

Original Research Article

Correlation of Neutrophil-Lymphocyte Ratio (NLR) with Glycemic Control in Diabetes Patients

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ABSTRACT

Background

Diabetes mellitus, a prevalent chronic metabolic disorder, poses a global health challenge with escalating rates. HbA1c is a conventional marker for glycemic control but lacks efficacy in predicting diabetic complications. Neutrophil Lymphocyte Ratio (NLR) emerges as a promising inflammatory marker in various disorders, including diabetes. This prospective observational study aimed to investigate the correlation between NLR and glycemic control in type 2 diabetes mellitus.

Method

Patients with diabetes attending the medicine department of AIMS BG Nagara from October 2023 to February 2024 were included. Exclusion criteria encompassed various conditions affecting inflammation. Institutional ethics clearance and patient consent were obtained. Data were collected and analyzed using SPSS v23.

Results

Among 150 patients, the mean age was 55.39 years, with 56% being male. Significant associations were found between HbA1c levels and NLR, with higher NLR values corresponding to poorer glycemic control. Patients with higher HbA1c exhibited lower hemoglobin and lymphocyte levels but higher neutrophil counts. A positive correlation was observed between NLR and fasting/post-prandial blood sugar levels.

Conclusion

NLR presents itself as a readily available, cost-effective measure for assessing subclinical inflammation and predicting poor glycemic control in type 2 diabetes. Its integration into routine screenings could aid in early identification of at-risk patients, facilitating timely interventions to mitigate diabetes-related complications.

Keywords: Diabetes Mellitus, Neutrophil Lymphocyte Ratio, Glycemic Control, Inflammation, Complications.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder which can be preventable if proper preventive measure are taken.^{1,2} It is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. It is broadly categorized into two types designated as type-1 and type-2. In type-1 diabetes mellitus there is complete or near total insulin deficiency. In type-2 diabetes mellitus there is decreased ability of the insulin to act on the peripheral tissue, which is called insulin resistance.

The worldwide prevalence of diabetes mellitus is rapidly escalating, reaching epidemic proportions. As per the World Diabetes Atlas, the global prevalence among adults aged 20– 79 years was 6.4% in 2010, affecting 285 million adults, and surged to 406 million adults in 2018, with projections estimating 511 million adults by 2030. HbA1C serves as the standard marker for evaluating glycemic control and is pivotal in assessing the effectiveness of oral hypoglycemic agents and insulin therapy. However, it lacks the capability to identify diabetes-related complications.^{3,4} Neutrophil Lymphocyte ratio is a marker which is used as a tool to assess inflammatory changes in cardiac disorders and other non cardiac disorders due to its extraordinary diagnostic value.³ Neutrophil lymphocyte count is sensitive marker of inflammation and various studies have been carried out in finding the relationship between this ratio and its significance in cardiac problems , stroke and even in myocardial infarction.¹ Inadequate and poor glycemic control is the major cause for both microvascular and macrovascular diabetic related complications.^{1,5} Present research aimed to study the correlation between neutrophil lymphocyte ratio and glycemic control in type 2 diabetes mellitus.

MATERIAL & METHOD

Present prospective observational study was conducted among the patients attending to medicine OPD or IPD of AIMS BG Nagara, during the period of October 2023 to February 2024 with history of diabetes mellitus were included. Patients with acute or chronic infection, inflammatory condition, chronic heart failure, hematological disorder, dyslipidemia, cancer and any emergencies related to diabetes mellitus were excluded.

The study obtained institutional ethics clearance prior to start of study and patients informed consent was collected. All the patients data were collected in proforma and entered in excel sheet. The patients were grouped based on HbA1c, as

group A (<7), group B (7-9), and groupC (>9).

Statistical Analysis

All the data was entered in excel sheet and analysed using SPSS v23 operating on windows 10. The mean difference between the continuous variables was analysed using the students t-test and for multiple group comparison ANOVA test with bonferroni post-hoc test was used. The difference between the categorical variables was analysed using chi-square test. A p-value of <0.05 was considered statistically significant.

RESULT

Total of 150 patients fulfilling inclusion criteria after obtaining the informed consent. The mean age of patients in the present study was 55.39±10.44 yrs. of age. Among them, 56% were male participants and 44% were female participants with male preponderance.

		Frequency	Percent
Smoking	No	121	80.7
	Yes	29	19.3
Alcohol	No	105	70.0
	Yes	45	30.0
Obesity	No	130	86.7
	Yes	20	13.3
Family history of DM	No	119	79.3
	Yes	31	20.7
Pallor	No	102	68.0
	Yes	48	32.0
<i>Table 1. Showing demographic details</i>			

		Duration of DM in years		ANOVA (p-value)
		Mean	SD	
Group	Group A (<7)	8.80	4.45	0.001**
	Group B (7-9)	11.60	4.67	
	Group C (>9)	15.52	5.15	
**p<0.01 showing the highly significant; post-hoc analysis was performed using the Bonferroni, which showed significance between all the three groups based on HbA1c.				
<i>Table 2. Comparison of mean duration of diabetes mellitus between the groups using ANOVA test</i>				

