Section: Medicine

Original Research Article

NEUTROPHIL-TO-LYMPHOCYTE RATIO, SEVERITY OF STROKE, AND SHORT-TERM OUTCOMES IN STROKE PATIENTS: A HOSPITAL-BASED OBSERVATIONAL STUDY

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Received *: 20/07/2025*
Received in revised form *: 05/09/2025*
Accepted *: 27/09/2025*

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DOI: 10.70034/ijmedph.2025.4.358

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (4); 1996-1999

ABSTRACT

Background: Stroke is the second most common cause of death all over the world. It is responsible for 6.2 million fatalities in 2015, which is an increase of 830,000 compared to the year 2000. In this study Neutrophil-to-Lymphocyte Ratio (NLR) has been used as a vital biomarker for predicting short-term mortality in stroke patients during emergency admissions. It is a straightforward, easily accessible, and cost-effective test. The aim is to determine the association of NLR with severity and short-term outcomes of stroke among hospitalized stroke patients.

Materials and Methods: A one-year hospital-based observational study was carried out involving 80 stroke patients admitted to the medicine ward of AMCH. The severity of the stroke was assessed using the SSS score at the time of admission. Upon discharge, the functional outcomes of the survivors were evaluated using the mRS.

Results: Among the 80 patients, the average age was 53.65 ± 12.86 years. The statistical analysis revealed a negative correlation between the SSS score and NLR ($r = -0.858$, $p < 0.001$). Conversely, there was a positive correlation between mRS grades and NLR ($r = 0.839$, $p < 0.001$). The mean NLR for the 63 surviving patients was 8.33 ± 4.62, while for the 17 patients who died, it was 20.71 ± 7.97.

Conclusion: Patients who succumbed to the condition had higher mean NLR values compared to those who survived when assessed within 24 hours of hospital admission. An elevated NLR is associated with worse outcomes. Prioritizing targeted therapy for patients with high NLR at admission could help reduce mortality and post-stroke complications.

Keywords: NLR: Neutrophil to Lymphocyte Ratio, SSS: Scandinavian Stroke Scale, mRS: Modified Rankin Scale, AMCH: Assam Medical College Hospital.

INTRODUCTION

Over the past two decades, India has undergone notable economic, demographic, and epidemiological shifts. This has led to increased life expectancy and a growing elderly population. According to a study by Kamalakannan et al. (2017), the prevalence of stroke in India is 559 per 1,000 individuals, or 0.5%. Kamalakannan and colleagues highlighted that stroke is a major global public health concern.[1]

A "stroke" or cerebrovascular accident (CVA) occurs when a localized vascular issue leads to a sudden onset of neurological deficits. Laboratory tests, including brain imaging, help confirm the diagnosis. The brain's intricate vascular and structural composition contributes to the diverse clinical manifestations of stroke. Cerebral ischemia occurs

when blood flow is reduced for more than a few seconds. Since neurons lack glycogen, they rapidly deplete their energy, leading to the quick onset of neurological symptoms. If blood flow is interrupted for several minutes, brain tissue infarction or death ensues.[2]

The neutrophil-to-lymphocyte ratio (NLR) is the most critical parameter in this study. Lok et al. highlight its importance as a key biomarker for predicting short-term mortality in stroke patients upon emergency admission. NLR is particularly valuable due to its simplicity, accessibility, and cost-effectiveness. Inflammatory processes become evident within 6 to 24 hours following vascular disease onset, playing a crucial role in ischemic damage. Elevated NLR levels in acute ischemic stroke (AIS) are strongly linked to vascular inflammation, with a direct correlation between NLR and infarct volume. Neutrophils may contribute to brain injury indirectly by obstructing cerebral micro vessels, leading to infarct expansion, or by releasing neurotoxic substances and inflammatory mediators into the ischemic penumbra.[3]

The neutrophil-to-lymphocyte ratio (NLR) has emerged as a novel biomarker for assessing an individual's systemic inflammatory status. It is particularly useful in evaluating patients with conditions such as cancer, peripheral vascular disease, and cardiovascular disease. Additionally, NLR serves as a valuable predictor of prognosis in individuals with acute ischemic stroke (AIS). In emergency care and acute stroke scenarios, NLR plays a vital role in forecasting patient outcomes. To fully utilize its predictive capabilities, appropriate clinical decision-making models and tools are necessary. These can aid in identifying and monitoring high-risk patients, facilitating early intervention, and ultimately improving treatment outcomes. Notably, patients with intracerebral haemorrhage (ICH) exhibit higher mortality rates when NLR levels are elevated. Furthermore, NLR can effectively predict the 30-day prognosis for individuals with ICH.

