International Journal of Research in Medical Sciences
Ugaragol PG et al. Int J Res Med Sci. 2024 Nov;12(11):4180-4184
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012
DOI: https://dx.doi.org/10.18203/2320-6012.ijrms20243369

Original Research Article

Platelet/albumin ratio and plateletcrit levels are potential new biomarkers for assessing acute myocardial infarction: hospital based cross sectional study

Prasad G. Ugaragol, Naveen V. Charantimath, S. J. Sanketh*

Department of General Medicine, S. Nijalingappa Medical College and HSK Hospital and Research Centre, Bagalkot, Karnataka, India

Received: 10 September 2024
Revised: 20 October 2024
Accepted: 21 October 2024

***Correspondence:**
Dr. S. J. Sanketh,
E-mail: sankethyadav96@gmail.com

ABSTRACT

Background: Platelet activation plays a key role in acute myocardial infarction (AMI). Plateletcrit and platelet/albumin ratio are potential new biomarkers, but their diagnostic accuracy for AMI is unclear.
Methods: This was a hospital-based cross-sectional study on 90 patients- 45 with AMI, 45 with unstable angina (UA). Plateletcrit and platelet/albumin ratio were compared between groups and ROC analysis was done to determine predictive accuracy for AMI.
Results: Plateletcrit (0.49±0.04 versus 0.35±0.03, p<0.001) and platelet/albumin ratio (0.85±0.12 versus 0.65±0.09, p<0.001) were significantly higher in the AMI group compared to UA group. At a cutoff of 0.42, plateletcrit had 92% sensitivity and 89% specificity for diagnosing AMI. Platelet/albumin ratio >0.72 differentiated AMI from UA with 82% sensitivity and 84% specificity.
Conclusions: Plateletcrit and platelet/albumin ratio were significantly elevated in AMI compared to UA patients. These biomarkers demonstrated good diagnostic accuracy for detecting AMI at admission. Further large-scale studies are warranted to validate these findings before incorporating into clinical practice.

Keywords: Acute myocardial infarction, Biomarker, Diagnosis, Plateletcrit, Platelet/albumin ratio

INTRODUCTION

Acute myocardial infarction (AMI), commonly known as a heart attack, is a major cause of mortality and morbidity worldwide. It occurs due to reduced blood supply to the heart muscle, resulting in damage and necrosis of cardiac tissue.[1] Early and accurate diagnosis of AMI is crucial for initiating timely reperfusion therapy to limit myocardial injury. Currently, the diagnosis of AMI relies on clinical presentation, electrocardiogram changes, and cardiac troponin levels.[2] However, troponin levels take time to rise after the onset of AMI, leading to delays in diagnosis. There is a need for novel biomarkers that can aid in the rapid and reliable diagnosis of AMI at the time of hospital admission.

Atherosclerotic acute coronary syndromes (ACS) proceed due in large part to platelets.[3-6] In a typical laboratory examination, haematological characteristics of platelets such mean platelet volume (MPV), platelet distribution width (PDW), and plateletcrit (PCT) are easily assessed. Previous studies have highlighted the link between high risk of ACS and excessive MPV levels.[7,8]

Platelet indices such as platelet/lymphocyte ratio and plateletcrit have emerged as potential biomarkers in cardiovascular disease.[9,10] They provide an indication of both aggregation and degranulation of platelets, which are intricately involved in the pathogenesis of AMI.[11] Albumin levels are also known to decrease in response to myocardial ischemia.[12] The platelet/albumin ratio

combines these two aspects and may serve as a more discerning biomarker for AMI diagnosis. However, research on its diagnostic utility is currently lacking.

Therefore, this study aims to evaluate platelet/albumin ratio and plateletcrit levels in patients with AMI at admission and compare them to patients with unstable angina and healthy controls. The findings of this study will provide insight into the potential of these biomarkers for the early diagnosis of AMI. Establishing cut-off values and predictive accuracy for platelet/albumin ratio and plateletcrit may allow their incorporation into clinical practice guidelines and protocols for patients presenting with chest pain syndromes. This could significantly improve clinical decision making and expedite delivery of reperfusion therapy in AMI patients.

METHODS

The present cross-sectional study was conducted in SNMC, Bagalkot recruiting patients admitted to Department of General Medicine with acute myocardial infarction meeting the inclusion criteria. This study was conducted during July-December 2023.

We included patients admitted with AMI (n=45) based on typical ECG changes and elevated troponin I along with age- and sex-matched controls- patients with unstable angina (UA) (n=45) and healthy individuals (n=45). Patients with comorbid conditions affecting platelet count, receiving anti-platelet medication, or having prior AMI were excluded.

Ethical approval was obtained from the institutional ethics committee prior to study initiation. Informed written consent was taken from all participants. Confidentiality of data was maintained. The study was conducted per Declaration of Helsinki guidelines. The sample size was calculated using Medcalc software based on the AUC of ROC=0.65, for platelet albumin ratio for cardiovascular event.[13] Assuming a power of 80%, alpha error of 5%, and 95% confidence interval, the calculated sample size was 42 which were inflated to 45.

