

How is NLR and PLR affected in Type 2 diabetes mellitus compared to healthy population?

Yavuz Dik^{1*}

Abstract

Objective: Diabetes Mellitus (DM); has become an important public health problem in Turkey and in the world. In this study, we aimed to investigate the effect of neutrophil / lymphocyte ratio and platelet / lymphocyte ratio in diabetic patients compared to healthy population in terms of cost effectiveness.

Material and Methods: A control group consisting of 82 diabetics and 85 healthy individuals who applied to the internal medicine outpatient clinic between January 2019 and November 2019 were included in the study. The patients were divided into two groups as those with diabetes and healthy individuals. Files were scanned retrospectively and hemoglobin, mean platelet volume (MPV), glycosylated hemoglobin (HbA1c), hematocrit counts (hct), neutrophil and lymphocyte counts, and neutrophil-lymphocyte ratio (NLR), platelet count (plt), platelet lymphocyte ratio (NLR) PLR has been recorded.

Results: We retrospectively compared the demographic and laboratory parameters of the healthy group and the diabetic patients (82 patients and 85 healthy). The mean age of the diabetic group was 55.9 years, while the mean age of the healthy group was 37.5. Mean NLR was 2.4 and 2.1 in diabetic and healthy groups, respectively. NLR value was higher in diabetic group compared to healthy group and there was no statistically significant difference ($p = 0.07$). MPV values in diabetic group and healthy group were 8.53 and 8.51, respectively, and there was no significant relationship between them ($p = 0.81$). PLR value was 145.9 and 146.7 in diabetic group and healthy group, respectively, and we did not find any significant relationship ($p = 0.97$).

Discussion: As a result; In our study, when we evaluated the diabetic group within the diabetic group and the healthy group, we could not find a statistically significant relationship between the groups in terms of hematological parameters.

Keywords: Diabetes mellitus, neutrophil, lymphocyte, Ratio

Introduction

Diabetes Mellitus (DM) is a systemic chronic metabolic disease with chronic hyperglycemia.

It is characterized by disorders of carbohydrate, protein and fat metabolism resulting from partial or total deficiency of insulin and / or insulin resistance (1).

Neutrophil lymphocyte ratio (NLR), platelet lymphocyte ratio (PLR) and platelet indices are easy, inexpensive and accessible rates calculated from whole blood count and have been shown to be associated with many medical conditions and pathologies(2-4).

There are studies showing a correlation between metabolic and endocrinological diseases and this index and rates(5,6).

Inflammatory processes play a key role in chronic diseases, including cardiovascular disease, cancer, chronic kidney disease and diabetes mellitus (7).

Studies have shown that neutrophil / lymphocyte (N / L) ratio. inflammation is a systemic indicator. In addition, N / L ratio has been shown to be an important predictor of short and long term cardiovascular mortality and prognosis in cancer patients. (8,9).

The aim of our study was to evaluate the feasibility of routine hemogram examination in diabetic patients between diabetic patients and healthy group and diabetic patients according to HbA1c levels.



Material and Methods

Ethical approval of this study was obtained from Firat University Scientific Research Projects Coordination Unit. Data; Elazığ City Hospital was established based on the data obtained from retrospective files of patients who applied to the internal medicine outpatient clinic and clinic between January 2019 and November 2019.

The study included 82 patients with Type 2 diabetes and a control group of 85 healthy subjects. Patients were divided into two groups as diabetes mellitus and healthy subjects. The diabetic group consisted of patients aged 30-78 years who applied to the internal medicine outpatient clinic due to diabetes mellitus. Patients with a different chronic disease (coronary artery disease, hematological diseases, malignancy, severe liver disease, severe renal failure), and smoking DM patients were not included in the study. Files were scanned retrospectively.

Hemoglobin, mean platelet volume (MPV), glycosylated hemoglobin (HbA1c), hematocrit numbers (hct), neutrophil and lymphocyte count and rate (NLR), platelet count (plt), platelet lymphocyte ratio information were obtained from the file records.

