

## Original Research Article

**Role of Neutrophilic Lymphocytic Ratio in prognosis of patients with stroke**Dr Ram Babu Gurjar<sup>1</sup>, Dr Dhan Raj Bagri<sup>2</sup>, Dr Hansraj Pahadiya<sup>3</sup><sup>1</sup>Physician, Govt of Rajasthan, DMHS, Jaipur<sup>2</sup>Ex Sr, J K Lon Hospital, Jaipur, JS Pediatrics Govt of Rajasthan<sup>3</sup>Physician, Govt of Rajasthan, DMHS, Jaipur**\*Corresponding author**

Dr Ram Babu Gurjar

Email: [meena.drdhanraj6@gmail.com](mailto:meena.drdhanraj6@gmail.com)

**Abstract:** The present study was undertaken at Dr. S. N. medical college which included 96 (Male/female: 59/37) patients presenting with acute stroke. Majority of the patients were from age group 40-75 year of age (72.92). Of the total 73 patients had AIS and 23 had AHS. The AHS patients had significantly higher mortality rate ( $p < 0.05$ ). Patients who expired were of significantly higher age group as compare to survived patients ( $p < 0.05$ ). Of the total 31 expired patients in our study, 16 (51.6%) expired during the hospital stay and rest 15 (48.4) patients expired within 3 months of event after discharge. On admission mean NLR was found significantly higher in patients those died as compare to survived patient, ( $8.96 \pm 7.98$ ;  $6.04 \pm 5.03$ ;  $p < 0.05$ ). The NLR value of  $> 4.814$  had significantly higher mortality rate ( $p < 0.001$ ). The cut off value of NLR  $> 4.814$  demonstrated a sensitivity of 67.74%, specificity of 58.46%, positive Predictive Value of 43.80%, negative Predictive Value of 79.20% and AUC was 0.634. ROC curves were constructed to assess the predictive value of NLR. The mortality rate was statistically significantly higher for cut off value of ANC  $> 6570$  ( $p < 0.002$ ). The cut off value of ANC  $> 6570$  for mortality rate of acute stroke had sensitivity of 80.65%, specificity of 47.69%, Positive Predictive Value of 42.4%, negative Predictive Value of 83.8% and AUC = 0.616. In conclusion, NLR is a readily available and inexpensive biomarker for predicting the short term mortality for acute CVA. It can be utilized as a robust stand-alone prognostic marker for patients presenting with stroke.

**Keywords:** stroke, prognostic marker, AHS, CVA

**INTRODUCTION**

Stroke is the second most common cause of death in the world, after coronary artery disease related deaths [1]. It is also a very important single cause responsible for morbidity of disease. The age-adjusted incidence of stroke decreased from 163 per 100 000 person-years in 1970–1979 to 94 per 100 000 person-years in 2000–2008 amongst high income countries, whereas it increased from 52 per person-years to 117 per 100 000 person-years in low to middle income countries [2]. In India stroke contributes to 2% of all hospital cases and 20% of all neurological admissions [3]. The neutrophil–lymphocyte ratio (NLR) is an established marker of systemic inflammation [4,5] and has been recently reported as a predictor of 60 day mortality following acute ischemic stroke [6].

**MATERIAL AND METHODS:**

This prospective observational study was conducted among patients of stroke admitted in

Mahatma Gandhi Hospital, Jodhpur, after fulfilling the inclusion criteria, after taking clearance from institute's research review board and ethics committee of Dr S.N. Medical College, Jodhpur, and written consent to participate in the study from each patient or, when a patient was unconscious or confused, from the patient's relatives. The objective of this study is to find out the prognostic value of NLR in patients with stroke and evaluate usefulness of NLR as a biomarker of short term mortality.

Admitted patients of stroke above the age of 18 years who willingly participated in the study were included. While Patients with systemic inflammatory disorders, trauma, surgery, neoplasm, active infection, hematologic disease or inflammatory disease; treatment that could affect inflammatory response (i.e. hormonal replacement therapy, immunosuppressive agents, chronic non-steroidal anti-inflammatory drugs or corticosteroids etc.); Patients who had acute cardiac disease, peripheral vascular disease (PVD), melanoma,

neurofibroma, glioblastoma and malignancy; Patients with prior history of stroke; Patients who had severe hepatic or renal dysfunctions, acute metabolic disorders or intoxication and Patients with incomplete or lacking medical, demographic, clinical, laboratory or radiologic data and who were not willing to participate in the study were excluded.