MATERIALS AND METHODS

This hospital-based observational study was carried out in the Department of Medicine at Assam Medical College and Hospital over a one-year period, from March 1, 2023, to February 29, 2024.The study population included all stroke patients who were admitted in the medicine ward of the institution. Participants more than 13 years old, irrespective of gender, with a confirmed stroke diagnosis based on clinical evaluation and radiological findings were included in the study. Additionally, patients who provided informed consent were included in the study. If a patient was unable to give consent, it was obtained from an authorized informant.

Exclusion criteria encompassed individuals below 13 years of age, those with a previous history of stroke, recent infections, haematological disorders, pre-diabetic or diabetic conditions, immunosuppressive therapy recipients, individuals who had undergone recent major surgery or experienced significant trauma, and those who declined to provide informed consent.

The sample size was determined based on a 95% confidence interval, with an absolute precision of 10%. Given that approximately 24.9% of stroke patients exhibit a high neutrophil-to-lymphocyte ratio (NLR), the estimated required sample size was 72. However, to minimize the margin of error, the final sample size was tentatively increased to 80 participants.

RESULTS

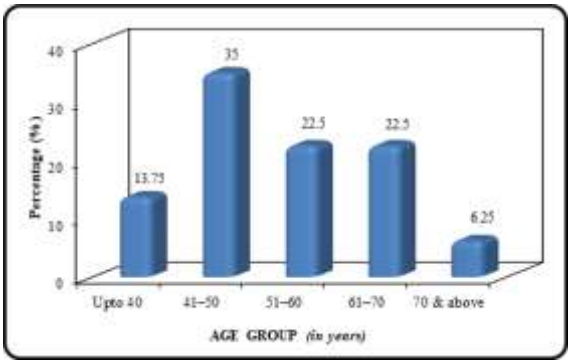

Figure 1: Showing Age Distribution

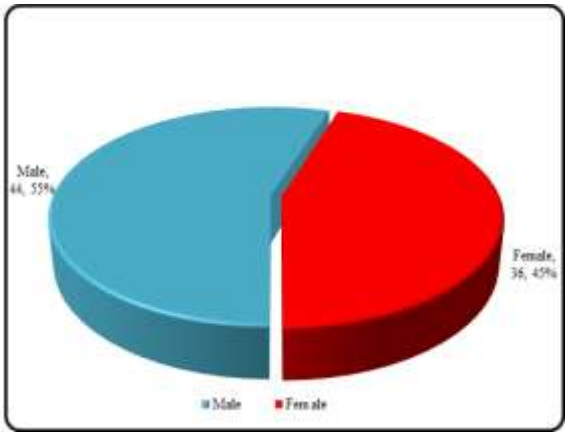

Figure 2: Showing Gender Distribution

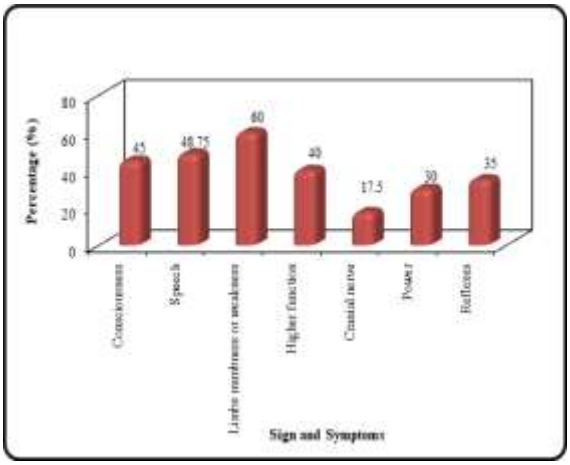

Figure 3: Showing Sign and Symptoms

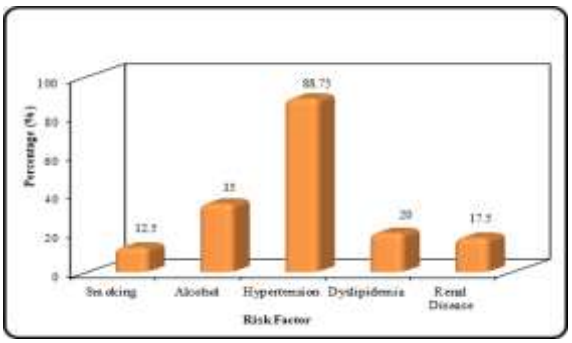

Figure 4: Showing Risk Factor

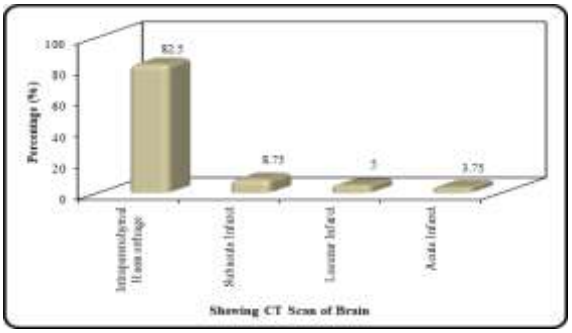

Figure 5: Showing CT Scan of Brain

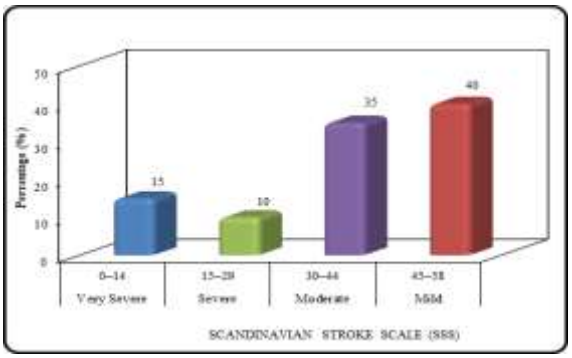

Figure 6: Scandinavian Stroke Scale

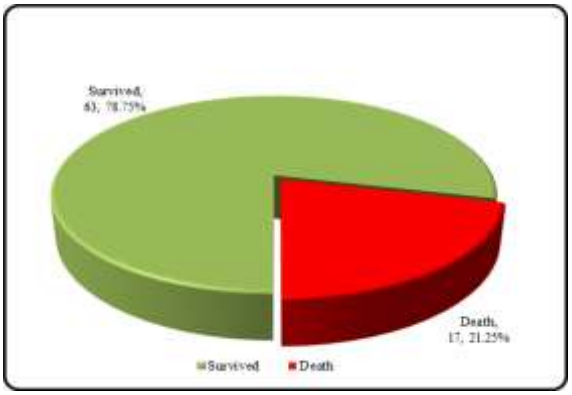

Figure 8: Showing Outcome

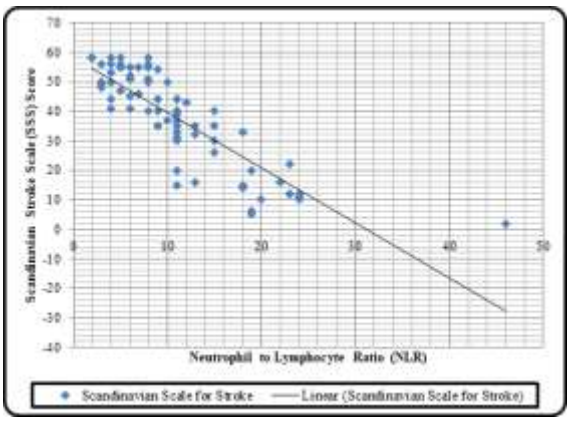

Figure 9: Correlation between NLR And Scandinavian Stroke Scale (SSS) Scores

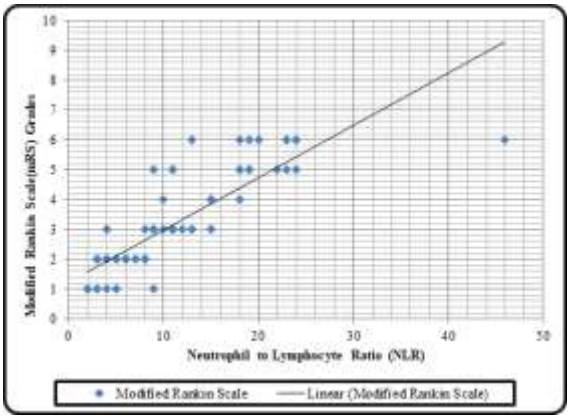

