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Importance Of Inflammatory Markers as Common Risk Factors in Diabetes Mellitus and Acute Ischemic Stroke

Leena C.O[1], Mathew John[2], Mahendra Kumar Verma[3], Harisuthan T[4]

[1,3]PhD Scholar, Nims College of paramedical, Jaipur, Rajasthan
[1,2]Jubilee Centre for Medical Research, Jubilee Mission Medical College &Research Institute,Thrissur, Kerala,
[4]Department of Neurology, Jubilee Mission Medical College &Research Institute, Thrissur, Kerala.

Abstract

Diabetes mellitus is a chronic inflammatory condition and it may lead to various secondary complications such as acute ischemic stroke. The common connecting pathophysiology in Type 2 Diabetes Mellitus (T2DM) and Acute Ischemic Stroke (AIS) are the inflammatory pathways. In the present study we compared and evaluated the Neutrophil lymphocyte ratio, Platelet lymphocyte ratio and C - reactive protein between Diabetes Mellitus and Acute ischemic stroke with Diabetes mellitus (AISDM).

Methodology

Five milliliters of peripheral blood was collected from the study participants followed by centrifugation to separate the serum. Test was done for quantitation of C - reactive protein. For complete blood counts, such as Neutrophil lymphocyte ratio and Platelet lymphocyte ratio, Anticoagulated blood is used. The automated chemistry/turbidimetry and hematology analyzers were used for all the assays.

Results

The results revealed statistically significant differences in Neutrophil lymphocyte ratio and Platelet lymphocyte ratio between T2DM and AISDM groups with p value <0.001 and C - reactive protein values did not significantly altered between the groups (p=0.087).

Conclusion

The result summarized that there was significant difference in Neutrophil lymphocyte ratio and Platelet lymphocyte ratio values between T2DM and AISDM groups.

Keywords: Platelets, Neutrophils, Lymphocytes

Introduction

Chronic hyperglycemia, a hallmark of diabetes mellitus (DM), can be caused by either absolute or relative insulin insufficiency or insulin resistance. Globally, diabetes is becoming a more serious public health concern. Between the years 2000 and 2030, there will be more than twofold increase in the number of people with diabetes [1, 2]. Managing blood glucose levels is an effective stroke care method since hyperglycemia, or high blood glucose, is a typical occurrence in stroke patients. The majority of stroke patients had hyperglycemia > 6.0 mmol/l(108 mg/dl), which causes lipid peroxidation and cell

lysis in damaged tissue, both of which can result in stroke sequel. Elevated blood glucose levels are also linked to poor clinical outcome, decreased recanalization, and infarction development [3]. Systems for continuously monitoring blood sugar have been implemented to lower the risk of stroke in stroke patients with and without diabetes [4]. Vascular problems may arise from the chronic form of type 2 diabetes mellitus (T2DM). It is estimated that 17 million individuals worldwide experience a stroke annually, and the incidence of stroke is on the rise. One common pathophysiological mechanism seen in both AIS and T2DM is pro inflammatory state [5, 6]. Stroke ranks as the second most common cause of mortality globally and is a major cause of disability. A blood artery blockage is a neurological condition known as a stroke. Brain clots obstruct blood flow, blocking arteries and rupturing blood vessels, which results in bleeding. Moreover, dementia and depression can result from strokes. One of the leading causes of death and permanent disability in the globe is stroke. Stroke survivors may have cognitive and physical impairments for the rest of their lives. Over 50 million people worldwide suffer from strokes, placing a heavy strain on the healthcare and financial systems [7]. Although the causes of stroke vary widely, atherosclerosis plays a significant role in many cases. This can be directly due to aortic, cervical, or intracranial large-artery atherosclerosis, or it can be indirectly caused by cardioembolism, such as when myocardial infarction or cardiac arrhythmias result in emboli. It is believed that atherosclerosis is a chronic inflammatory vascular disease.

T2DM and AIS are chronic inflammatory diseases. Therefore it is essential to study the PLR and NLR and CRP in impacting the inflammatory status of both disease conditions. Stroke is a brain attack that causes sensory, motor, and cognitive defects [8], and stroke survivors may need short-term or lifelong support, leading to enormous human and economic costs [9]. Larger infarct sizes and more severe strokes were shown to be associated with earlier, higher white blood cell (WBC) and neutrophil counts in AIS patients [10]. Recurrent ischemic stroke has also been linked to elevated peripheral WBC and neutrophil levels [11]. The objective of the present study is to analyse the importance of inflammatory markers as risk factors in the occurrence of diabetes mellitus and acute ischemic stroke.

