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Original Research Article

A study on neutrophil lymphocyte ratio as a prognostic predictor in patient with acute ischaemic stroke visiting tertiary care hospital of southern Bihar

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Abstract

Introduction: The Neutrophil- Lymphocyte Ratio (NL Ratio) is one of potential early markers that can be correlated to mortality or morbidity in acute ischaemic stroke , being readily available, cost effective and routinely requested in laboratory **Aim and Objectives**: To study the clinical presentation and risk factors of acute Ischaemic stroke And To study the pattern of stroke and neutrophil lymphocyte correlation. **Methodology**: This was a Retrospective study, conducted on 100 study subjects of stroke at medical ward of Narayan medical college and Hospital, Rohtas, South Bihar. Data was collected from the record of Narayan medical college, Rohtas,NLR was calculated as the ratio of neutrophils to lymphocytes in peripheral blood. **Result**: There was correlation between NLR value of patients and GCS score with R square 0.593. On applying multivariate analysis for seeing the effect of age, Time duration, Total count, and NLR over GCS score, we found significant correlation with R square 0.636.There was also correlation between SSR score and NLR with R square 0.661. On applying multivariate analysis for seeing the effect of age, Time duration, Total count, and NLR over SSS score, we found significant correlation with R square 0.686. **Conclusions:** An elevated NLR at the time of hospital admission may be a predictor of morbidity and mortality in acute stroke patients. Because of its routine use, low cost and easy-to-measure nature, NLR can be used for prediction of prognosis and in-hospital mortality in stroke patients.

Keywords: Stroke, NLR, GCS score, SSS score, TIA.

Introduction

Worldwide, stroke is the commonest cause of mortality after coronary artery disease. It is also the commonest cause of chronic adult disability. Among the strokes, ischemic stroke accounts for approximately 80% to 85% of the cases, and is characterized by the disruption of cerebral blood flow.[1]

Stroke is a medical event in which the brain loses its function because of abnormal blood supply.

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In general, we divide stroke into two categories: ischemic and haemorrhagic strokes, based on the distribution of brain blood. It has been reported that ischemic stroke accounts for approximately 85% of strokes, and it is characterized by a disruption in cerebral blood flow, while haemorrhagic stroke is characterized by bleeding within the intracranial space.[2]

Immune cell activation is among the first biological responses detected after ischemic stroke, revealing a tight cross-talk between the ischemic brain and the peripheral immune system. Ischemic brain injury triggers not only a local inflammatory response but also induces a systemic, sterile inflammatory reaction, through different mechanisms: the release of danger-/damage-associated molecular patterns (DAMPs) from injured and dying neurons.[3]

It is well known that inflammatory reactions accompany all stages of cerebral ischemia. Ischaemic brain tissues release strongly pro-inflammatory chemokines which activate leukocytes and enhance their trans-endothelial migration to the site of inflammation. Of note, among leukocytes, neutrophils are a crucial mediator of the inflammatory response. A growing body of clinical evidence suggests that the neutrophil-lymphocyte ratio (NLR) can be used as an inexpensive and readily available marker to assess inflammation, especially in ischaemic stroke . Moreover, NLR has proven to be associated with an increased risk of stroke severity and worse outcomes of patients diagnosed with ischaemic stroke.[4]

The Neutrophil- Lymphocyte Ratio (NL Ratio) is one of potential early markers that can be correlated to mortality or morbidity, being readily available, cost effective and routinely requested in laboratory.[5]

The level of NLR is relatively stable, not affected by smoking, age and other baseline levels, but mainly by the body's inflammatory response. NLR is a combination of neutrophil count and lymphocyte count. NLR integrates the predictive information of two leukocyte subtypes. The increase of neutrophil count or the decrease of lymphocyte count can lead to the increase of NLR, so NLR has higher predictive value than a single subtype.[6]

With the above background we had conducted a study having following aims and objectives.

Aim and objectives

- To study the clinical presentation and risk factors of acute Ischaemic stroke.
- To study the pattern of stroke and neutrophil lymphocyte correlation.

Material and Methods

This was a Retrospective study, conducted on 100 study subjects of stroke at medical ward of Narayan medical college and Hospital, Rohtas, South Bihar. Data was collected from the record of Narayan medical college, Rohtas, on the basis of following inclusion and exclusion criteria.

Inclusion criteria

- All patients above 18yrs and having clinical and CT confirmeddiagnosis of stroke.
- Patients presenting with TIA.

Exclusion Criteria

- Stroke due to Haemorrhage /trauma /neoplasm /active infection /immunosuppressive agents /haematological disease.
- Previous history of stroke and TIA.
- Patients with incomplete or lacking medical, demographic, clinical laboratory and radiological data.