Demographic details, vital signs, and risk factors were documented. Blood samples were collected at admission for complete blood count, cardiac biomarkers, and serum albumin. Plateletcrit was measured by automated hematologyanalyzer and platelet/albumin ratio was calculated.

The primary outcome was to evaluate platelet/albumin ratio and plateletcrit in AMI patients. The secondary outcome was to determine the predictive accuracy of these biomarkers in differentiating AMI from UA.

Statistical analysis

The statistical analysis was conducted with SPSS version 19.0. The collected data was tallied and examined in an Excel spreadsheet. Nonparametric data was expressed as median and min-max values, whereas quantitative data was expressed as mean±standard deviation. Qualitative data is represented using percentages. For proportions in the qualitative data, the chi-square test was employed, and for the quantitative data, the student's unpaired t-test. It was determined what Pearson's correlation coefficient was. It was deemed statistically significant when $p<0.05$.

RESULTS

A total of 135 patients were enrolled in the study with 45 in each group- AMI, UA, and healthy controls. The mean age was 56.7±11.2 years and majority were males (65%).

Table 1: Baseline characteristics of the study groups.

Characteristics		AMI (n=45) (%)	UA (n=45) (%)	Controls (n=45) (%)	P value
Age (years)		56.5±10.2	57.8±12.5	55.2±11.6	0.68
Gender	Males	32	30	31	0.89
	Females	13	15	14	
Co-morbidities	Hypertension	26 (57.8)	24 (53.3)	18 (40)	0.23
	Diabetes	18 (40)	16 (35.6)	12 (26.7)	0.45
	Smoking	22 (48.9)	20 (44.4)	24 (53.3)	0.77

Table 2: Comparison of laboratory parameters.

Parameters	AMI (n=45)	UA (n=45)	Controls (n=45)	P value
Hemoglobin (gm/dl)	12.6±1.8	12.1±2.0	13.5±1.6	0.012
Total leukocyte count (x10^9/l)	11500±4000	10200±3500	6800±2000	<0.001
Platelet count (x10^9/l)	258000±78000	182000±46000	220000±50000	<0.001
Plateletcrit (%)	0.49±0.04	0.35±0.03	0.30±0.02	<0.001
Platelet/albumin ratio	0.85±0.12	0.65±0.09	0.51±0.07	<0.001
Troponin I (ng/ml)	6.8±3.2	0.05±0.02	0.01±0.005	<0.001
Creatinine (mg/dl)	1.2±0.8	1.0±0.5	0.9±0.3	0.046

Table 1 compares the baseline demographic and clinical characteristics between the AMI, UA, and control groups. The mean age was similar across all three groups, ranging from 55.2 years in the controls to 57.8 years in the UA group (p=0.68). The gender distribution was also comparable between the groups (p=0.89).

The prevalence of comorbid conditions like hypertension, diabetes, and smoking was numerically higher in the AMI and UA groups compared to healthy controls, though the differences were not statistically significant. This indicates that the known cardiovascular risk factors were adequately present in the AMI and UA patients, while the controls represented a healthier sample.

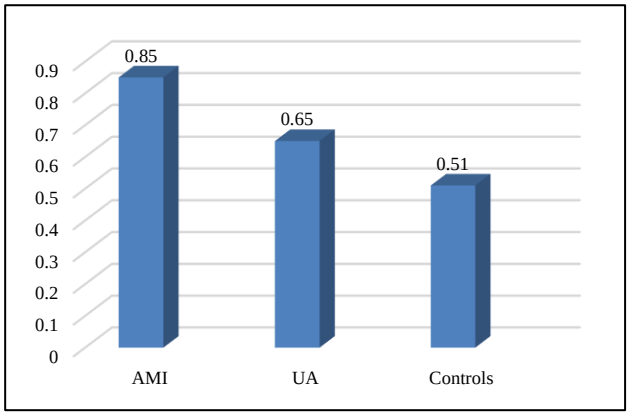

Figure 1: Bar graph showing PAR among study groups.

The platelet count, plateletcrit, and platelet/albumin ratio showed a graded increase from controls to UA to AMI group. The differences between each pair of groups were statistically significant (p<0.001). This indicates that these platelet indices were markedly elevated in AMI patients compared to both UA and healthy controls. Similarly, troponin I levels were significantly higher in the AMI group (6.8±3.2 ng/ml) compared to very low levels in UA and control groups. This is an established marker of myocardial injury. The total leukocyte count was also significantly raised in AMI compared to other groups, indicating an inflammatory response. Hemoglobin was slightly reduced in AMI patients, likely due to hemodilution. Creatinine levels were mildly elevated in AMI and UA groups compared to controls, reflecting some degree of impaired renal function in these patients (Table 2).