Figure 10: Correlation between NLR and Modified Rankin Scale (mRS) Grades

DISCUSSION

The study analyzed various clinical and demographic factors influencing stroke outcomes. The majority of patients were between 41–50 years (35%), with a mean age of 53.65 ± 12.86 years, comparable to similar studies. Males comprised 55% of the cohort, yielding a male-to-female ratio of 1.22:1, aligning with prior research showing varying degrees of male predominance. Clinically, limb numbness or weakness (60%) was the most prevalent symptom, followed by speech disturbances (48.75%), loss of consciousness (45%), altered cognitive function (40%), and abnormal reflexes (35%), while less frequent manifestations included abnormal motor power (30%) and cranial nerve palsy (17.5%). Risk factor analysis identified hypertension (88.75%) as the most common predisposing factor, followed by alcohol consumption (35%), dyslipidaemia (20%), renal disease (17.5%), and smoking (12.5%), consistent with previous studies that reported hypertension as the leading risk factor. CT scan findings revealed that 82.5% of patients had intraparenchymal haemorrhage, while ischemic events, including subacute infarcts (8.75%), lacunar infarcts (5%), and acute infarcts (3.75%), were less common, contrasting with studies such as Sridharan et al., where ischemic strokes were predominant. Stroke severity assessment using the Scandinavian

Stroke Scale (SSS) showed that 40% of patients had mild strokes (SSS: 45–58), 35% had moderate (30–44), 15% had very severe (0–14), and 10% had severe strokes (15–29), with a mean SSS score of 37.74 ± 16.24, which aligns with prior findings. Functional outcomes based on the Modified Rankin Scale (mRS) demonstrated that 27.5% had moderate disability (mRS grade 3), 26.25% had slight disability (grade 2), 21.25% did not survive (grade 6), while others experienced severe disability (11.25%), no significant disability (8.75%), or moderately severe disability (5%), with a mean mRS score of 3.16 ± 1.55, comparable to previous studies. The overall survival rate was 78.75%, while 21.25% of