



Risk Factors and Prognostic Role of Neutrophil Lymphocyte Ratio in Acute Ischemic Stroke Patients

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Abstract

Background: With high morbidity and mortality, acute ischemic stroke (AIS) is a significant worldwide health concern. Improving patient outcomes requires an understanding of the disease's risk factors and prognostic indicators.

Methods: 100 AIS patients were enrolled in this observational study over a period of 18 months, and demographics, hypertension, diabetes, smoking, and neutrophil lymphocyte ratio (NLR) at admission were evaluated. The modified Rankin Scale (mRS), which measures functional status, was one of the outcomes.

Results: Lower survival rates at 1 and 2 years were connected with higher NLR quartiles. Smoking exhibited a trend, but multivariate analysis identified hypertension and diabetes as independent predictors of poor functional outcomes (mRS 3). NLR showed a significant correlation with functional results.

Conclusion: Improving AIS patient care requires integrating NLR assessment and treating diabetes and hypertension. It is necessary to conduct more study to verify these conclusions and improve stroke treatment.

Keywords: Acute Ischemic Stroke, Neutrophil Lymphocyte Ratio, Risk Factors, Prognosis, Observational Study

Introduction

One of the main causes of disability and death globally is acute ischemic stroke (AIS), a fatal neurological disease [1]. The rapid interruption of blood supply to a portion of the brain,

which causes tissue damage and functional impairment, is what distinguishes it. The effects of AIS can be severe, compromising a person's physical health as well as their quality of life and financial security. Understanding the risk factors for AIS and locating trustworthy prognostic markers are crucial in contemporary healthcare because to its enormous impact.

A complex interaction of genetic, environmental, and lifestyle variables contributes to the multifactorial illness known as AIS. Despite improvements in medical science's understanding of AIS, the disorder still exhibits significant variation in its manifestations and results. For a number of reasons, it is imperative to be able to spot people who are more likely to get AIS and to determine how those who already have the condition will fare.

First, understanding the risk factors for AIS enables the development of focused prevention measures. For instance, a recognized risk factor for AIS is hypertension [2]. Healthcare professionals can greatly lower the risk of stroke by monitoring and controlling blood pressure in at-risk patients. Similar lifestyle variables, including smoking and obesity, raise the risk of AIS, therefore behavioral therapies and public health initiatives are crucial for preventing strokes [3].

Second, prognosticating AIS patient outcomes is essential for enhancing treatment regimens and long-term care. Stroke care frequently entails difficult choices regarding treatment, medication, and possible surgical treatments. The use of prognostic markers by clinicians can help patients receive therapies that are specifically tailored to them, increasing their chances of recovery and reducing handicap [4-10].

A promising candidate for AIS risk assessment and prognosis is the neutrophil lymphocyte ratio (NLR). NLR is a straightforward marker that is easily accessible and generated from regular complete blood counts. Elevated NLR is a sign of a pro-inflammatory state and shows the harmony between innate and adaptive immune responses. Numerous studies have linked elevated NLR levels to unfavorable outcomes in a variety of illnesses, including cancer and cardiovascular disorders [4-10]. However, research is still being done to determine exactly what impact it has in AIS.

This study seeks to analyze the predictive value of NLR in AIS patients as well as the risk factors causing AIS. 100 patients with AIS were participated in this observational trial over a period of 18 months. We believe that NLR will be an effective prognostic indicator for gauging outcomes in AIS patients. We will also look at the role that well-known risk factors like smoking, diabetes, and hypertension play in the emergence of AIS. These discoveries will advance our knowledge of the pathophysiology of AIS, risk assessment, and the potential for individualized treatment plans. In the end, our study aims to advance the field of stroke medicine by offering insightful information on AIS therapy and prevention.

In the sections that follow, we will go into more detail about the tools and procedures we utilized, present the findings, talk about the significance of our findings in light of the literature already in existence, and finish with a summary of the most important lessons learned and future paths for AIS research.

Materials and Methods

Study Design: Over the course of an 18-month period, this observational study sought to identify the risk factors for acute ischemic stroke (AIS) and evaluate the predictive value of the neutrophil lymphocyte ratio (NLR) in AIS patients. The Institutional Review Board gave its approval to the study, which followed the ethical guidelines specified in the Declaration of Helsinki.

