



Utility of Neutrophil Lymphocyte ratio and Platelet Lymphocyte ratio as biomarkers of inflammation in type II Diabetes Mellitus

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KEYWORDS

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ABSTRACT:

Introduction- Type II Diabetes mellitus (DM) is a chronic disease characterized by hyperglycemia. NLR and PLR are new inflammatory biomarkers widely studied in Type II Diabetes Mellitus. Their normal ranges are (NLR and PLR) 1.9 ± 0.6 and 91.77 ± 26.95 respectively.

Objectives: To evaluate the role of neutrophil lymphocyte ratio and platelet lymphocyte ratio in Type II diabetes patients.

Methods: - A total of 176 patients were included in this study. WBC count, absolute counts for neutrophils, lymphocytes and platelet were recorded and NLR and PLR were calculated. Results were categorized in two groups- Diabetes with/without complications. Results were analyzed and compared using Kruskal -Wallis and Mann Whitney U tests.

Results: Among the total of 176 patients, 134(76.1%) showed raised NLR ($p < 0.001$) and 127 showed raised PLR ($p < 0.002$). Comparison between type II DM with and without complications also showed statistical significance in NLR ($P < 0.003$) but not with respect to PLR ($p < 0.16$).

Conclusion: This study highlights the prognostic utility and significant association of both of these parameters in type II DM.

1. Introduction

A metabolic illness characterised by persistent hyperglycaemia and/or abnormalities of the metabolism of carbohydrates, proteins, and fats is called diabetes mellitus. Despite having a diverse aetiology, the disorder is caused by either decreased insulin output, resistance to insulin's effects, or both (1).

A lack of insulin, or the inability of cells to respond to it, leads to high levels of blood glucose (hyperglycaemia). Insulin deficiency over the long term can cause disabling and life-threatening health complications such as cardiovascular diseases, neuropathy, nephropathy and retinopathy (2).

These complications are linked to increased disability, frailty, and a shortened life expectancy. (3,4). Inflammation in Type II DM is driven by hyperglycaemia induced oxidative stress, endothelial dysfunction and immune dysregulation. Traditional inflammatory biomarkers, such as interleukins and TNF alpha are costly and require advance laboratory

facilities, limiting their use in resource constrained hospitals. The neutrophil-to-lymphocyte ratio (NLR), a readily detectable and reasonably priced laboratory metric derived from frequently examined leucocyte properties, is significant because it combines the detrimental effects of neutrophils on endothelium damage with the anti-atherosclerotic function of lymphocytes (5). As a result, the NLR has been regarded as a practical systemic inflammation indicator. Parameters like the neutrophil-to-lymphocyte ratio (NLR) and platelet-to-lymphocyte ratio (PLR) are inflammatory markers that are used to predict the inflammatory state of a number of clinical conditions, including diabetes, tumours, and cardiovascular issues (6,7). This study aims to evaluate the utility of NLR and PLR as biomarkers of systemic inflammation in Type II DM with a focus on their association with disease severity and complications.

2. Objectives

Objective: Primary objective- To evaluate and compare neutrophil lymphocyte ratio and platelet lymphocyte



ratio in Type II diabetes patients with and without complications.

Methods

A cross sectional study was conducted on 176 patients diagnosed with Type II DM over a period of one year. Acute infections and sepsis cases were excluded. Venous blood samples of 176 patients were collected in K2EDTA and white blood cell count, absolute counts for neutrophils, lymphocytes and platelet were recorded using DxH haematology analyser 900 and NLR and PLR were calculated. The data was coded and entered in a Microsoft excel sheet and exported to SPSS version 25 for statistical analysis. Results were categorized in two groups- Diabetes with/without complications. Results were analysed and categories were compared using Kruskal -Wallis and Mann Whitney U tests.

3. Results

This study included 176 patients diagnosed with Type II DM, of which 66 patients (37.5%) presented with complications such as diabetic foot, retinopathy, nephropathy and neuropathy. 110 patients (62.5%) had no identified diabetes related complications. The mean age of the study population was 52.4 ± 8.9 years, with a male to female ratio of approximately 1.2:1. Elevated NLR (>2.5) was observed in 76.1% of patients ($n=134$). Decreased NLR (<1.5) was noted in 21.6% ($n=38$). Normal NLR was seen only in 2.3% ($n=4$). (**Figure 1**) Patients with complications had significantly higher NLR (mean 3.2 ± 0.8) compared to those without complications (mean 2.4 ± 0.6 , $p < 0.05$). Within the complications group, the highest NLR values were observed in patients with diabetic foot and nephropathy, indicating more pronounced inflammation in these subgroups. Elevated PLR was observed in 72.2% ($n=127$). Decreased PLR was noted in 6.3% ($n=11$). Normal PLR was found in 21.6% cases (**Figure 2**). Mean PLR was slightly higher in patients with complications than in those without complications but this difference was not statistically significant ($p > 0.05$) (**Table 1**). While the overall difference in PLR between groups was not statistically significant, elevated PLR was more frequent in patients with advance disease stages, suggesting a potential trend correlating with long term inflammation.