Materials & Methods

This study is approved by Institutional Ethical committee. This study was prospective comparative cross sectional study of early diagnosed DM patients and AIS patients who were consecutively admitted to the tertiary care hospital. The study involved the participants in the age group between 40 and 70 years. Five milliliters of peripheral blood was collected from the study participants followed by centrifugation to separate the serum. Test was done for quantitation of C - reactive protein. For complete blood counts, such as Neutrophil lymphocyte ratio and Platelet lymphocyte ratio, Anticoagulated blood is used. The automated chemistry/turbidimetry and hematology analyzers were used for all the assays. Acute ischemic stroke was confirmed by computed tomography or magnetic resonance imaging within 48 hours after onset. DM patients without secondary complications diagnosed within five years were included in the study. The exclusion criteria were as follows; intracerebral hemorrhage, transient ischemic attack, other etiologies and undetermined stroke, subarachnoid hemorrhage, brain tumors, those treated with intravenous thrombolytic therapy before onset, patients with incomplete clinical data, patients with antiplatelet and anticoagulation therapy, surgery, rheumatoid immune-related diseases, or malignancy.

The laboratory investigations done were Complete blood count done in DxH 900 Beckman Coulter hematology fully automated analyzer, CRP were done by turbidimetry in BT 1500 Biotecnica Chemistry/Turbidimetry fully automated analyzer and HbA1c were done by HPLC method in G8HPLC automated Glycohemoglobin analyzer, Tosoh Bioscience.

Statistical analysis

Statistics was done by using SPSS version 26. Continuous variables were described as means ± standard deviations or medians with interquartile range (IQR). Categorical variables were presented as proportions. Mann-Whitney U tests were used for continuous variables. P value <0.05 will be considered as significant.

Result

Baseline characteristics

Table 1 Baseline characteristics, laboratory data, in-hospital measures, and outcome parameters for all patients with AIS and T2DM

	T2DM		AIS DM	
	Mean	**Median**	**Mean**	**Median**
Age (years)	52.53	53	62.68	65
Gender				
Male (%)	94		101	
Female (%)	57		50	
Laboratory Values				
Neutrophil	53.51	54	68.81	70
Lymphocyte	35.88	36	23.15	22
NLR	1.60	1.51	4.05	3.18
Total WBC	7.30	7.3	9.22	8.38
Platelet	245.21	236	237.42	223
PLR	101.53	93.29	140.96	118.57
CRP	0.57	0.4	1.08	0.5
HbA1c	7.52	7.5	9.41	8.9

Table 2 Comparison of Inflammatory markers between T2DM and AISDM

Parameters	**T2DM**		**AISDM**		**P Value**
	Median	**IQR**	**Median**	**IQR**	
NLR	1.51	1.13 - 1.93	3.05	2.5 - 3.3	< 0.001
PLR	93.29	75.25 -115.7	125	94.98-174.68	< 0.001
CRP	0.40	0.28 - 0.6	0.5	0.2-0.9	0.087