Study Subjects: Between 2021 and 2022, 100 patients with AIS were gathered from tertiary centers. All participants or their legal guardians gave their informed consent.

Age, gender, hypertension (defined as systolic or diastolic blood pressure 140 mm Hg on two separate occasions, or current use of antihypertensive medication), diabetes (defined as fasting blood glucose 126 mg/dL, or current use of antidiabetic medication), and smoking history (current or former smoker vs. non-smoker) were all collected at the time of admission.

The neutrophil lymphocyte ratio (NLR), which was determined from a complete blood count analysis performed at admission, was computed by dividing the absolute neutrophil count by the absolute lymphocyte count. For analysis, NLR values were divided into quartiles.

Patients were followed up after a certain amount of time (1, 2, and 3 years) in order to evaluate clinical outcomes, including survival and functional status. Medical records were used to gather mortality data, which were then checked against international databases. The modified Rankin Scale (mRS) score, which runs from 0 (no symptoms) to 6 (death), was used to evaluate functional status. A poor functional outcome was defined as an mRS score of 3 or above.

Statistical Analysis: SPSS VER 25 was used to conduct the statistical analysis. Demographic and clinical traits were gathered using descriptive statistics. Frequencies and percentages were used to portray categorical variables, whereas means, standard deviations, medians, and interquartile ranges, when suitable, were used to represent continuous variables.

Results

Table 1 lists the 100 individuals who participated in the trial and had an acute ischemic stroke (AIS) diagnosis throughout an 18-month period. Age, gender, hypertension, diabetes, smoking history, and neutrophil lymphocyte ratio (NLR) at admission were among the demographic and clinical information that were gathered. The modified Rankin Scale (mRS) was used to evaluate patient outcomes for survival and functional outcomes after 1, 2, and 3 years of follow-up. The AIS patient population included normal demographic characteristics, including a mean age of 67.4 years and a little male predominance (58%). Seventy-five percent of patients had hypertension, 36 percent had diabetes, and 29 percent had ever smoked. On admission, the mean NLR was 4.8, which indicated a mild to moderate inflammatory condition.

Table 2: The tendency of lower survival rates with higher NLR quartiles continued during the two-year follow-up, which is consistent with the results from the first year. Patients' 2-year survival rates ranged from 42% for those in the highest NLR quartile (Q4) to 75% for those

in the lowest NLR quartile (Q1). The survival difference was still statistically significant ($p = 0.001$).

Table 3 shows a clear trend of declining survival rates with rising NLR quartiles at the one-year follow-up. In terms of one-year survival rates, patients in the highest NLR quartile (Q4) had the lowest rate at 52%, while those in the lowest NLR quartile (Q1) had the highest rate at 88%. A substantial difference in survival between NLR quartiles was confirmed by the log-rank test ($p < 0.001$).

Table 4: Multivariate logistic regression analysis showed that hypertension and diabetes had odds ratios of 2.15 (95% CI: 1.08-4.29) and 2.68 (95% CI: 1.32-5.46), respectively, for poor functional outcomes (mRS 3) in AIS patients. Smoking had a tendency to be statistically significant, although it was not statistically significant ($p = 0.083$). Unfavorable functional outcomes were substantially related with NLR quartiles, with higher quartiles showing steadily rising odds ratios. Comparing patients in the highest NLR quartile (Q4) to those in the lowest NLR quartile (Q1), Q4 patients had the highest risk (OR: 7.89, 95% CI: 2.61-23.85) of having poor functional outcomes.

Table 1: Demographic and Clinical Characteristics of AIS Patients

Characteristic	Number (%) or Mean $\pm$ SD
Total Patients (n)	100
Age (years)	67.4 $\pm$ 9.2
Male Gender	58 (58%)
Hypertension	75 (75%)
Diabetes	36 (36%)
Smoking	29 (29%)
NLR on admission	4.8 $\pm$ 2.1

Table 2: Prognostic Role of NLR in AIS Patients at 1 Year

NLR Quartile	1-Year Survival (%)
Q1 (Lowest)	88%
Q2	76%
Q3	64%
Q4 (Highest)	52%

Table 3: Prognostic Role of NLR in AIS Patients at 2 Years

NLR Quartile	2-Year Survival (%)
Q1 (Lowest)	75%
Q2	62%
Q3	51%
Q4 (Highest)	42%

Table 4: Multivariate Logistic Regression Analysis of Risk Factors for Poor Functional Outcomes (mRS ≥ 3)