	Group A (<7)		Group B (7-9)		Group C (>9)		ANOVA (p- value)
	Mean	SD	Mean	SD	Mean	SD	
Hemoglobin	11.49	1.72	10.23	.89	10.25	2.09	0.001**
Neutrophil	55.52	3.87	63.28	3.60	68.62	7.59	0.001**
Lymphocyte	36.88	3.07	24.36	2.64	20.98	6.65	0.001**
Neutrophil-lymphocyte ratio	1.49	.16	2.59	.32	3.62	1.40	0.001**
FBS	149.64	30.40	184.52	26.38	223.66	31.94	0.001**
PPBS	253.36	37.08	320.28	27.40	404.36	55.09	0.001**

**p<0.01 showing the highly significant; post-hoc analysis was performed using the Bonferroni, which showed significance between all the three groups based on HbA1c.

Table 3. Showing the comparison of mean level of complete blood count between the groups using ANOVA test

		Neutrophil-lymphocyte ratio
HbA1C	r	0.773
	Sig	.001**
FBS	r	0.659
	Sig	0.01*
PPBS	r	0.75
	Sig	0.01*

Table 4. Showing the Pearson's correlation between the NLR with glycemic index-HbA1c

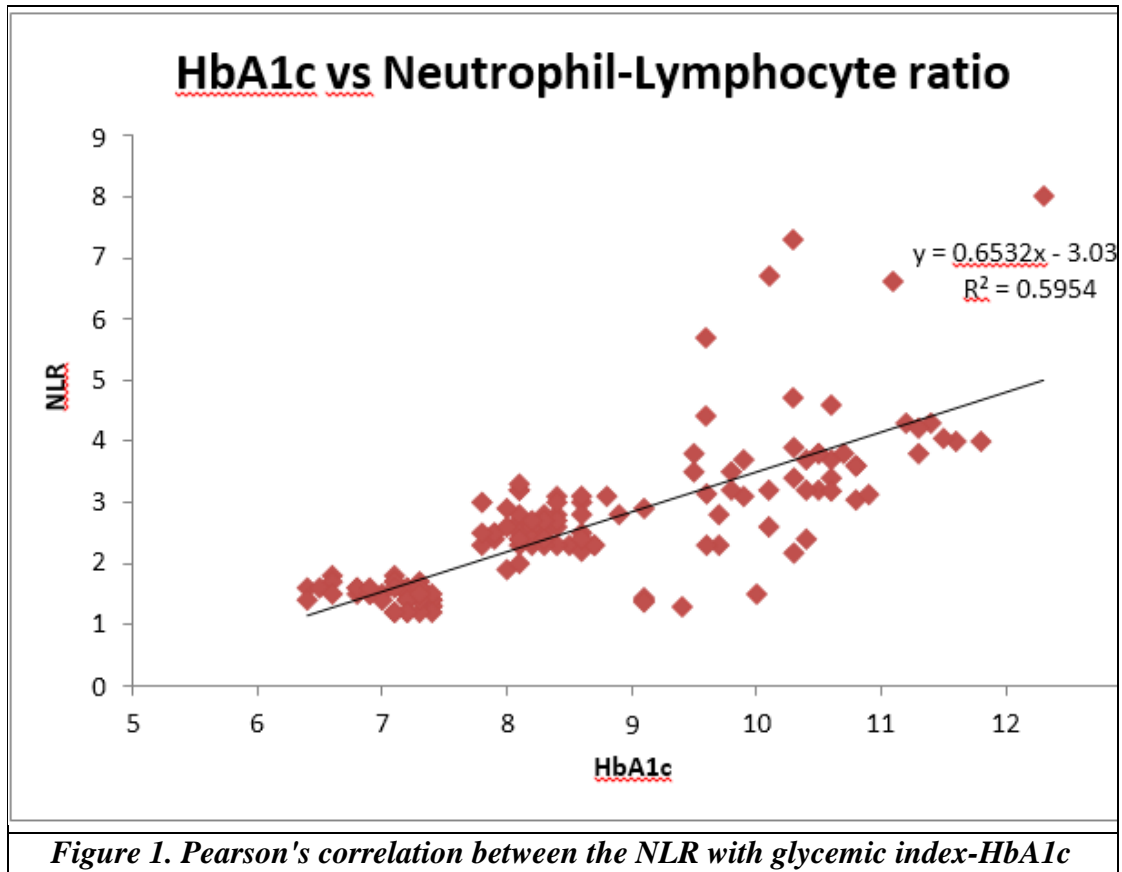


Figure 1. Pearson's correlation between the NLR with glycemic index-HbA1c

Duration of diabetes was longer among the patients with higher HbA1c. There was significant lower hemoglobin and lymphocyte among the group C patients compared to group B and A. Significant higher mean neutrophil was higher in group C patients compared to group B and A. ($p < 0.001$). The neutrophil-lymphocyte ratio among the patients among the group C was significantly higher compared to group B and group A. ($p < 0.05$). There was significant higher mean of FBS, PPBS and HbA1c among the group C compared to group B and group A. ($p < 0.05$) Significant positive strength of association between the NLR with HbA1c ($r = 0.773$, $p < 0.001$) Significant positive strength of association between the NLR with FBS ($r = 0.659$, $p < 0.001$) and PPBS ($r = 0.750$, $p < 0.001$).

