume was also measured at the same time using an automated haematology analyser as part of a complete blood count.

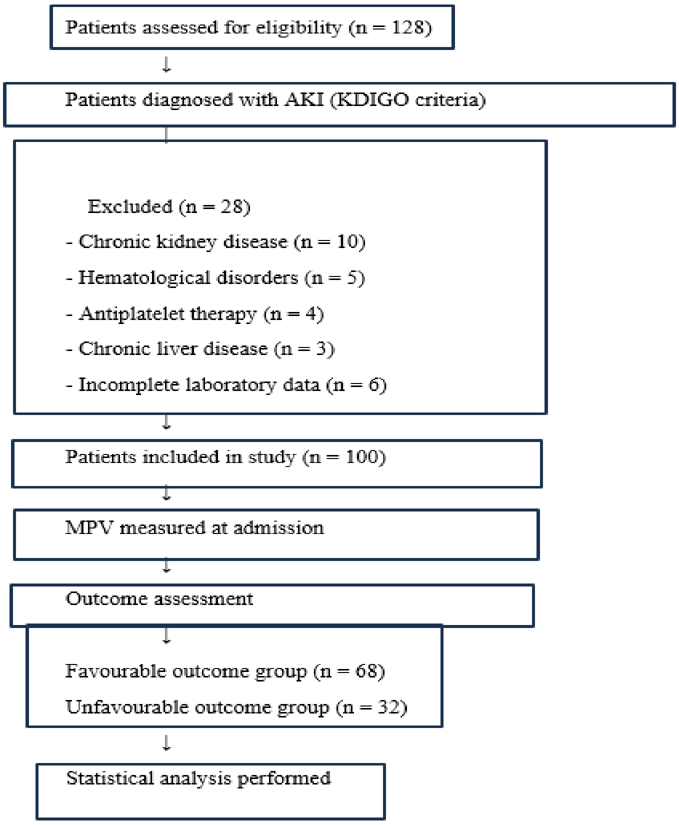
Outcome Measures

Patients were categorised into favourable- and unfavourable-outcome groups. The KDIGO staging criteria (Stages 1–3) were used, although a separate staging-based analysis was not performed in the present study.[1] A favourable outcome was defined as recovery of renal function without the requirement of dialysis. Unfavourable outcomes included patients requiring dialysis and/or in-hospital mortality. [6,9] The main outcome was to ascertain the relationship between the disease prognosis and MPV. Secondary outcomes included variation in MPV across outcome groups and its relevance to disease severity.

Statistical Analysis

Data were analysed using SPSS software. Appropriate statistical tests were used. A p-value <0.05 was considered significant.

Figure 1 – Study Flow Diagram



RESULTS

There were 100 patients included in the study with an average age of 54.2 years ,with some evident male predominance (Table 1). Patients were categorised into favourable and unfavourable outcome groups based on clinical outcome.

Baseline Characteristics

Of the 100 patients, 68 had a favourable outcome and 32 an unfavourable one.

Table 1. Demographics of the patients with acute kidney injury

Variable	Favourable outcome (n = 68)	Unfavourable outcome (n = 32)	Test statistic	p value
Age (years), mean ± SD	51.3 ± 15.2	60.1 ± 17.4	t = 2.58	0.02
Male, n (%)	40 (58.8%)	20 (62.5%)	χ^2 = 0.12	0.71
Female, n (%)	28 (41.2%)	12 (37.5%)	—	—
Serum creatinine (mg/dL), mean ± SD	2.6 ± 0.9	4.1 ± 1.3	t = 5.90	<0.001
Platelet count ($\times 10^9$/L), mean ± SD	235 ± 64	210 ± 58	t = 1.92	0.08
MPV (fL), mean ± SD	8.5 ± 0.9	11.0 ± 1.2	t = 11.20	<0.001

Mean Platelet Volume and Clinical Outcome

Mean platelet volume was higher in patients with an unfavourable outcome. This difference was statistically significant (Table 2).

Table 2. MPV between outcome groups

Outcome group	Number of patients	MPV (fL), mean ± SD	Test statistic	p value
Favourable outcome	68	8.5 ± 0.9		
Unfavourable outcome	32	11.0 ± 1.2	t = 11.20	<0.001

MPV Categories and Outcome

Patients were further categorized based on MPV values. Higher values were associated with a greater proportion of unfavourable outcomes, whereas lower MPV was predominantly seen in patients with favourable outcomes. The distribution of outcomes according to MPV categories is shown in Table 3.

Table 3. Distribution of outcome according to MPV categories

MPV (fL)	Favorable outcome	Unfavorable outcome	Total
<9.0	32	2	34
9.0–10.5	28	10	38
>10.5	8	20	28
Total	68	32	100

MPV and Disease Severity

Higher mean platelet volume values were observed in patients with more severe disease state. Patients with an unfavourable outcome had higher MPV and serum creatinine levels (Table 4).