The present study included 96 patients with acute cerebrovascular accident and the data obtained from these cases formed the basis of our study. All patients were managed indoor on standard protocol for stroke. The outcome of these patients was recorded at the time of discharge and discharged patients were followed up at the 3 month duration. Venous samples were drawn at the time of inserting the intravenous (iv)

line i.e. before any medical intervention (the first hour of admission) and sent for routine blood examinations including complete blood count (CBC), liver function tests, renal function tests, electrolytes, and lipid profile. The blood sample for white blood cell count (WBC) and differential (NLR) collected with EDTA tube (2mg/dl EDTA anticoagulant). Differential WBC counts include neutrophils, lymphocytes and monocytes. The NLR counted deploying the absolute count method. The diagnosis of the stroke was confirmed by using imaging techniques (MRI/CT scan) depending on accessibility.

**Observations:** Data analysis revealed the following results:-

**Table 1: Age wise distribution of patients**

Age (in years)	Male	Female	Total/ percentages
<40	03	04	07 (7.29)
40-59	26	12	38 (39.58)
60-75	18	14	32 (33.33)
> 75	12	07	19 (19.79)
<b>Total</b>	<b>59 (61.89±13.80)</b>	<b>37 (62.70±16.36)</b>	<b>P=0.796</b>

The table-1 depicts that majority of patients studied were male 59(61.45%) and females were 37(38.35%). Age distribution shows that more than

50% of the patients were of >60 years of age. The mean age of patients was 62.20±14.40 years.

**Table 2: Mortality data among different age groups**

Age groups	Total number of (n=96)	Surviving (n=65)	Expired (n=31)	P value
< 40	11	09	02	0.494 OR=2.33
40-59	34	26	08	0.253 OR=1.917
60-75	32	23	09	0.645 OR=1.33
>75	19	07	12	<b>0.002</b> <b>OR=0.191</b>
<b>Total</b>	<b>96</b>	<b>65</b>	<b>31</b>	

In our study out of total 96 patients of acute stroke, 65(67.7%) survived and 31 (32.29%) patients expired. The mortality rate was more in older age group(Table-2).

Of the total 96 patients, 73 (76.04%) had acute ischemic stroke (AIS) and 23(26.96%) had acute hemorrhagic stroke (AHS) shown in Table-3. The

difference of mean age between both groups was not statistically significant. The mortality rate was higher in AHS patients as compare to AIS patients. (p value <0.05). The WBC, ANC, and NLR value were higher in AHS as compare to AIS patients' but this difference was not statistically significant. The difference of RBS, creatinine, bilirubin, SGPT and various lipids between AIS and AIH group was not statistically significant.

**Table 3: Baseline characteristic of ischemic and hemorrhagic stroke patients**

Parameters	Ischemic	Hemorrhagic	P value
------------	----------	-------------	---------

<b>No of patients (n)</b>	<b>73</b>	<b>23</b>	
<b>Age Mean±SD</b>	62.86±14.26	60.13±16.43	Ns
<b>Gender</b>			Ns
<b>Male/female(N)</b>	47/26	12/11	
Outcome			P<0.05
Survived (N)	53	12	
Expired (N)	20	11	
Risk factor			
HTN (N=47)	36	11	
DM (N=48)	37	9	
Tobacco (N=44)	39	7	
Dyslipidemia			
≥2 risk factor			
WBC	10522.60±3958.84	10875.43±4227.12	Ns
ANC	8024.02±3922.91	8786.08±4684.98	Ns
Lym	1660.03±901.10	1480.86±710.15	Ns
NLR	6.89±6.30	7.30±5.87	Ns
RBS	128.05±66.25	122.65±61.71	Ns
S.Cr.	1.15±0.54	1.17±0.34	Ns
STB	0.90±0.32	0.76±0.32	Ns
SGPT	39.11±27.28	36.95±17.34	Ns
CHOL	166.42±33.71	168.34±28.28	Ns
TG	127.02±53.84	124.69±28.64	Ns
HDL	37.20±14.55	34.78±5.06	Ns
VLDL	26.79±11.69	25.21±5.81	Ns
LDL	102.68±26.73	114.52±25.87	Ns

**Table 4: Baseline characteristic in survivors & Expired patients**

Parameters	Survivors (n=65)	Expired (n=31)	P value
<b>Age</b>	59.61±14.16	67.64±14.74	0.012
<b>Gender</b>			0.823
<b>Male/female(N)</b>	39/26	20/11	
Type of stroke			P<0.05
Ischemic (N=73)	53	20	
Hemorrhagic(n=23)	12	11	
Risk factor			
HTN (N=47)	29	18	
DM (N=48)	34	14	
Tobacco (N=44)	24	20	
Dyslipidemia			
≥2 risk factor			
WBC	10283.07±36.23.60	11319.25±4962.80	0.249
ANC	7739.84±3676.90	9185.69±4802.60	0.107
Lym	1733.84±871.50	1372.33±790.91	0.053
RBS	133.29±70.66	113.06±49.08	0.154
S.Cr.	1.09±0.34	1.28±0.71	0.083
STB	0.89±0.34	0.83±0.27	0.419
SGPT	34.32±22.16	47.54±66.47	0.150
CHOL	170.93±32.17	158.38±31.59	0.075
TG	130.15±54.99	118.74±31.91	0.287
HDL	37.21±15.34	35.38±5.01	0.520
VLDL	27.29±12.08	24.58±6.16	0.242
LDL	107.46±30.09	101.48±18.20	0.312

The mean age of expired patients was 67.64±14.74 and survived patient's 59.61±14.16 years.

