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Original Research Paper

Medicine

CORRELATION OF PLATELET TO LYMPHOCYTE RATIO WITH NATIONAL INSTITUTE OF HEALTH STROKE SCALE FOR SEVERITY PREDICTION IN ACUTE ISCHEMIC STROKE

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ABSTRACT

Background: Stroke is the second leading cause of death worldwide and was responsible for an estimated 6.5 million deaths and 113 million DALYs in 2013. In recent years, the platelet to lymphocyte ratio (PLR) has emerged as a well-accepted biomarker for the assessment of overall inflammatory status. The aim of the present study was to find out the role of PLR (Platelet to lymphocyte ratio) in patients of acute ischemic stroke and correlating with NIHSS for predicting the severity.

Settings and Design: It is a case control study carried out in 70 cases with acute ischemic stroke and 70 age and gender matched controls. Severity of stroke was determined among cases with the National Institute of Health Stroke Scale (NIHSS) at admission and at discharge. Laboratory investigations were done to calculate Platelet-lymphocyte ration at admission and discharge.

Results: 68% of cases were males and 32% were females with a mean age of 59.03± 10.6 years. The platelet count was significantly higher in cases as compared to controls whereas the value of total lymphocyte count was vice-versa. The majority of cases belonged to NIHSS score 5-15 which is classified as moderate stroke both at the time of admission and at discharge. There was positive correlation between PLR with National Institute of Health Stroke Scale Severity Score ($r=0.68$, $p<0.001$). The mean PLR increased with increasing NIHSS score.

Conclusions: Platelet to lymphocyte ratio (PLR) is a simple, cost effective and easily obtainable tool in predicting the severity of stroke.

KEYWORDS : Platelet Lymphocyte Ratio, Acute Ischemic Stroke, National Institute of Health Stroke Scale.

INTRODUCTION

Stroke is increasingly becoming a leading cause of death and disability in emerging countries. Stroke is the world's second biggest cause of mortality, with an estimated 6.5 million fatalities and 113 million DALYs in 2013. More over two-thirds of those killed were in underdeveloped countries. By 2050, poor and middle-income nations will account for more than 80% of the estimated 15 million new strokes worldwide. According to studies, the incidence of stroke in India ranges from 116 to 163 per 100,000 people. According to the ICMR's "India: Health of the Nation's States" report, stroke was the fourth largest cause of mortality and the fifth major cause of Disability Adjusted Life Years (DALY) in 2016.[1]

A stroke, also known as a cerebrovascular accident, is characterized by the abrupt development of neurological deficits caused by a localized vascular etiology. Because of the intricate anatomy of the brain and its vascular, the clinical signs of stroke are exceedingly variable. When blood supply is restored fast, brain tissue can fully heal and symptoms are only temporary. This is referred to as a transient ischemic attack (TIA). Ischemic stroke occurs when blood flow cannot be immediately restored, resulting in irreparable brain damage. Hemorrhagic stroke occurs when cerebral blood arteries rupture, allowing blood to flow into the brain parenchyma. Hemorrhagic stroke accounts for 15% of all stroke cases and has a higher death rate.

The platelet to lymphocyte ratio (PLR) has become a widely recognized biomarker for assessing overall inflammatory status in recent years. These biomarkers are simple and inexpensive.[2] Elevated PLR levels in patients are linked to oxidative stress and increased cytokine production.[3] Poor prognoses, the rate of insufficient recanalization, and the extent of the infarcted area after stroke have all been predicted using the PLR.[4] The platelet to lymphocyte ratio (PLR) is a simple and straightforward measure that may be derived from a complete blood count, even in outlying hospitals.

The primary goal of this study is to evaluate the Platelet to Lymphocyte Ratio (PLR) in patients with acute ischemic stroke and connect it with the NIHSS score in order to predict stroke severity.

