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STUDY OF NEUTROPHIL-LYMPHOCYTE RATIO IN ACUTE STROKE

General Medicine

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ABSTRACT

Stroke is the second leading cause of death worldwide and is defined as the abrupt onset of neurological deficit attributable to a focal vascular cause, leading to cerebral ischemia or hemorrhage. Inflammatory mechanisms play a key role in the pathogenesis of acute stroke, with recruitment of various inflammatory cells to the ischemic brain tissue. The neutrophil-to-lymphocyte ratio (NLR) is a simple and cost-effective biomarker reflecting the balance between systemic inflammation and oxidative stress.**Objectives:** To assess NLR in patients with acute stroke at the time of initial evaluation in the emergency department.**Methodology:** This cross-sectional study included 50 patients aged 18–80 years presenting with acute stroke. All patients underwent detailed clinical evaluation, neuroimaging, and laboratory investigations. Data were analyzed using descriptive statistics, with statistical significance set at $p<0.05$.**Results:** Among the study population, 72% were males and 28% females. Elevated NLR (>3) was observed in 66% of patients. Among ischemic stroke patients, 54% had elevated NLR, whereas 79% of hemorrhagic stroke patients showed elevated NLR. Moderate to high NLR was seen in 43% of ischemic and 74% of hemorrhagic stroke patients. Very high NLR (>18) was observed in 3 patients with hemorrhagic stroke. Higher NLR values were noted in elderly patients, those with long-standing diabetes, hypertension, and active smokers.**Conclusions:** Acute stroke is associated with a systemic inflammatory response. NLR measured early in the course of stroke is higher in hemorrhagic stroke compared to ischemic stroke, suggesting a greater degree of inflammation and oxidative stress. NLR may serve as a simple and useful prognostic biomarker in acute stroke

KEYWORDS

INTRODUCTION

Stroke is a major cause of mortality and morbidity worldwide and ranks as the second leading cause of death globally. It is defined as the sudden onset of neurological deficit resulting from a focal disturbance in cerebral blood circulation, leading to ischemic or hemorrhagic injury.

Inflammation plays a central role in the pathophysiology of acute stroke. Following cerebral ischemia or hemorrhage, there is activation of the immune system with recruitment of inflammatory cells such as neutrophils and lymphocytes to the site of injury. Neutrophils contribute to tissue damage through the release of reactive oxygen species and proteolytic enzymes, whereas lymphocytes modulate the immune response.

The neutrophil-to-lymphocyte ratio (NLR), derived from routine complete blood count, integrates these opposing immune pathways and serves as an indicator of systemic inflammation and oxidative stress. Recent studies suggest that NLR may be useful in predicting severity and outcomes in acute stroke.

This study aims to evaluate the role of NLR in patients presenting with acute stroke.

METHODOLOGY

This was a cross-sectional study conducted in the Department of General Medicine at BGS GIMS.

A total of 50 patients aged between 18 and 80 years presenting with acute stroke were included in the study. All patients underwent detailed clinical history taking, neurological examination, radiological evaluation (CT/MRI brain), and laboratory investigations including complete blood count.

NLR was calculated from the differential leukocyte count obtained at the time of admission in the emergency department.

Inclusion Criteria:
Patients aged 18–80 years
Clinically and radiologically confirmed acute stroke

Exclusion Criteria:
Patients with active infections
Malignancy
Autoimmune disorders
Chronic inflammatory conditions

Data were analyzed using descriptive and inferential statistical methods. Chi-square test was used for categorical variables and an independent t-test was used for comparison of means. A p-value <0.05 was considered statistically significant.

RESULTS

In this study, 72% of patients were males and 28% were females.

Table1 DEMOGRAPHIC PROFILE

Parameter	Number (n=50)	Percentage (%)
Male	36	72%
Female	14	28%

Elevated NLR (>3) was observed in 66% of the study population.

Table 2 Distribution of NLR

NLR Category	Definition	Number	Percentage (%)
Normal	<3	17	34%
Elevated	>3	33	66%

Among ischemic stroke patients:
54% had elevated NLR
43% had moderate to high NLR
Among hemorrhagic stroke patients:
79% had elevated NLR
74% had moderate to high NLR
3 patients had very high NLR (>18)

Table 3 NLR in Stroke Types

Parameter	Ischemic Stroke	Hemorrhagic Stroke
Elevated NLR (>3)	54%	79%
Moderate–High NLR	43%	74%
Very High NLR (>18)	0	3 cases

On statistical analysis using the Chi-square test, elevated NLR was found to be significantly higher in patients with hemorrhagic stroke compared to ischemic stroke (79% vs 54%, $p = 0.045$).

Table 4 Comparison of Elevated NLR Between Ischemic and Hemorrhagic Stroke

Stroke Type	Elevated NLR (>3)	Normal NLR (<3)	Total
Ischemic Stroke	14 (54%)	12 (46%)	26

Hemorrhagic Stroke	19 (79%)	5 (21%)	24
Total	**33**	**17**	**50**

Chi-square value = 4.02
p-value = 0.045 (statistically significant)

Higher NLR values were observed in elderly patients, patients with long-standing diabetes mellitus, hypertension, and active smokers.

Table 5 Risk Factors Associated with High NLR

Risk Factor	Association
Elderly age	Present
Diabetes Mellitus	Present
Hypertension	Present
Smoking	Present

These findings suggest a higher inflammatory burden in hemorrhagic stroke compared to ischemic stroke.

No statistically significant association was found between individual risk factors and NLR values, although higher trends were observed in elderly patients, diabetics, hypertensives, and smokers.

DISCUSSION

This study demonstrates that NLR is significantly elevated in patients with acute stroke, particularly in those with hemorrhagic stroke. The higher NLR observed in hemorrhagic stroke may be attributed to a more intense inflammatory cascade triggered by blood extravasation and tissue injury.

Neutrophils contribute to early brain injury through the release of inflammatory mediators and oxidative stress, while lymphopenia reflects stress-induced immunosuppression. Thus, an elevated NLR represents a combined effect of increased inflammation and reduced immune regulation.

The association of higher NLR with risk factors such as diabetes, hypertension, smoking, and advanced age further supports its role as a marker of systemic vascular inflammation.

Given its simplicity, low cost, and widespread availability, NLR can be easily incorporated into routine clinical assessment, especially in resource-limited settings.

CONCLUSIONS

NLR is a simple, inexpensive, and readily available biomarker that reflects systemic inflammation in acute stroke.

Higher NLR values in hemorrhagic stroke indicate a more severe inflammatory and oxidative response compared to ischemic stroke.

NLR may be used as an early prognostic marker and can aid in risk stratification and clinical decision-making in patients with acute stroke.

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