Institutional ethics committee permission was taken. Informed consent from patient or patient relative was taken before including the study subjects in the study. The diagnosis of stroke already made by treating physician and confirmed using computed tomography (CT) and magnetic resonance imaging (MRI) was considered. The defined comorbidities and risk factors included a history of hypertension, atrial fibrillation (AF), diabetes mellitus, smoking, coronary artery disease (CAD) and dyslipidaemia.

All comorbidities were defined according to previously established diagnosis. A history of stroke was also documented. Each patient was evaluated using the Scandinavian Stroke Score, Glasgow Coma Scale and mortality.

Hemogram wasevaluated using the peripheral venous blood samples taken on admission to the medical ward. NLR was calculated as the ratio of neutrophils to lymphocytes in peripheral blood.

Data was analysed using SPSS software and presented as mean values. P value of less than or equal to 0.05 will be considered to be statistically significant. Correlation analysis was carried out using the Spearman correlation test for non-parametrically distributed variables.

Result

In our study, 76 study subjects were male and 24 were female out of total 100 study subjects. The mean age of study subjects was 60.61±14.21 yrs, with range 29-88 yrs. In our study subjects 40 subjects were diabetic, 43 were hypertensive, 30 had dyslipidaemia, 35 was smoker where as 12 had coronary artery disease.

Table 1: Showing Risk profile of study subjects

RISK FACTORS	NO OF CASES	PERCENTAGE
SMOKING	35	35
DIABETES	40	40
HYPERTENSION	43	43
DYSLIPIDEMIA	30	30
CORONARY ARTERY DISEASE	12	12

In our study mean GCS score was 9.11±2.82, Duration of hospital stay was 6.24±1.787, mean NLR was 7.82±3.11. Mean total count was 7762.38±1805.76, whereas mean of SSS score was 28.97±12.46.

Table 2: Mean value of NLR, GCS score, SSS score, Total count and duration of hospital stay

	GCS SCORE	DURATION OF HOSPITAL stay	TOTAL COUNT	NLR	SSS SCORE
Mean	9.11	6.24	7762.38	7.82	28.97
N	100	100	100	100	100
Std. Deviation	2.821	1.787	1805.762	3.11	12.464
Minimum	3	2	4000	3.23	5
Maximum	14	9	11000	16.04	48

Table 2 shows the mean value of GCS, SSS score, NLR and duration of hospital stay. The mean GCS score 9.11 ±2.82, mean hospital stay was 6.24±1.787 day, mean total count was 7762.38±1805.76, Mean NLR was 7.82±3.11, and mean SSS score was 28.97±12.46.