4. Discussion

This study evaluates the role of NLR and PLR as markers of systemic inflammation in Type II DM. Chronic inflammation is a well-established factor in pathogenesis of Type II DM and its complications. NLR and PLR are derived from routine haematological parameters, making them cost effective and accessible biomarkers for assessing the inflammatory state and disease progression. NLR was significantly elevated in patients with complications compared to those without complications. This aligns with existing literature where higher NLR values are associated with poor glycaemic control, oxidative stress and systemic inflammation in Type II DM.

Elevated NLR in this study reflects a pro inflammatory state marked by increased neutrophil activity (marker of acute inflammation) and decreased lymphocyte levels (indicative of immune suppression). These findings support the hypothesis that a persistent inflammatory state contributes to pathogenesis and progression of diabetes complications including diabetic nephropathy, retinopathy and diabetic foot.

Although PLR was elevated in 72.2% patients, the difference between groups with and without complications was not statistically significant.

This suggests PLR may not be as sensitive as NLR in reflecting disease severity. However, elevated PLR in patients with advanced disease stages may reflect increased platelet activation and aggregation, known contributors to vascular inflammation and thrombosis in diabetes.

At Safdarjung Hospital in New Delhi, a cross-sectional study was carried out. 80 individuals with type 2 Diabetes Mellitus (DM) were chosen. The mean \pm standard deviation (SD) of NLR was 3.29 ± 1.49 .

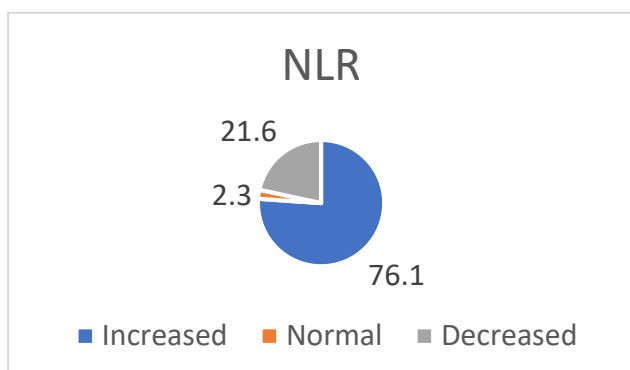


Fig 1: NLR in percentage

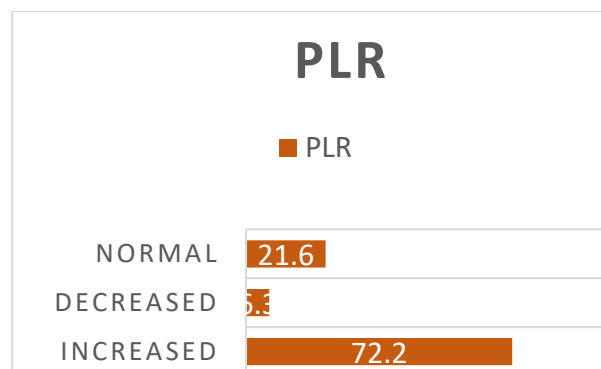


Fig 2: PLR in percentage

Kruskal Wallis Test				
	Complications of Diabetes Mellitus	Total no of patients	Median (IQR)	p- value
Neutrophil Lymphocyte ratio	Diabetic foot	19	8.60(3.45-15.1)	0.03
	Diabetic ketoacidosis	04	2.66(1.95-7.21)	
	Diabetic nephropathy	05	4.06(1.98-6.74)	
	Diabetic retinopathy	38	4.94(3.71-6.66)	
	No Complications	110	3.60(2.20-6.21)	
Platelet lymphocyte ratio	Diabetic foot	19	189.38(138.58-278.44)	0.16
	Diabetic ketoacidosis	04	135.94(99.49-276.96)	
	Diabetic nephropathy	05	172.63(108.81-220.46)	
	Diabetic retinopathy	38	180.78(142.99-276.15)	
	No complications	110	145.51(107.33-223.77)	

Table 1: Representation of NLR and PLR in patients of Type II DM with/without complications

This indicates that 38.7% (31) of the patients had high NLR. NLR was also significantly higher in DM patient having more than one microvascular complication (8).

A study by Zhang J et al. discovered that in patients with diabetic nephropathy, higher NLR was linked to deteriorating renal function and correlated with more severe histological abnormalities (9).

In a study by Nagabhushan BK et al, 110 individuals out of 150 had well-controlled diabetes mellitus (HbA1c-7%). Compared to the controls, diabetic

patients exhibited significantly increased NLR and PLR ($p = 0.003$ and $p = 0.008$, respectively). Compared to participants with well-managed DM, patients with poorly controlled DM showed significantly greater NLR and PLR ($p = 0.02$ and 0.007) (10).

Studies by Mertoglu et al. and others stated NLR and PLR were higher in diabetics similar to the findings in this study (11).

Conclusion: The findings of this study reinforce the potential utility of NLR and PLR as biomarkers of



systemic inflammation. These markers derived from routine haematological parameters, provide an affordable and accessible means of assessing the inflammatory state which can be used as an alternative to advanced inflammatory markers like cytokines and interleukins predicting disease severity and monitoring complications in patients with Type II DM. Their simplicity and affordability are especially advantageous in resource constrained settings, where access to sophisticated diagnostic tools is limited. Including NLR and PLR into routine clinical practice could improve risk stratification, facilitate early detection of complications and guide treatment decisions in Type II DM. Regular monitoring of NLR could enable timely interventions to prevent or mitigate complications, thereby reducing the overall disease burden.

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