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Relationship between Neutrophil Lymphocyte Ratio and Prognosis in Acute Ischemic Stroke

Authors
Dr Narra Lavanya[1], Dr Yogitha C[2], Dr Anil Kumar. S[3], Dr Deepika Somapur[4]
[1]Junior Resident, Department of General Medicine, KIMS Hospital, Bangalore
[2]Professor, Department of General Medicine, KIMS Hospital, Bangalore
[3]Senior Resident, Department of General Medicine, St' Johns Hospital, Bangalore
Department of General Medicine, Kempegowda Institute of Medical Sciences and Research Centre
V. V. Puram, Bangalore, 560004
Corresponding Author
Dr Narra Lavanya
Junior Resident, Department of General Medicine, KIMS Hospital, Bangalore, India
Email: *lavi4321@gmail.com*, Mob: 0091- 9483544476

Abstract
Aims and Objectives: *Stroke is the second leading cause of death worldwide and mostly presents acutely. This study was done to determine the relationship between neutrophil lymphocyte ratio (NLR) and acute ischemic stroke and to establish whether neutrophil-lymphocyte ratio can be used as a prognostic marker in acute ischemic stroke.*
Materials and Methods: *This retrospective study included a total of 100 patients, who presented to the Medicine Department at KIMS hospital, with cerebrovascular accident. Demographic characteristics and comorbidities of patients were recorded. GCS and NIHSS (The National Institutes of Health Stroke Scale) scores were calculated at admission. A hemogram from peripheral venous blood samples was taken at the time of admission. Neutrophil lymphocyte ratio was calculated as the ratio of neutrophils to lymphocytes.*
Results: *In our study among the 100 patients, 63 were male and 37 were female. The mean NLR was 2.57, 4.28 and 7.36 respectively in mild, moderate and severe categories of GCS, at admission. The mean NLR was 1.63, 3.14, 5.66, 8.8 in mild, moderate, moderate to severe and severe categories of NIHSS respectively, at admission. When the linear relationships of NLR with other continuous variables were examined, the NIHSS score and the GCS had a strong positive correlation with the NLR (P =0.001).The median NLR was significantly increased among the mortality group compared with the survival group. Also the NLR was higher than the normal value in stroke patients.*
Conclusion: *The 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 short-term prognosis and in-hospital mortality in stroke patients.*
Keywords: *Neutrophil-lymphocyte ratio (NLR), Glasgow Coma scale (GCS), NIHSS (The National Institutes of Health Stroke Scale).*

Introduction

Worldwide, stroke is the commonest cause of mortality after coronary artery disease. It is also the commonest cause of chronic adult disability[1]. Among the strokes, ischemic stroke accounts for approximately 80% to 85% of the cases, and is characterized by the disruption of cerebral blood flow[2].

Acute ischemic stroke is an inflammatory event where the ischemic tissues release chemokines and cytokines, and recruit peripheral circulating leukocytes[3]. Among the leucocytes, neutrophils were found to be an important mediator and early neutrophilia was found to be associated with larger stroke volumes and poor prognosis[4]. Lymphocytes also infiltrate the ischemic tissues and mediate inflammatory responses[3].

Neutrophil-lymphocyte ratio as an inflammatory marker has been shown to be associated with poor prognosis in patients with malignancies[5] and acute coronary syndrome[6].The aim of this study was to establish the relationship between NLR and acute ischemic stroke and to determine whether can predict mortality in stroke.

Materials and Methods

Source of data: Patients admitted with cerebrovascular accident at KIMS hospital, Bengaluru.

Duration of study: November 2015toSeptember 2017

Sample size: 100 subjects with ischemic stroke admitted to Department of Medicine

Type of study: Retrospective study

Inclusion Criteria

- Age more than 18 Years.
- Patients with stroke proven by clinical picture, CT, or MRI were included in the study.

Exclusion Criteria

- Patients with an infection history within 2 weeks before the stroke,
- Patients with hematologic disorders,
- Immunosuppressant drug users (steroids),
- Patients with a stroke history within 6 months, and
- Patients with a history of malignancy were excluded from the study.

Method of collection of data

The demographic and clinical characteristics of 100 patients who met the criteria were obtained from the patient's archived records to evaluate Glasgow Coma Score (GCS), National Institutes of Health Stroke Scale (NIHSS) score, and mortality.

Blood sample analysis: A hemogram was evaluated using the peripheral venous blood samples taken on admission to the emergency department. NLR was calculated as the ratio of neutrophils to lymphocytes in peripheral blood. In addition, other routine laboratory findings were examined using the digital record systems of the hospital. The normal NLR values in an adult, non-geriatric, population in good health are between 0.78 and 3.53[7].

Statistical Analysis

Data were analysed using SPSS software and presented as mean values. P value of 0.001 was taken to be statistically significant. Correlation analysis was carried out using the Spearman correlation test for non parametrically distributed variables. The difference between 2 groups was tested using independent Student t tests for normally distributed variables; the Mann–Whitney U test was used for the comparison of non parametrically distributed variables. The difference between categorical variables was determined using the Chi-square test. Kaplan–Meier survival analysis was performed to investigate the relationship between the median NLR value and death.

Results

In our study, among the 100 patients, 63 were male and 37 were female. 51 subjects were diabetic and 69 were hypertensive. Right hemiparesis was the most common neurological

deficit at admission with incidence being 29% and Left sided weakness was the second most common neurological deficit with incidence being 25%. 4% of the patients were in a state of altered sensorium and had no response. Left MCA territory is the most common vascular territory involved with the incidence being 34% with Right MCA being the second most common arterial territory involved with the incidence being 31%.

The mean NLR was 2.57, 4.28 and 7.36 respectively in mild, moderate and severe categories of GCS, at admission. And this difference was statistically significant (p=0.001).

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The mean NLR was 2.50 among 32 patients who improved, 2.95 among 22 patients who were at status quo, 3.73 among 26 patients who had morbidity at discharge and 8.88 among 20 patients who died during the course in hospital, respectively. And this difference was statistically significant (p=0.001).

When the linear relationships of NLR with other continuous variables were examined, the NIHSS score had a strong positive correlation with the NLR (P =0.001) so did the GCS score (P= 0.001). In addition, NLR values were high as a whole among the stroke patients and were significantly higher among the deceased group than among the surviving subjects.

Discussion

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 reaction[8]. 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[9].

Neutrophil migration into the damaged area is the first response to ischemic brain damage[4]. Neutrophils are the main source of free oxygen radicals post-stroke, which directly destroy the neurons[10]. It has been proposed that baseline neutrophil numbers may be related to tissue damage severity, re-infarct risk, and poor neurologic outcome[11].

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[12]. T-cell lymphocytes have been suggested to play an important role repairing inflamed tissues[13].This T cell–mediated repair is related to the release of cytokines and growth factors by T cells to modulate microglial activation[14].The significant negative correlation of lymphocyte values with mortality in our study suggests a relationship between severity of stroke and lymphopenia.

The main finding of this study is that NLR is an independent predictor of mortality in Acute ischemic stroke. A statistically significant increase in mortality caused by stroke was found among patients with higher NLRs. The strong correlation between the NLR, NIHSS score, and GCS score with mortality supports the importance of the clinical course.

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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