Figure 1: Comparison of CRP among T2DM and AIS

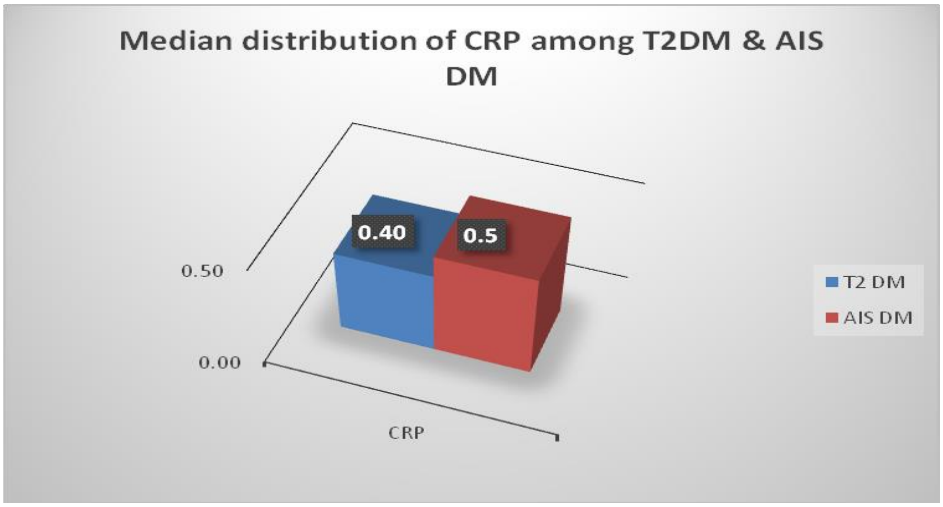


Figure 2: Comparison of PLR among T2DM and AISDM

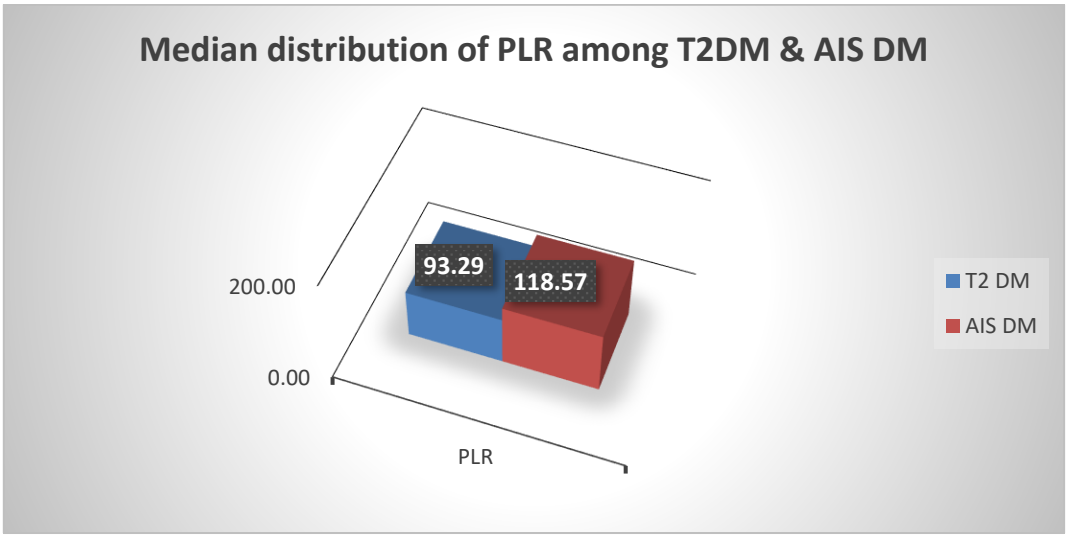
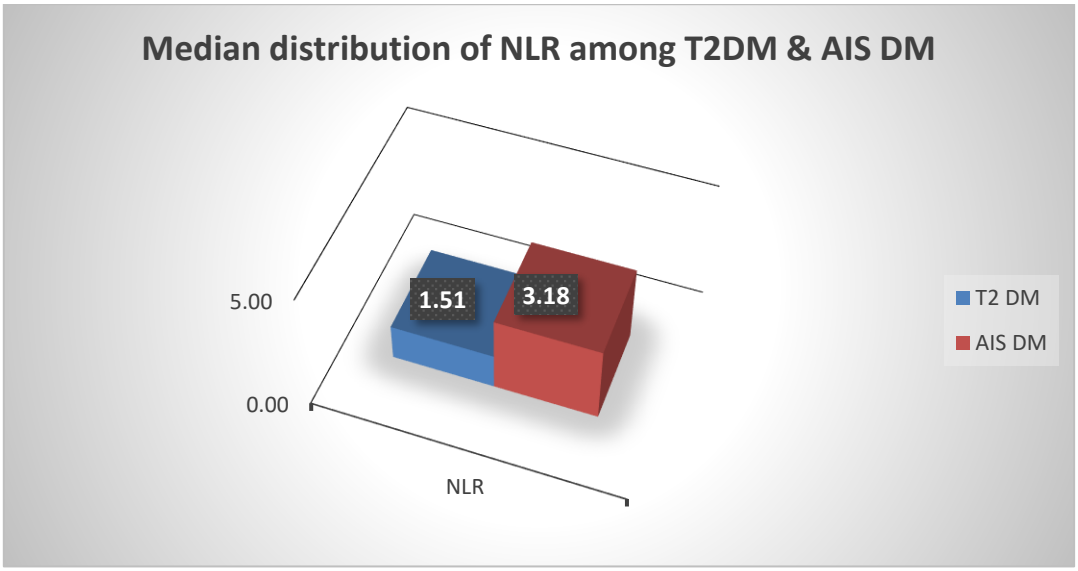


