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Study of Neutrophil-To-Lymphocyte Ratio in Ischemic Stroke

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Abstract

Background: Neutrophils are the earliest leukocyte subtype to show substantial upregulation in gene expression and to infiltrate areas of brain ischemia.The neutrophils plays a key role in atherosclerotic plaque development and its instability. An elevated neutrophil/lymphocyte ratio has also found to be independently associated with risk of recurrent stroke in high risk populations.

Methods: This retrospective cross-sectional study included 200 patients admitted to the emergency & general opd (medicine & pediatric) of a tertiary care hospital in JLN Medical College Ajmer from July 2019 to April 2020. The data were evaluated according to NLR levels, National Institutes of Health Stroke Scale (NIHSS) scores. The patients were divided into groups based on NLR ≤1.0, 1.1-2.0, 2.1-3.0, 3.1-4.0, 4.1-5.0, 5.1-6.0.

Results: A significant difference was found between NLR values of all 3 categories. Patients of severe stroke had higher value of NLR than those of mild and moderate stroke and patients of moderate stroke had higher values than those of mild stroke.

Conclusion: In our study, we found that NLS is a specific hematological marker which is exclusively and significantly elevated in patients of acute ischemic stroke. This is a simple and cost effective test which can be easily done at any primary care centre.

Keywords: Ischemic stroke, Neutrophil Lymphocyte Ratio.

Introduction

A stroke, or cerebrovascular accident, is defined as an abrupt onset of a neurologic deficit that is attributable to a focal vascular cause[1]

Epidemiology: Worldwide, stroke is the commonest cause of mortality after coronary artery disease, and the third overall leading cause of morbidity, according to the global burden of diseases (GBD) study in 1990.[2]

Ischemic stroke is characterized by the sudden loss of blood circulation to an area of the brain, resulting in a corresponding loss of neurologic function.

Neutrophil-Lymphocyte Ratio (NLR)

Neutrophils are the earliest leukocyte subtype to show substantial upregulation in gene expression and to infiltrate areas of brain ischemia.

The neutrophils plays a key role in atherosclerotic plaque development and its instability. Activated neutrophils also release autacoids, which are responsible for vasoconstriction and platelet aggregation[14]

An elevated neutrophil/lymphocyte ratio has also found to be independently associated with risk of recurrent stroke in high risk populations. [15]

The NIH Stroke Scale (NIHSS) [23]measures neurological function in patients with signs and symptoms of stroke. The NIHSS neurologic examination includes 15 individual elements.

National Institutes of Health Stroke Scale (maximum = 42)

Response	(Score)	Response	(Score)
Level of consciousness		Motor arm (left and right)	
alert	(0)	no drift	(0)
drowsy	(1)	drift before 10 seconds	(1)
stuporous	(2)	falls before 10 seconds	(2)
coma	(3)	no effort against gravity	(3)
		no movement	(4)
Response to level of consciousness questions*		Motor leg (left and right)	
answers both correctly	(0)	no drift	(0)
answers one correctly	(1)	drift before 5-10 seconds	(1)
answers neither correctly	(2)	falls before 5-10 seconds	(2)
		no effort against gravity	(3)
		no movement	(4)
Response to level of consciousness commands†		Ataxia	
obeys both correctly	(0)	absent	(0)
obeys one correctly	(1)	one limb	(1)
obeys neither	(2)	two limbs	(2)
Pupillary response		Sensory	
both reactive	(0)	normal	(0)
one reactive	(1)	mild	(1)
neither reactive	(2)	severe loss	(2)
Gaze		Language	
normal	(0)	normal	(0)
		mute or global aphasia	(3)
Visual fields		Facial palsy	
no visual loss	(0)	normal	(0)
partial hemianopsia	(1)	minor paralysis	(1)
complete hemianopsia	(2)	partial paralysis	(2)
bilateral hemianopsia	(3)	complete paralysis	(3)
Dysarthria		Extinction/inattention	
normal	(0)	normal	(0)
mild	(1)	mild	(1)
severe	(2)	severe	(2)

* Level of consciousness questions: "How old are you?" "What month is this?"
† Level of consciousness commands: "Squeeze my hand" (using nonparetic hand), "Close your eyes."