The expired patient were significantly older as compare to survived (p value <0.05). The AIS was found in 73

and AHS in 23. The mortality in AHS was significantly higher as compared to AIS (p value <0.05). Of the total, 47 had hypertension followed by 44 had diabetes, and 44 were addict to tobacco (smoking or tobacco chewing

or both). The difference of WBC, ANC, RBS, creatinine, bilirubin, SGPT and various lipids between survived and expired group was not statistically significant.

**Table 5: NLR cut off value with outcome**

Parameters	NLR <4.814 (n=48)	NLR>4.814 (n=48)	P value
Survivors	38	27	0.028
Expired	10	21	OR=0.338

Above data shows that higher % of mortality was seen in NLR group >4.814 and difference of % mortality between the two NLR groups was statistically significant (p<0.05).

**SUMMARY AND CONCLUSION**

The present study titled “Prognostic value of Neutrophilic-Lymphocytic ratio (NLR) in patients with stroke” was undertaken at Dr. S. N. medical college and attached group of hospitals Jodhpur. The study included 96 (Male/female: 59/37) patients presenting with acute stroke. Majority of the patients were from age group 40-75 year of age (72.92). Of the total 73 patients had AIS and 23 had AHS. The AHS patients had significantly higher mortality rate (p<0.05).

On admission mean WBC, NLR and Mean ANC was higher in those patients who had AHS as compare to those who had AIS, this difference was statistically not significant (p >0.05). Patients who expired were of significantly higher age group as compare to survived patients (p<0.05). Of the total 31 expired patients in our study, 16 (51.6%) expired during the hospital stay and rest 15 (48.4) patients expired within 3 months of event after discharge. On admission mean NLR was found significantly higher in patients those died as compare to survived patient, (8.96±7.98; 6.04±5.03;p<0.05). The NLR value of >4.814 had significantly higher mortality rate (p<0.001). The cut off value of NLR >4.814 demonstrated a sensitivity of 67.74%, specificity of 58.46%, positive Predictive Value of 43.80%, negative Predictive Value of 79.20% and AUC was 0.634. ROC curves were constructed to assess the predictive value of NLR. The mortality rate was statistically significantly higher for cut off value of ANC >6570 (p<0.002). The cut off value of ANC >6570 for mortality rate of acute stroke had sensitivity of 80.65%, specificity of 47.69%, Positive Predictive Value of 42.4%, negative Predictive Value of 83.8% and AUC = 0.616.

In conclusion, NLR is a readily available and inexpensive biomarker for predicting the short term mortality for acute CVA. It can be utilized as a robust stand-alone prognostic marker for patients presenting with stroke [7]. When NLR is combined with standardized clinical mortality risk prediction scores, it

markedly and significantly augments the predictive power of these scores.

**REFERENCES:**

1. WHO: the top 10 causes of death online address (2011). Available at: <http://www.who.int/mediacentre/factsheets/fs310/en/index.html> Accessed April 2012.
2. Feigin VL, Lawes CM, Bennett DA, Barker-Collo SL, Parag V. Worldwide stroke incidence and early case fatality reported in 56 population-based studies: a systematic review. *The Lancet Neurology*. 2009 Apr 30; 8(4):355-69.
3. Stroke in Park’s Text book of Preventive and Social Medicine. 18th Edition. K Park (Ed) Jabalpur. India. Banarasidas Bhanot 2004: 298-299.
4. S Smith, Johnston Sc, Donald Ej. Cerebrovascular diseases in Harrison’s principles of Internal Medicine (vol 2) 15th Ed, Braunwald Fauci, Kasper Hauser, Longo, Jameson (Eds). North America. Mac Grawhill. 2004: 2369-2391.
5. Hatano S. Variability of the diagnosis of stroke by clinical judgment and by a scoring method. *Bulletin of the World Health Organization*. 1976; 54(5):533.
6. Tokgoz S, Kayrak M, Akpınar Z, et al. Neutrophil lymphocyte ratio as a predictor of stroke. *J Stroke Cerebrovasc Dis* Published Online First: 13 Mar 2013.
7. Zahorec R. Ratio of neutrophil to lymphocyte counts-rapid and simple parameter of systemic inflammation and stress in critically ill. *Bratislavské lekárske listy*. 2001; 102(1):5-14.