MATERIALS AND METHODS

It is a case control study carried out in the department of General Medicine at HSK hospital, Bagalkot, Karnataka after obtaining institutional ethical committee approval. We included 70 patients of acute ischemic stroke presenting with symptoms onset within 7 days who give consent for the study and were compared with 70 age and gender matched controls. Stroke due to trauma, neoplasm, active infection, immunosuppressive agents, hematological disease were excluded from the study. We also excluded patients with who are already on antiplatelet drugs, with thrombocytopenia and those with known history of hereditary disorders of large platelets.

All the cases of acute stroke were reviewed with thorough history, clinical examination, lab investigations and imaging studies (CT/MRI). Severity of stroke was determined among cases with the National Institute of Health Stroke Scale (NIHSS) at admission and at discharge. Minor strokes (1-4), moderate strokes (5-15), moderate to severe strokes (16-20), and severe strokes (21-30) were the different types of strokes (21-42).

PLR (Platelet to lymphocyte ratio) was obtained by dividing total platelet count by total lymphocyte count. After that, the platelet to lymphocyte ratio was compared to a reference value generated from a control group of the same age and gender, as well as the NIHSS severity score (calculated at the time of admission and discharge).

Statistical Analysis

Statistical analysis was performed using SPSS 22.0. Measurement data were expressed as mean ± standard deviation, and numerical data are described as frequency and percentages. All the parameters were compared between

cases and controls using independent students t-test or Chi-square test. $P<0.05$ was considered to indicate a statistically significant difference. Pearson correlation coefficient was used to assess the correlation between PLR and NIHSS.

RESULTS

Demographics and risk factors

Among the total 70 cases, 68% were males and 32% were females with a mean age of 59.03± 10.6 years. Controls were age and gender matched. Risk factors were assessed in both cases and controls and we found that smoking, hypertension, dyslipidemia and cardiovascular disease were more prevalent in cases compared to controls and this was statistically significant when chi-square test was applied ($p<0.05$). (Table 1)

Table 1: Age and gender distribution of study participants

Variables		Cases (n=70)	Controls (n=70)	p-value
Mean Age in years		53.5± 11.3	54.1 ± 12.1	0.76
Gender	Male	47 (67.1%)	47 (67.1%)	1
	Female	23 (32.8%)	23 (32.8%)	
Risk factors	Smoking	43 (61.4%)	27(38.6%)	**0.006**
	Alcoholism	16 (22.8%)	12(17.1%)	0.398
	Hypertension	52 (74.3%)	28 (40%)	**<0.001**
	Diabetes Mellitus	33 (47.1%)	29 (41.4%)	0.496
	Dyslipidemia	36 (51.4%)	18 (25.7%)	**0.002**
	Cardiovascular disease	13 (18.6%)	5 (7.1%)	**0.043**

Infarct territory

The most common patterns were the tempero - parietal and parietal infarcts followed by corona radiata infarcts. The MCA territory was predominantly involved around 94 %. This was followed by involvement of posterior circulation and combined MCA and ACA territory – 3 % each. Left sided focal neurological deficit was most common compared to right hemiparesis. (Table 2).

Table 2: Infarct territory and laterality among stroke cases

Stroke features		Frequency (%)
Laterality	Right hemiparesis	56 (76.7%)
	Left hemiparesis	17 (23.3%)
Territory	MCA	64 (91.4%)
	Vertebral/Basilar artery	3 (4.3%)
	MCA+ACA	3 (4.3%)

Severity of Stroke by NIHSS

Table 3 shows the distribution of cases with acute ischemic stroke based on NIHSS score. The majority of cases belonged to NIHSS score 5-15 which is classified as moderate stroke) both at the time of admission and at discharge.

Table 3: Distribution of cases according to NIHSS score

NIHSS Score	At the time of admission	At the time of discharge
1-4 (Minor stroke)	19 (27.1%)	24 (34.3%)
5-15 (Moderate stroke)	32 (45.7%)	29 (41.4%)
16-20 (Moderate to severe stroke)	10 (14.3%)	8 (11.4%)
21-42 (Severe stroke)	9 (12.9%)	9 (12.9%)

Laboratory investigations

Laboratory investigations of both case and control groups shows that the platelet count was significantly higher in cases as compared to controls whereas the value of total lymphocyte count was significantly lower in cases than controls. (Table 4)

Table 4: Laboratory profile of cases and controls.