In practice, the NIHSS is a useful tool for early prognostication and serial assessment. In trial by

Kavian et al. comparing various stroke outcome and severity scales[28], the NIHSS was found to be superior to all other scales.

Material and Methods

Study design- Comparative cross sectional study

Study group:The study was conducted in Department of General Medicine, J.L.N Medical College and Associated Group of Hospitals, Ajmer.

Inclusion Criteria

200 Patients with clinical and/or radiological evidence of cerebral infarction regardless of age, sex, religion or ethnicity admitted within 24 hours of onset of neurological signs and symptoms including-

A. Patients in whom the neurological signs and symptoms resolved within 24 hours with NO radiological evidence.

B. Patients with clinical and radiological evidence of lacunar infarcts,

C. Patients matching above criteria who gave written and informed consent for the study

Exclusion Criteria

Following patients were excluded from the study

1. Patients with known or suspected source of sepsis
2. Patients with known preexisting inflammatory or connective tissue disorders (Rheumatoid Arthritis, TB, etc) or malignancy [29]
3. Severely anaemic patients (Hb less than 7.0 gm/dl)
4. Patients with radiological evidence (CT/MRI) of Hemorrhagic stroke/ extra dural hematoma/ sub dural hematoma/ space occupying lesion.
5. Patients with known or suspected thrombo-embolic disorder.
6. Patients on medication causing thrombocytopenia.
7. Patients who presented to the hospital ***after*** 12 hours of onset of symptoms
8. Patients who refused to give consent for investigations.

Study duration: 11/07/2019-30/04/2020

Statistical analysis

The statistical software used was SPSS version 17.0 (for windows) and Graphpad software. The description of data was in the form of mean (±) SD .Student-t Test (t) and was used for comparison between two groups regarding normally distributed (parametric) quantitative data.

Results were considered significant **if $P \leqslant 0.05$.**

Observations

Table 1: Age distribution of cases males & Female

Age in years	Male	Female
<20 y	2	0
21-30y	1	0
31-40y	5	3
41-50	22	21
51-60	21	35
61-70	35	24
71-80	13	13%
81-90	1	3
>90 y	0	0
Total	100	100

Average age of males was 57.87± 13.44 & for females was 58.18±11.886 With p value 0.8630 which is not significant.

Table 2: Severity of stroke patients according to NIHSS

Score	Description	Male	Female
0	No stroke	0	0
1-4	Minor stroke	10	11
5-15	Moderate stroke	67	65
>/16	Severe stroke	23	24