patients succumbed to stroke, which is consistent with prior studies reporting survival rates between 76% and 86.5%. Correlation analysis showed that survivors had a significantly higher mean SSS score of 44.29 ± 10.49, while non-survivors had a much lower score of 13.47 ± 8.97, reinforcing findings by Christensen et al., which indicated higher mortality risk in patients with SSS scores between 40–49 compared to those scoring above 49. Furthermore, a significant association was observed between neutrophil-to-lymphocyte ratio (NLR) and patient outcomes, with survivors having a mean NLR of 8.33 ± 4.62, while those who died exhibited a markedly elevated NLR of 20.71 ± 7.97. Higher NLR values were linked to poorer functional outcomes, consistent with studies like Zhang et al., which established an optimal NLR cutoff of 3.16 for predicting adverse prognosis.

CONCLUSION

This study found that patients who did not survive had significantly higher Neutrophil-to-Lymphocyte Ratio (NLR) values within the first 24 hours of hospital admission compared to those who survived. Additionally, a higher NLR was linked to worse clinical outcomes, indicating its potential as a prognostic marker in stroke patients.

The study demonstrated a positive correlation between NLR values and the Modified Rankin Scale (mRS) scores, meaning that as NLR increased, the level of post-stroke disability also worsened. Conversely, there was a negative correlation between NLR values and the Scandinavian Stroke Scale (SSS) scores, suggesting that higher NLR was associated with more severe strokes.

These findings emphasize the potential benefits of early targeted interventions for patients presenting with elevated NLR levels at admission. Prioritizing treatment for this high-risk group could help reduce mortality rates and post-stroke complications. Moreover, recognizing NLR as a prognostic marker may not only enhance end-of-life care planning but also assist families in preparing for possible adverse outcomes in critically ill stroke patients.

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