Table 4. Association of mean platelet volume with disease severity

Variable	Favourable outcome	Unfavourable outcome	Test statistic	p value
MPV (fL), mean ± SD	8.5 ± 0.9	11.0 ± 1.2	t = 11.20	<0.001
Serum creatinine (mg/dL), mean ± SD	2.6 ± 0.9	4.1 ± 1.3	t = 5.90	<0.001
Platelet count ($\times 10^9$/L), mean ± SD	235 ± 64	210 ± 58	t = 1.92	0.08

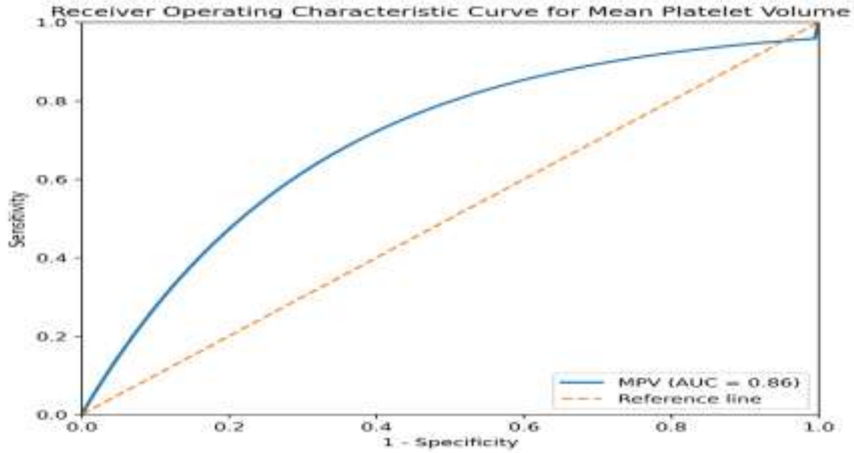
ROC Analysis

Receiver operating characteristic curve analysis was performed to evaluate MPV's ability to discriminate between favourable and unfavourable outcomes. AUC for MPV was 0.86, indicating good predictive ability. An MPV cut-off value of 10.2 fL showed 78.1% sensitivity and 82.4% specificity for predicting an unfavourable outcome. The ROC analysis are presented in **Table 5** and **Figure 2**.

Table 5: Receiver operating characteristic analysis for predicting unfavourable outcome

Parameter	Value
AUC	**0.86**
95% CI	**0.78–0.93**
Cut-off value (fL)	**10.2**
Sensitivity (%)	**78.1**
Specificity (%)	**82.4**
p value	**<0.001**

Figure 2. ROC curve



DISCUSSION

Patients with poorer clinical outcomes showed higher mean platelet volume values, whereas those with more favourable outcomes had lower values. This pattern indicates that increased platelet size may be associated with a worse clinical course in acute kidney injury. Larger platelets are known to be more active biologically and may reflect an enhanced inflammatory and prothrombotic state, which could contribute to disease progression. Similar trends were seen in earlier studies evaluating platelet indices in critically ill populations.[3,4]

Patients with worse prognosis were generally older, which aligns with the already recognised influence of age on recovery. Reduced renal reserve and a higher burden of comorbid illness in older individuals may contribute to this pattern. In addition, greater disease severity, reflected by higher serum creatinine levels, was observed in this group, supporting its association with adverse clinical course. Similar relationships among age, renal dysfunction severity, and outcome have been reported in previous studies.[2,9]

The MPV in this cohort is consistent with its prognostic significance in acute kidney injury as reported in earlier studies. Elevated values have been associated with a greater likelihood of poor outcomes, particularly in patients requiring renal replacement therapy. This consistency across studies supports the concept that platelet activation may play a role in the underlying pathophysiology, potentially contributing to microvascular dysfunction and worsening renal injury.[6–8]

When mean platelet volume was examined by category, higher values were associated with a greater proportion of unfavourable outcomes, whereas lower values were seen in patients with a favourable course. (Table 3) This stepwise pattern suggests that increasing platelet size may parallel worsening clinical status rather than acting as an isolated finding.

Patients with unfavourable outcomes had raised serum creatinine levels, reflecting more severe renal dysfunction. This aligns with the expected relationship between the extent of kidney injury and clinical course, where greater impairment is more likely to require dialysis and delay recovery, as observed in previous studies.[2,9]

Receiver operating characteristic analysis showed that mean platelet volume had good discriminatory ability for identifying patients with unfavourable outcomes, with an AUC of 0.86 (Table 5, Figure 2). At the observed cut-off, both sensitivity and specificity were reasonably high, suggesting that MPV may have practical value in early risk stratification, as found in earlier studies.[6,10,11]

Platelet count did not differ significantly between outcome groups, whereas MPV showed a clear separation. This suggests that platelet size, rather than absolute count, may better reflect underlying platelet activity, as reported in studies evaluating platelet indices in inflammatory and critical care conditions.[3,5]

Taken together, these findings suggest that mean platelet volume may help identify patients at higher risk of an unfavourable course of acute kidney injury. As it is routinely available standard laboratory testing, it could be considered alongside other clinical parameters for early risk assessment. Similar observations have been noted in recent studies evaluating MPV in critically ill populations.[12,13] However, it should be interpreted cautiously and in the context of overall clinical evaluation.