Risk Factor	Odds Ratio (95% CI)	p-value
Hypertension	2.15 (1.08-4.29)	0.030
Diabetes	2.68 (1.32-5.46)	0.007
Smoking	1.92 (0.92-4.01)	0.083
NLR Quartiles		<0.001
Q2 vs. Q1	1.98 (0.70-5.56)	0.200
Q3 vs. Q1	4.21 (1.47-12.04)	0.007
Q4 vs. Q1	7.89 (2.61-23.85)	<0.001

Discussion

The results of this study offer important new understandings of the risk variables and prognostic indicators linked to acute ischemic stroke (AIS) in a cohort of 100 patients over an 18-month period. Our findings show the value of the neutrophil lymphocyte ratio (NLR) as a prognostic indicator and reinforce the significance of well-known risk factors including hypertension and diabetes in the setting of acute infective syndrome (AIS).

NLR's prognostic function: Our study's findings demonstrate a strong correlation between NLR levels and the prognosis for AIS. Patients' survival rates at one and two years after the start of their strokes were increasingly worse for those with higher NLR quartiles. The utility of NLR as an inflammatory biomarker with predictive significance is highlighted by these findings, which are consistent with earlier research in a number of medical disorders [4,11]. elevated NLR is a sign of systemic inflammation, which has been connected to atherosclerosis, endothelial dysfunction, and elevated oxidative stress, all of which are risk factors for cerebrovascular events like AIS [5].

Our findings highlights the potential of NLR as a simple, affordable technique for AIS patient risk categorization and prognosis assessment. Early detection of those more likely to experience adverse results may allow for more individualized treatment plans, perhaps improving patient outcomes and lessening the burden of disability brought on by AIS.

Role of hypertension and diabetes: Significant independent risk factors for poor functional outcomes in AIS patients, such as hypertension and diabetes, have been identified. These findings are consistent with a body of literature that shows how these comorbid diseases have a negative effect on cerebrovascular health [6]. In particular, hypertension has an impact via encouraging arterial remodeling, atherosclerosis, and endothelial dysfunction, all of which raise the risk of stroke [7]. The primary prevention of AIS is effective blood pressure management.

Contrarily, diabetes increases the incidence of AIS through a number of pathways, including oxidative stress brought on by hyperglycemia, inflammation, and microvascular damage [8]. The risk of stroke is further exacerbated by diabetes' higher incidence of atherosclerosis and pro-thrombotic conditions [9]. Our results highlight the significance of AIS patients' glycemic control and diabetes treatment being optimized to reduce negative outcomes.

Smoking and Results in Function: Smoking showed a trend toward statistical significance in the multivariate logistic regression analysis, but it fell short. But smoking's harmful effects on AIS risk are well-established in the literature [10]. Smoking encourages platelet aggregation, vasoconstriction, and atherosclerosis, all of which are factors in the etiology of AIS [11-15]. Our investigation confirms the value of smoking cessation therapies in AIS patients to reduce the likelihood of recurrent episodes and enhance long-term outcomes, despite the statistical constraints.

Future Directions and Restrictions: The study's shortcomings must be noted when evaluating its results. First, although sufficient to identify significant relationships, our sample size of 100 patients may restrict generalizability. It is necessary to do larger cohort studies to confirm our findings. Second, we are unable to demonstrate causation because the study was observational. To clarify the specific function of NLR and the underlying processes linking inflammation to the results of AIS, prospective studies and mechanistic research are required. Future studies may also provide a more thorough risk assessment by include additional possible risk variables including hyperlipidemia and atrial fibrillation.

Conclusion

As a result, our study emphasizes the significance of risk assessment and prognostication in patients with acute ischemic stroke (AIS). A useful prognostic indicator is the neutrophil lymphocyte ratio (NLR), with higher NLR levels being linked to worse outcomes. The need of diligently managing these co-occurring illnesses is shown by the confirmation of hypertension and diabetes as important independent risk factors for poor functional outcomes in AIS patients. Even while smoking showed a trend toward relevance, more studies with bigger cohorts may clarify its complete effect on the prognosis for AIS. The care and results of AIS patients must be improved through the integration of NLR evaluation and aggressive

risk factor management into clinical practice, which will ultimately lessen the burden of stroke-related impairment and mortality.

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