DISCUSSION

The Neutrophil Lymphocyte Ratio (NLR) stands out as a promising indicator for gauging inflammation across a range of cardiac and non-cardiac conditions due to its superior predictive, diagnostic, and discriminative capabilities compared to the total White Blood Cell (WBC) count. It proves valuable in forecasting outcomes for ailments like acute myocardial infarction (AMI), stroke, and heart failure. Various clinical studies have shown that NLR's predictive power matches that of other inflammatory markers such as C-reactive protein (CRP), tumor necrosis factor (TNF-), and interleukin (IL-6) in identifying hidden inflammation and endothelial

dysfunction, unlike the overall WBC count.⁶ HbA1c serves as a standard blood test for assessing long-term glycemic control and evaluating the extent of hyperglycemia. Nevertheless, its reliability in predicting ongoing inflammation and complications related to diabetes isn't always consistent. NLR holds promise as a tool for gauging both inflammatory status and the ramifications of diabetes.

A total of 150 patients meeting the inclusion criteria participated in the study after providing informed consent. The average age of the patients in this investigation was 55.39 years, with a standard deviation of 10.44 years. Of these participants, 56% were male, indicating a slight male predominance, while 44% were female. Similar to present study, the mean age of the participants in the study by Devamsh et al., found to be 55.2±4.3yrs of age.² In study by Hussain M et al., the mean age of participants was found to be 60.4±12.7 yrs.⁴

On assessment of the blood parameters, there was significant lower hemoglobin and lymphocyte among the group C patients compared to group B and A, similarly the significant higher mean neutrophil was higher in group C patients compared to group B and A. ($p < 0.001$) The neutrophil-lymphocyte ratio among the patients among the group C was significantly higher compared to group B and group A. ($p < 0.05$) Devamsh et al., documented the total count and NLR was significantly higher in the group C compared to group B and group A in their study.² There was significant higher mean of FBS, PPBS and HbA1c among the group C compared to group B and group A. ($p < 0.05$) similar to present study, Devamsh et al., documented the significant higher mean sugar level and HbA1c among the groups.²

On correlation of the NLR with glycemic control, we found a significant positive strength of association between the NLR with HbA1c ($r = 0.773$, $p < 0.001$). On comparison of the NLR with the fasting and post-prandial blood sugars, we found a significant positive strength of association between the NLR with FBS ($r = 0.659$, $p < 0.001$) and PPBS ($r = 0.750$, $p < 0.001$). In concordance to present study, Shiny et al, (2014) NLR with a significant positive connection with glycated hemoglobin ($r = 0.411$), fasting plasma glucose ($r = 0.378$), and HOMA-IR ($r = 0.233$) ($P < 0.001$). Even after controlling for age, waist circumference, blood pressure, lipids, and smoking, regression analysis revealed a linear rise in NLR with increasing severity of glucose intolerance.⁷ In similar terms, Sefil F et al., documented the NLR to have positive relationship with HbA1c and the blood glucose regulation. Higher NLR may be related with elevated HbA1c in type 2 diabetes mellitus patients.³

Umarani MK et al., documented that NLR might be regarded as an early and prognostic predictor for microvascular problems in diabetic individuals.⁸ Wan H et al., documented that in diabetic individuals, a greater NLR level was associated with an increased prevalence of CVD and DKD other than DR.⁹

In concordance to present study, Devamsh GN et al., stated that NLR demonstrated a positive connection with HbA1c and was discovered to be an independent predictor of poor glycemic management in type 2 diabetes mellitus patients.² Hussain M et al., found NLR to be an independent predictor of poor diabetes control (OR: 1.809, 95% CI: 1.459-2.401), along with fasting blood sugar

(OR: 0.938, 95% CI: 0.995-0.982) and CRP (OR: 1.020, 95 percent CI: 1.003-1.028). Increased NLR levels are linked to higher HbA1c and poor glycemic control in type 2 diabetes patients. It can be used as a disease monitoring tool during diabetic patient follow-up.⁴

NLR may be beneficial as an easily quantifiable, non-invasive, readily available, and cost-effective measure for diabetes patient follow-up.¹⁰ Because of its wide availability, low cost, reliability, and ease of lab detection, NLR has several benefits over other inflammatory markers. Patients with a high NLR but a normal TLC count may be at risk for atherosclerosis-related illnesses.

CONCLUSION

NLR is a simple test that is readily available, safe, and inexpensive. NLR is a measure of subclinical inflammation as well as a predictor of poor glycemic control in type 2 diabetes patients. NLR can be used as a screening test to identify type 2 diabetes patients who are more likely to develop diabetes-related complications, allowing for the implementation of preventative treatments and the avoidance or delay of life-threatening consequences.

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Conflict of interest: Nil

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