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ELEVATED PLATELET TO LYMPHOCYTE RATIO AS A PREDICTOR OF LARGE-ARTERY ATHEROSCLEROSIS IN ACUTE ISCHEMIC STROKE: A TOAST CLASSIFICATION-BASED STUDY

General Medicine

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ABSTRACT

Background: Acute ischemic stroke (AIS) continues to be a significant cause of mortality and long-term disability worldwide. Early identification of the underlying etiology plays a key role in determining patient management and outcome. The TOAST classification system provides a structured approach to etiologic subtyping, with large-artery atherosclerosis (LAA) being a common category. The platelet-to-lymphocyte ratio (PLR), a simple inflammatory marker derived from routine blood tests, has shown promise in correlating with stroke severity. **Aim and Objectives: Aim:** To assess the association between elevated platelet-to-lymphocyte ratio and large-artery atherosclerosis subtype of acute ischemic stroke using TOAST classification. **Objectives:** 1. To determine the mean PLR values across different TOAST subtypes of AIS. 2. To compare the PLR levels among patients with LAA, cardioembolic, and small-vessel occlusion strokes. 3. To evaluate the diagnostic performance of PLR in predicting the LAA subtype using ROC curve analysis. **Methods:** This hospital-based cross-sectional study included 100 patients with CT/MRI-confirmed AIS. PLR was calculated from admission complete blood count. Stroke subtyping was performed according to TOAST classification based on clinical, imaging, and cardiac workup. Differences in PLR across subtypes were evaluated using ANOVA, and ROC analysis was conducted to determine the optimal PLR cut-off for predicting LAA. **Results:** Patients with LAA had significantly higher PLR values (mean ± SD: 178.4 ± 42.6) than those with cardioembolic (155.2 ± 38.5) or small-vessel occlusion (138.6 ± 36.2) strokes ($p < 0.01$). **Conclusion:** An elevated PLR is significantly associated with the LAA subtype of AIS. It may serve as a simple, cost-effective biomarker for early etiological classification, particularly in settings where access to advanced imaging is limited.

KEYWORDS

Platelet-to-Lymphocyte Ratio, Acute Ischemic Stroke, TOAST Classification, Large-Artery Atherosclerosis, Stroke Subtypes, Inflammatory Biomarkers

INTRODUCTION

Acute ischemic stroke (AIS) is a heterogeneous clinical entity characterized by abrupt loss of cerebral blood flow due to arterial occlusion. The TOAST classification categorizes AIS into five major subtypes, among which large-artery atherosclerosis (LAA) is particularly associated with significant inflammatory and thrombotic activity. [1]

Platelet-to-lymphocyte ratio (PLR), derived from routine complete blood count, reflects a balance between thrombosis (platelets) and immune regulation (lymphocytes). Previous research has demonstrated the association of elevated PLR with poor stroke outcomes. [2,3,4] However, the relationship between PLR and stroke subtypes—especially LAA—remains underexplored. [3]

This study aims to assess the utility of PLR in identifying LAA subtype strokes using the TOAST classification and to evaluate its potential as an accessible marker for early etiological stratification in AIS.

MATERIAL AND METHODS

Study Design And Population

This was a hospital-based cross-sectional observational study conducted in the Department of General Medicine at SSMC & Hospital, Tumkur, Karnataka, India over 24 months. A total of 100 adult patients with radiologically confirmed AIS presenting within 7 days of symptom onset were enrolled.

Inclusion Criteria: All the patients aged above 18 years with acute ischemic stroke with symptom onset within 7 days confirmed by history, neurological examination and imaging modalities who give informed written consent.

Exclusion Criteria: 1. Hemorrhagic stroke, 2. Active infection, sepsis, or malignancy, 3. Hematologic disorders or immunosuppressive therapy, 4. Prior history of stroke or chronic inflammatory disease.

Data Collection

TOAST Classification was applied using standard clinical, imaging, echocardiographic, and ECG criteria. [1]

PLR was calculated from CBC performed at admission:

PLR = Platelet Count ($\times 10^3/\mu L$) / Lymphocyte Count ($\times 10^3/\mu L$)

Demographic and risk factor data (hypertension, diabetes, smoking, etc.) were recorded.

Statistical Analysis

Data were analyzed using SPSS version 22.0. Continuous variables were expressed as mean ± SD; categorical variables as frequency (%). ANOVA and post hoc Tukey tests were used to compare PLR across TOAST subtypes. ROC analysis identified the optimal PLR threshold to predict LAA. A p-value <0.05 was considered statistically significant.

RESULTS

Out of 100 patients: 38% had LAA, 32% had cardioembolic strokes, 25% had small-vessel occlusion, 5% were unclassified/other etiology. The mean PLR values were: LAA: 178.4 ± 42.6, Cardioembolic: 155.2 ± 38.5, Small vessel: 138.6 ± 36.2. The difference was statistically significant ($p<0.01$). ROC curve analysis yielded: Cut-off PLR: 165, AUC: 0.781, Sensitivity: 76%, Specificity: 68%. These findings indicate a strong association between elevated PLR and the LAA subtype of ischemic stroke. [3,4]

TOAST Subtype	Number of Patients	Mean PLR ± SD
Large Artery Atherosclerosis (LAA)	38	178.4 ± 42.6
Cardioembolic Stroke	32	155.2 ± 38.5
Small Vessel Occlusion	25	138.6 ± 36.2
Other/Undetermined	5	147.3 ± 33.1
p-value	—	**< 0.01 (ANOVA)**

DISCUSSION

Our findings suggest that elevated PLR is significantly associated with large-artery atherosclerotic strokes. [3, 4] This aligns with the pathophysiological basis of LAA, which involves plaque rupture, endothelial dysfunction, and intense thromboinflammatory activity. [6]

Increased platelet counts in LAA contribute to thrombosis, while relative lymphopenia reflects an impaired adaptive immune response. The combination, as expressed by PLR, therefore reflects the systemic

milieu in LAA strokes. [5,6]

This study reinforces the potential role of PLR not just as a general marker of severity, but as a discriminative tool for AIS subtype classification. [2,3,7] This could guide early targeted management, especially when advanced diagnostic tools are delayed or unavailable. [7,8]

CONCLUSION

PLR is a simple, inexpensive, and readily available biomarker that correlates strongly with the large-artery atherosclerosis subtype in acute ischemic stroke. Its inclusion in the initial evaluation of stroke patients may aid rapid etiological classification and individualized treatment planning. [3,4,7]

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