Variables	Cases	Controls	p-value
Leukocyte count (10^3/cu.mm)	8.8±2.6	8.1±2.2	0.09
Lymphocyte count (10^3/cu.mm)	1.4±0.63	1.7±0.34	**<0.001**
Platelet count (10^3/cu.mm)	287.5±71.3	202.7±56.4	**<0.001**
Platelet to lymphocyte ratio	238.2± 59.9	122.8 ±36.8	**<0.001**

There was positive correlation between PLR with National Institute of Health Stroke Scale Severity Score ($r=0.68$, $p<0.001$). Figure 1 shows the PLR ratio distribution among the NIHSS groups. The mean PLR increased with increasing NIHSS score.

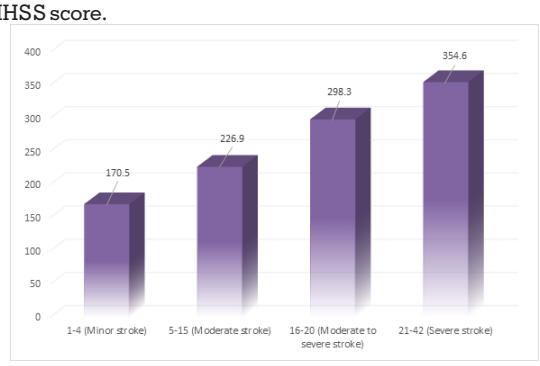

Figure 1: PLR ratio according to NIHSS groups

DISCUSSION

Inflammation has a key role in the progression of an ischemic stroke. Hypertension was shown to be the most common risk factor for stroke in this study, accounting for 74.3 percent of cases. According to A.Muscari et al.[5], hypertension is the most common risk factor, accounting for 84.7 percent of cases. According to Pikija et al.[6], hypertension is the most common risk factor, accounting for 82.7 percent of cases. This is similar to a research conducted by Lok U et al.[7], which found a prevalence of hypertension of 74%. Men had a higher rate of ischemic stroke than women in this study. Aiyar et al.[8], Kay Sin Tan et al.[9], and R P Eapen et al.[10] conducted comparable research.

The PLR is a new systemic inflammatory load biomarker that combines the predictive value of individual platelet and lymphocyte counts. It is repeatable and easy to obtain. Platelets are involved in the production of circulating arterial platelet–fibrin thrombi, as well as the development, instability, and rupture of atherosclerotic plaques. [11,12] Increased cortisol production by physiological stress could explain a decrease in total and relative number of circulating lymphocytes during an acute ischemic event.[13] High platelet concentrations and low lymphocyte numbers are thought to contribute to atherosclerosis progression, increase restenosis and plaque instability, and thus be linked to a worse outcome in ischemic events. The PLR and NIHSS scores had a positive association. With a higher NIHSS score, there is a statistically significant rise in PLR. Govind D. et al.[14], Pei Hsun sung et al.[15], Sharma D et al.[16], and Andres Perez et al.[17] all observed similar findings.

Study Limitations:

1. We did not conduct follow-up exams after discharge to assess the long-term effects of the stroke.
2. The small sample size, with only one center involved.
3. Because the inflammatory process was so complex, we were unable to evaluate other inflammatory indicators including interleukin 6, tumor necrosis factor, and others. The results could be improved if PLR could be linked to these inflammatory indicators.

CONCLUSION:

The present study has shown a significant difference in the values of PLR about NIHSS Score. Therefore, PLR is strongly related to the Stroke Severity Score thereby associated with the prognosis of the stroke. Platelet to lymphocyte ratio (PLR) is a simple, cost effective tool which helps in predicting the severity in peripheral setting and thus helps in urgent referral.

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