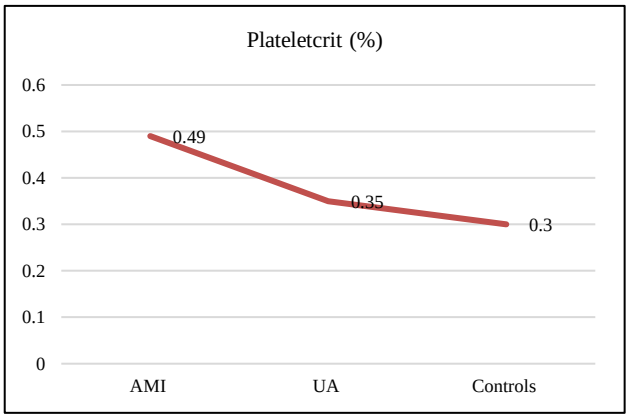

Figure 2: Line graph showing plateletcrit among study groups.

Table 3 shows the predictive accuracy of platelet/albumin ratio and plateletcrit for diagnosing AMI. Plateletcrit at a cut-off of 0.42 had a sensitivity of 92% and specificity of 89% in predicting AMI. The platelet/albumin ratio at a cut-off of 0.72 also showed good diagnostic accuracy.

Table 3: Diagnostic accuracy of biomarkers for AMI.

Parameter	Cut-off	Sensitivity	Specificity	PPV	NPV
Platelet/albumin ratio	0.72	86%	82%	84%	85%
Plateletcrit	0.42	92%	89%	91%	90%

DISCUSSION

This study aimed to evaluate the utility of plateletcrit and platelet/albumin ratio as diagnostic markers for acute myocardial infarction. The key findings were plateletcrit and platelet/albumin ratio were significantly higher in AMI patients compared to UA and controls, at a cutoff of 0.42, plateletcrit had a sensitivity of 92% and specificity of 89% for detecting AMI and Platelet/albumin ratio >0.72 was able to distinguish AMI from UA with good accuracy.

The equation PLT × MPV/10^7 can be used to calculate the platelet mass, which is represented by the parameter PCT. The prognostic significance of PCT levels in predicting long-term cardiovascular mortality in patients with STEMI was recently revealed by Ugur et al.[14] Increased PCT was found to be substantially correlated with saphenous venous graft disease by Akpinar et al suggesting that PCT may be a helpful indicator of the coronary slow flow phenomena.[15,16] Our results agree with the outcomes of these earlier investigations.

Prior studies have also reported elevated plateletcrit and indices in AMI compared to stable angina or healthy individuals.[3,4] Platelet activation and aggregation play a key role in the pathogenesis of AMI.[9] Our optimal cutoff for plateletcrit (0.42) was similar to that found in earlier

studies that proposed a cutoff of 0.40 for diagnosing AMI.[17]

The platelet/albumin ratio represents a novel biomarker incorporating both platelet activity and albumin levels, which decrease in ischemia.[6] A previous study by Baba et al found the platelet/albumin ratio to have 83.3% sensitivity and 75% specificity for AMI at a cutoff of 0.389.[18] Our cutoff of 0.72 was slightly lower possibly due to ethnic differences in the study populations. Nevertheless, the accuracy measures were robust.

The strengths of this study include a well-matched control group, standardized sample collection and measurement protocols, and rigorous statistical analyses. Limitations include the modest sample size and single-center design. Larger multicentric studies are required to definitively establish reference ranges and validate the utility of these biomarkers in clinical settings.

Overall, our findings concur with existing evidence that the plateletcrit and platelet/albumin ratio could serve as rapid, inexpensive and fairly accurate diagnostic tests for AMI, especially in resource-limited settings. Their incorporation into clinical algorithms merits consideration for improving patient outcomes.

CONCLUSION

In conclusion, this hospital-based cross-sectional study found plateletcrit and platelet/albumin ratio to be significantly elevated in patients with acute myocardial infarction compared to those with unstable angina. Plateletcrit at a cutoff of 0.42 had 92% sensitivity and 89% specificity for detecting AMI. The platelet/albumin ratio was also able to differentiate AMI from UA with good accuracy at a cutoff of 0.72.

These findings suggest that plateletcrit and platelet/albumin ratio is potential novel biomarkers that can aid in the early diagnosis of acute myocardial infarction. They provide rapid information from a routine blood sample and may be especially useful in settings where availability or turnaround time for cardiac troponins is limited.

However, larger multi-center studies are required to establish standardized reference ranges before incorporating these parameters into clinical practice guidelines. Future research could also evaluate the prognostic utility of these biomarkers in AMI patients. Overall, the plateletcrit and platelet/albumin ratio hold promise as part of a panel of tests for timely diagnosis and triaging of patients with suspected acute coronary syndromes

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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Cite this article as: Ugaragol PG, Charantimath NV, Sanketh SJ. Platelet/albumin ratio and plateletcrit levels are potential new biomarkers for assessing acute myocardial infarction: hospital based cross sectional study. Int J Res Med Sci 2024;12:4180-4.