Figure 3: Comparison of NLR among T2DM and AISDM

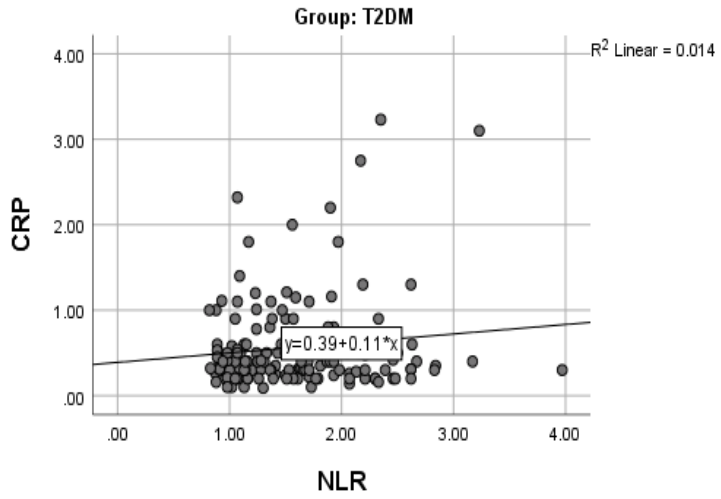


Mann-whitney U tests were conducted to find out any statistically significant differences in the inflammatory markers such as NLR, PLR and CRP between T2 DM and AISDM. The results revealed that there were statistically highly significant differences in NLR and PLR between the groups as their p values were <0.001 and it is insignifcant in the case of CRP as p=0.087.

Table 4 Correlation between CRP and NLR

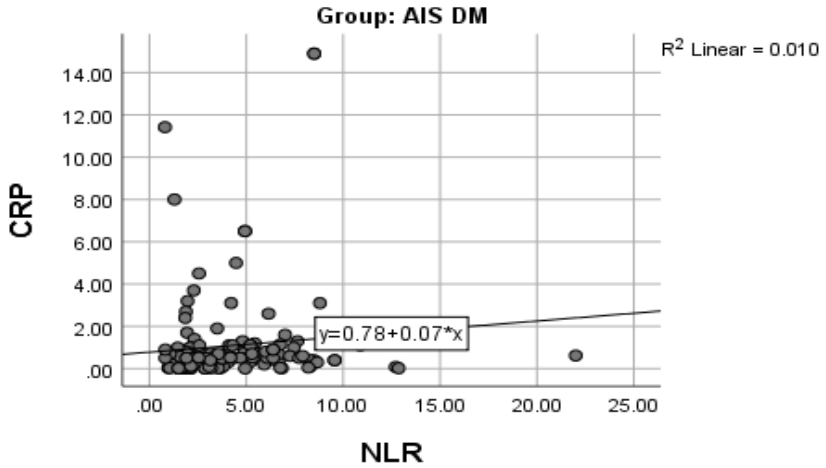
Correlation between CRP and NLR in T2DM group		
Parameters	**Correlation coefficient**	**P value**
CRP vs.NLR	-0.003	0.974
Correlation between CRP and NLR in AISDM group		
Parameters	**Correlation coefficient**	**P value**
CRP vs.NLR	0.173	0.034*

Figure 4: Correlation between CRP and NLR in T2DM group



The result is a graphical representation of the correlation between CRP and NLR in T2DM group. The result indicated that there is no correlation between CRP and NLR in T2DM group.

Figure 5: Correlation between CRP and NLR in AISDM group



The result is a graphical representation of the correlation between CRP and NLR in AISDM group. The result indicated that there is a correlation between CRP and NLR in AISDM group.

Discussion and Conclusion

DM and AIS are chronic inflammatory disorders that are commonly connected by pathophysiology in terms of activation in the inflammatory pathways. Many studies have shown that DM is a strong risk factor for the occurrence of ischemic stroke. The result indicated that NLR and PLR, which are the inflammatory markers increased significantly in acute ischemic stroke compared to T2DM. However, another known inflammatory marker CRP did not alter significantly between T2DM and AISDM. The study could help in assessing the role of NLR and PLR in the occurrence of stroke in DM. The study indicated that the inflammatory markers such as NLR and PLR could be the aggravating predictive markers for the occurrence of stroke during Diabetes mellitus.

Declaration by Authors

Ethical Approval: Approved

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Conflict of Interest: The authors declare that there is no conflict of interest in the study.

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