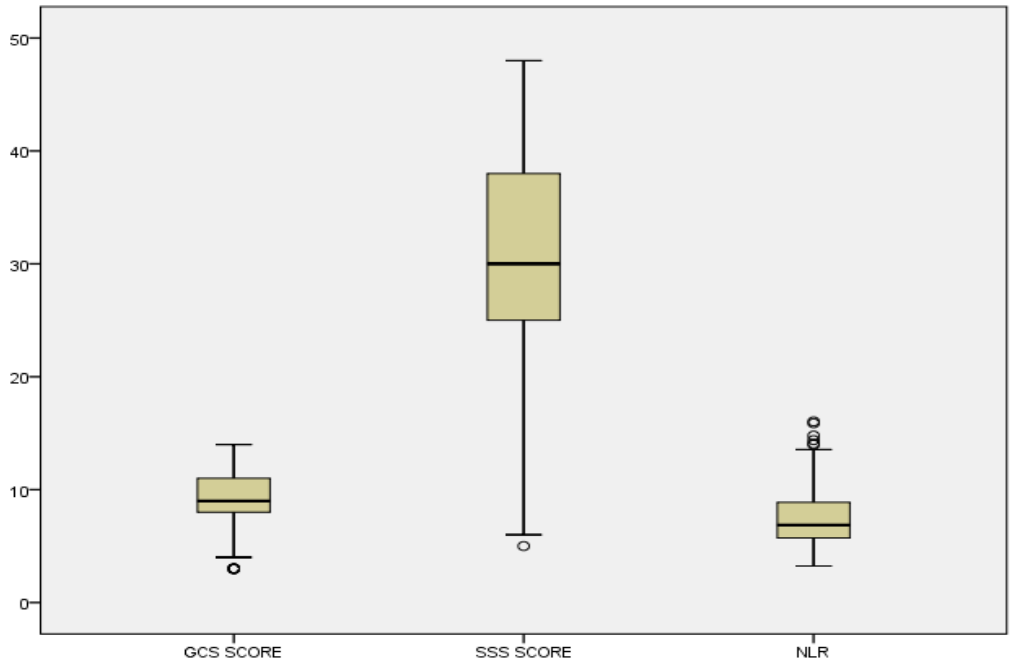

Fig 1 : Boxplot showing distribution of GCS score, SSS score and NLR value

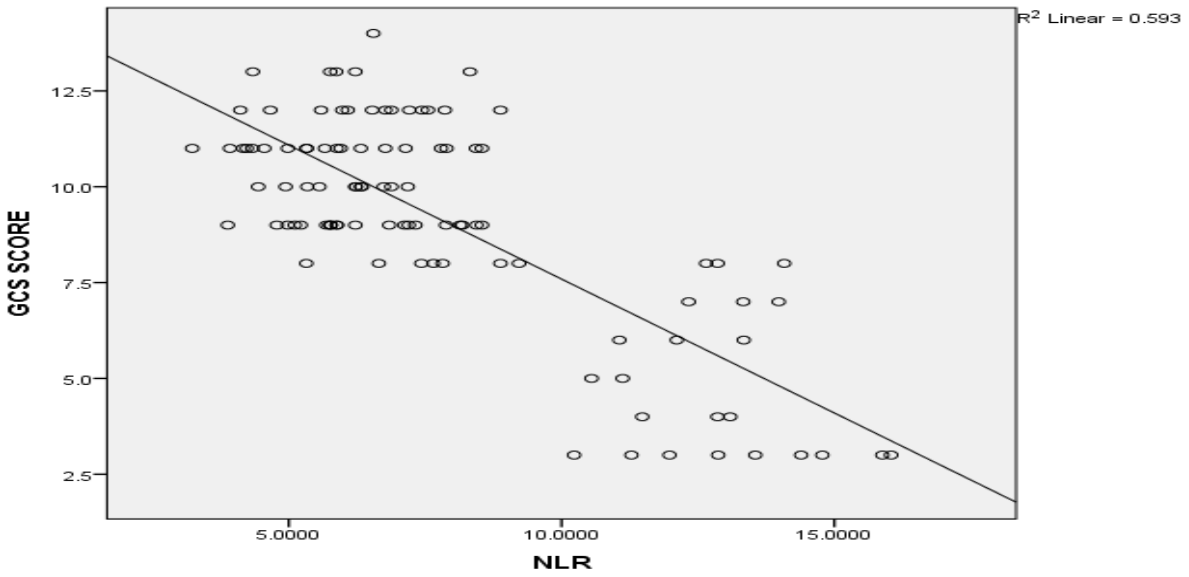

Fig 2 : Scatter diagram showing distribution of GCS Score and NLR value

Fig 2 shows correlation between GCS Score and NLR value. On assessing association we found there was correlation between NLR value of patients and GCS score with R square 0.593. On applying multivariate analysis for seeing the effect of age, Time duration, Total count, and NLR over GCS score, we found significant correlation with R square 0.636.

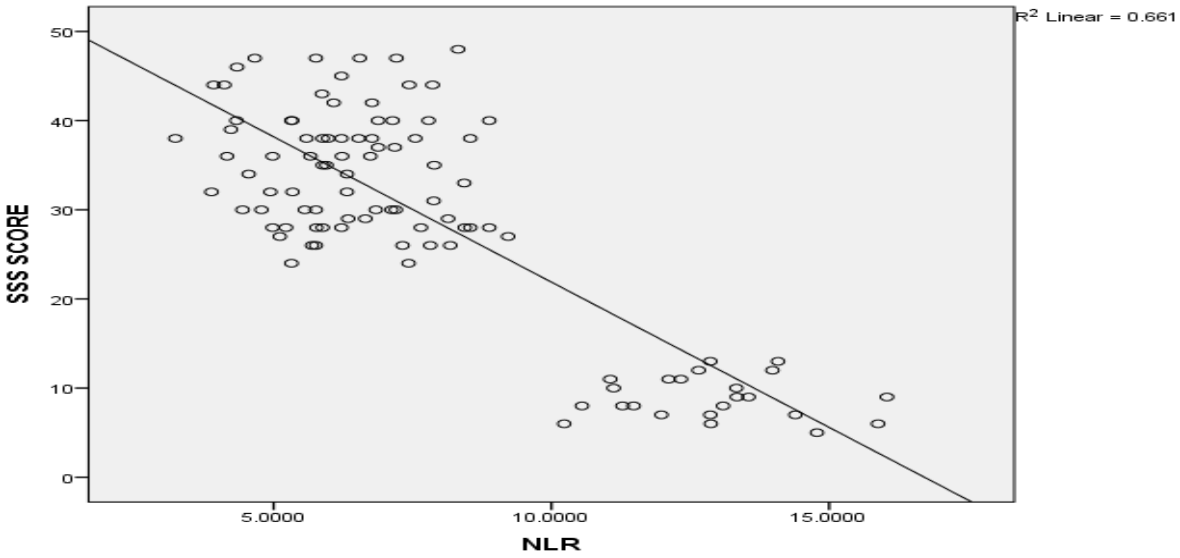

Fig 3 : Scatter diagram showing distribution of SSS score and NLR

Fig 3 shows the correlation between SSR score and NLR. On applying correlation we found that there was correlation between SSR score and NLR with R square 0.661. On applying multivariate analysis for seeing the effect of age, Time duration, Total count, and NLR over SSS score, we found significant correlation with R square 0.686.