Strengths

A uniform definition of acute kidney injury based on KDIGO criteria was used to ensure consistent patient selection. Including clearly defined outcome groups made it possible to assess the significance of MPV. In addition, MPV values were obtained from routine laboratory investigations, reflecting real-world clinical applicability and improving the practical relevance of the findings.

Limitations

The study was limited by its retrospective design and reliance on hospital records. Serial measurements of mean platelet volume were unavailable, so dynamic changes in MPV could not be assessed. Other inflammatory markers were not included, which may have provided additional insight into the relationship between platelet activation and acute kidney injury. Regression analysis was not performed; therefore, the independent predictive value of MPV could not be established. It was a single-centre study, which may limit the interpretation of the results. In addition, potential confounding factors, including underlying comorbidities (e.g., sepsis, diabetes, and cardiovascular disease), inflammatory status, and medication use, were not adjusted for in the analysis. These factors may influence mean platelet volume and clinical outcomes and could have affected the observed associations.

Future Prospects

Further work with larger and more diverse patient groups would help clarify the clinical relevance of MPV in acute kidney injury. Evaluating changes in MPV over time may provide additional insight into its relationship with disease progression and recovery. Combining it with other clinical and laboratory parameters could improve its utility in risk assessment. Multicentre data may also help define more consistent thresholds for its use in routine practice.

CONCLUSION

Patients with unfavourable outcomes in acute kidney injury had higher mean platelet volume and appeared to reflect greater disease severity. As a routinely available parameter, it may offer practical value in early risk assessment. Its role, however, should be considered in conjunction with overall clinical evaluation.

REFERENCES

1. Khwaja A. KDIGO clinical practice guidelines for acute kidney injury. Nephron Clin Pract. 2012;120(4):c179–84.
2. Kellum JA, Lameire N; KDIGO AKI Guideline Work Group. Diagnosis, evaluation, and management of acute kidney injury: a KDIGO summary. Crit Care. 2013;17(1):204.
3. Gasparyan AY, Ayvazyan L, Mikhailidis DP, Kitas GD. Mean platelet volume: a link between thrombosis and inflammation? Curr Pharm Des. 2011;17(1):47–58.
4. Chu SG, Becker RC, Berger PB, Bhatt DL, Eikelboom JW, Konkle B, et al. Mean platelet volume as a predictor of cardiovascular risk: a systematic review and meta-analysis. J Thromb Haemost. 2010;8(1):148–56.
5. Li J, Li Y, Sheng X, Wang F, Cheng D, Jian G, et al. Combination of mean platelet volume/platelet count ratio and APACHE II score predicts outcome in patients with acute kidney injury receiving continuous renal replacement therapy. Kidney Blood Press Res. 2018;43(2):479–89.
6. Han JS, Park KS, Lee MJ, Kim CH, Bae EH, Ma SK, et al. Mean platelet volume is a prognostic factor in patients with acute kidney injury requiring continuous renal replacement therapy. J Crit Care. 2014;29(6):1016–21.
7. Tunca O, Yıldırım T, Demir M, et al. Mean platelet volume as a predictor of outcome in patients with acute kidney injury. Int Urol Nephrol. 2023.
8. Singh G, Kumar P, Sharma A, et al. Role of mean platelet volume as a prognostic marker in patients with acute kidney injury. Cureus. 2024;16:e70605.
9. Coca SG, Yusuf B, Shlipak MG, Garg AX, Parikh CR. Long-term risk of mortality and other adverse outcomes after acute kidney injury: a systematic review and meta-analysis. Am J Kidney Dis. 2009;53(6):961–73.
10. Vardon-Bounes F, Gratacap MP, Groyer S, Garcia C, Payrastre B, Minville V. Mean platelet volume in septic shock patients and its association with outcome. Platelets. 2019;30(3):372–7.
11. Lee MJ, Park JT, Park KS, et al. Mean platelet volume and mortality in patients with acute kidney injury requiring continuous renal replacement therapy. Kidney Res Clin Pract. 2015;34(4):211–6.
12. Tunca O, Yıldırım T, Demir M, et al. Mean platelet volume as a predictor of outcome in patients with acute kidney injury. *Int Urol Nephrol.* 2023.
13. Singh G, Kumar P, Sharma A, et al. Role of mean platelet volume as an indicator of disease severity and outcomes in acute kidney injury. *Cureus.* 2024;16:e70605.