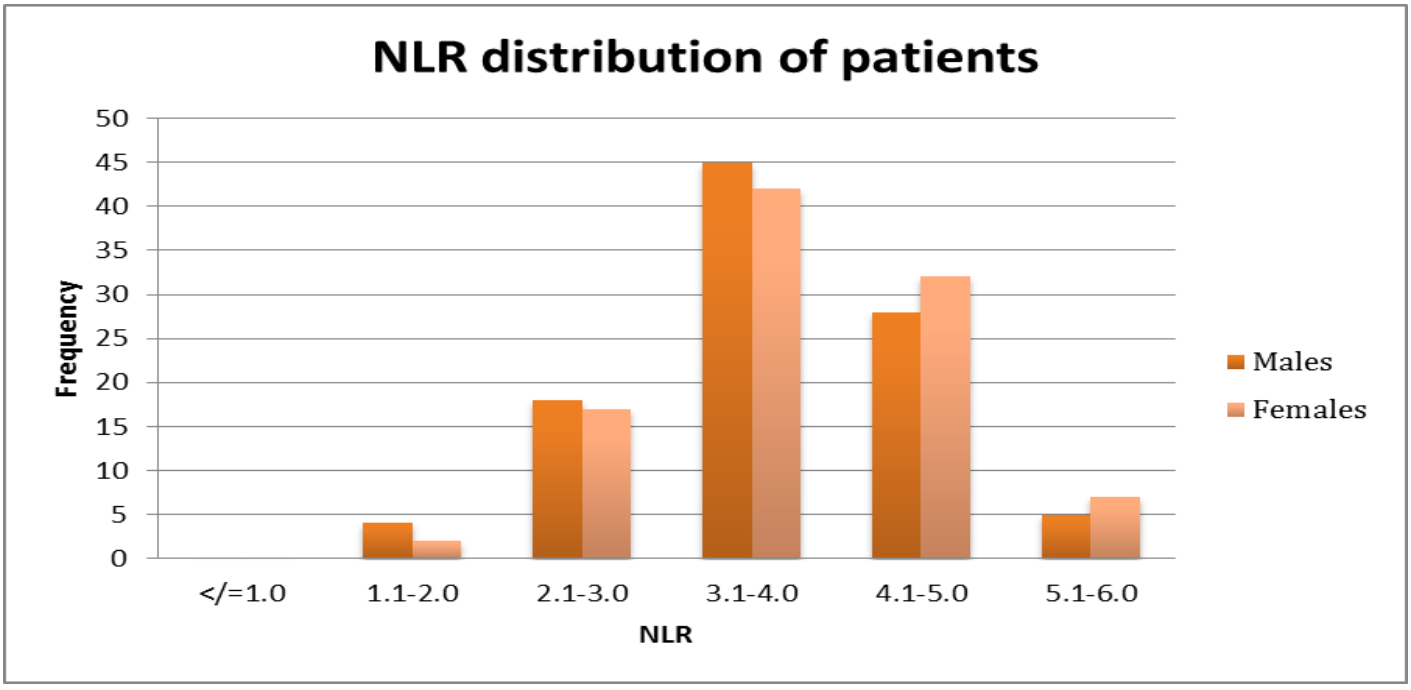
Table 3: NLR (Neutrophil-Lymphocyte Ratio)

Neutrophil-to-lymphocyte ratio (NLR) in male & female

NLR	Male	Female
</1.0	0	0
1.1-2.0	4	2
2.1-3.0	18	17
3.1-4.0	45	42
4.1-5.0	28	32
5.1-6.0	5	7
TOTAL	100	100%

Average NLR in males is 3.712 ±0.922 & in females is 3.711± 0.864 with p value 0.9937 which is not significant.

Figure 1



Statistical Analysis of Data

Table 4: Comparison of NLR with severity of Stroke

Stroke category	Mean ± S.D (Male)	Mean ± S.D (Female)
Mild	2.55±0.585	2.727±0.66
Mod	3.48±0.639	3.455±0.540
Sev	4.88±0.507	4.854±0.446

p is <0.00001 (extremely significant)

A significant difference was found between NLR values of all 3 categories.Patients of severe stroke had higher value of NLR than those of mild and moderate stroke and patients of moderate stroke had higher values than those of mild stroke.

No significant difference was found in NLR between male and female patients with mild (p value 0.5276), moderate (p value 0.8088) and severe stroke (p value 0.8526).

Discussion

In our study, a significant association was found between severity of stroke (according to NIHSS criteria) and NLR in male and female populations. ($p<0.0001$ and $p<0.0001$ respectively)

Celikbilek et al (2013)[8] conducted studies which total of 190 patients including 70 patients with first-ever atherothrombotic acute ischemic stroke (AAIS), 50 patients with transient ischemic attack, and 70 healthy subjects were enrolled in this study. They analyzed the values of N/L ratio and association with severity of stroke by NIHSS. They found that NLR correlated significantly with severity of stroke., ($P < 0.001$).In addition, N/L ratio values were found to increase significantly in dead patients ($P = 0.029$).

Conclusion

In our study, we found that NLS is a specific hematological marker which is exclusively and significantly elevated in patients of acute ischemic stroke.This is a simple and cost effective test which can be easily done at any primary care centre.

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