Table 3 : Mean NLR Vs Mortality At Hospital

Mortality at hospital	Neutrophil lymphocyte ratio
	MEAN± SD
YES	12.84±1.96
NO	7.67±2.49
UNPAIRED T TEST, P VALUE - 0.001, significant	

Table 3 shows Mean NLR Vs Mortality At Hospital. Mean NLR in mortality group was 12.84±1.96, whereas in non-mortality group was 7.67±2.49, and difference was significant after applying unpaired t test.

Discussion

In our study, 76 study subjects were male and 24 were female out of total 100 study subjects. The mean age of study subjects was 60.61±14.21 yrs, with range 29-88 yrs. Other similar studies conducted on this topic such as Nam KW et al[7] shows that mean age of study subjects was 67 years and 60% of them were male which is in accordance with our study showing male predominance.

Brain ischemia and trauma elicit robust inflammation in the brain. Brain cells can produce cytokines and chemokines, and can express adhesion molecules that enable an in situ inflammatory reactions. Due to the increased expression of adhesion molecules both on cerebral endothelial cells and circulating blood cells, there is accelerated recruitment of leucocytes in the area of ischemia Neutrophil migration into the damaged area is the first response to ischemic brain damage.

Neutrophils are the main source of free oxygen radicals post-stroke, which directly destroy the neurons. It has been proposed that baseline neutrophil numbers may be related to tissue damage severity, re-infarct risk, and poor neurologic outcome.

Similar to neutrophils, lymphocytes also play an important role in the inflammatory response.

Lymphocytes begin to increase on the first day after stroke, peaking on day [7]. T-cell lymphocytes have been suggested to play an important role repairing inflamed tissues.This T cell–mediated repair is related to the release of cytokines and growth factors by T cells to modulate microglial activation.

The mean GCS score 9.11 ±2.82, mean hospital stay was 6.24±1.787 day, mean total count was 7762.38±1805.76, Mean NLR was 7.82±3.11, and mean SSS score was 28.97±12.46.Other similar studies such as Gurbuz O et al [8]shows (mean duration of follow-up 78.2±15.79 months). NLR ranged from 0.17 to 27.9 (mean 3.04±2.69; interquartile range 1,4)

In our study there was correlation between NLR value of patients and GCS score with R square 0.593. On applying multivariate analysis for seeing the effect of age, Time duration, Total count, and NLR over GCS score, we found significant correlation with R square 0.636. there was also correlation between SSR score and NLR with R square 0.661. On applying multivariate analysis for seeing the effect of age, Time duration, Total count, and NLR over SSS score, we found significant correlation with R square 0.686.The strong correlation between the NLR, SSR and GCS score supports the importance of the clinical course.Other study such as Huang et al.[9] reported that N/L ratio was borderline-significantly higher in patients withmajor adverse cardiac events after a medianfollow-up of 21 months post-ACS. Conversely, Zouridakis et al.[10] did not find any correlation between neutrophils and clinical outcomes (18/22events were readmission for recurrent angina) ina population of 71 patients with UA although theauthors described an inverse relationship betweenclinical outcomes and lymphocyte count.Semerano et al[11] shows that In stroke patients, the NL-R is associated with short- and long-term outcome, and mortality.liu Set al 12shows results showed that high NLR had a predictive role for major disability at 90 days in ICHpatients. Although significant heterogeneity among studiedexisted, it became very low after removing the study by Lattanziet al[13], and the result was still valid. Higher NLR was alsoassociated with higher mortality at short-term in our study. Liu J et al [6] shows NLR for predicting ACI, the difference was statistically significant (P<0.05). The area under the curve of NLR for ACI was 0.869, the optimal cut-off value of NLR was 2.66, with a

specificity of 94.5% and a sensitivity of 74.4% for predicting ACI (P<0.001)

Conclusion

An elevated NLR at the time of hospital admission may be a predictor of mortality in acute stroke patients. Because of its routine use, low cost and easy-to-measure nature, NLR can be used for prediction of prognosis and in-hospital mortality in stroke patients.

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