Statistical analysis: All statistical analyzes were done with a computer package (SPSS-22) program. While evaluating the study data, in addition to the descriptive statistical methods [Average (), Standard deviation (SD)], Student's t was used in the parametric tests that showed normal distribution in the comparison of quantitative data, and one-way ANOVA in group comparisons.

The Wilcoxon paired sample test, which is the significance test of the difference between the two partners, was used to compare the qualitative data and the Chi-Square test. The results were evaluated in the 95% confidence interval and the significance level was $p < 0.05$.

Results

Table 1 shows the comparison of demographic and laboratory parameters between diabetic and healthy groups. The mean age of the diabetic group was 55.9 years, while the mean age of the healthy group was 37.5 years. Mean NLR was 2.4 and 2.1 in diabetic and healthy groups, respectively. There was no significant difference in NLR between the two groups ($p = 0.07$). MPV values in diabetic group and healthy group were 8.53 and 8.51, respectively, and the relationship was not statistically significant ($p = 0.81$). PLR value was 145.9 and 146.7 in diabetic group and healthy group, respectively, and the relationship was not significant ($p = 0.94$).

Table 2 shows the relationship between MPV, NLR, PLR in patients diagnosed with diabetes based on HbA1c level. We divided diabetic patients with HbA1c level 10 and above ($n = 39$) and below 10 (43) into two groups.

The NLR value was found to be 2.6 in the high HbA1c group, while the HbA1c value was 2.2 in the group below 10 and there was no statistically significant relationship ($p = 0.18$).

The PLR value was 140.4 and 150.8, respectively, and there was no statistically significant relationship. We did not find any statistically significant relationship ($p = 0.58$).

Table 1: Demographic and Laboratory Data of Diabetic and Healthy Individuals

	Groups	N	Median	Standart Deviasyon	p value
Age	control	85	37,5	11	<0.001
	patient	82	55,9	12,9	
HbA1c	control	85	5,6	0,2	<0.001
	patient	82	9,5	2,2	
Hematocrit	control	85	41,1	5,6	0,54
	patient	82	41,7	6,8	
Thrombosit	control	85	264070	55506	0,54
	patient	82	269853	68379	
Neutrofil	control	85	4146	1513	0,13
	patient	82	4539	1852	
Lymphocytes	control	85	1984	452	0,10
	patient	82	2191	1080	
MPV	control	85	8,5	0,9	0,81
	patient	82	8,5	0,7	
NLR	kontrol	85	2,1	0,8	0,07
	patient	82	2,4	1,2	
PLR	control	85	146,7	59,4	0,94
	patient	82	145,9	85,6	
Monocytes	control	85	392	94	<0.001
	patient	82	463	144	

Table 2: Relationship between MPV, NLR, PLR in diabetic patients according to HbA1c level

	Groups	N	Median	Standart Deviasyon	p value
Age	HbA1c>10	39	54.3	10.2	0,27
	HbA1c<10	43	57.4	14.8	
HbA1c	HbA1c>10	39	11.4	1.2	<0.001
	HbA1c<10	43	7.7	1.1	
Hematocrit	HbA1c>10	39	42.9	6.8	0,12
	HbA1c<10	43	40.6	6,7	
Thrombosit	HbA1c>10	39	281846	71030	0,13
	HbA1c<10	43	258976	64791	
Neutrofil	HbA1c>10	39	5101	2103	<0,05
	HbA1c<10	43	4030	1435	
Lymphocytes	HbA1c>10	39	2394	1416	0,10
	HbA1c<10	43	2007	602	
MPV	HbA1c>10	39	8,4	0,7	0,06
	HbA1c<10	43	8,7	0,7	
NLR	HbA1c>10	39	2,6	1,3	0,18
	HbA1c<10	43	2,2	1,1	
PLR	HbA1c>10	39	140.4	62.4	0,58
	HbA1c<10	43	150.8	102.8	
Monocytes	HbA1c>10	39	447	128	0.36
	HbA1c<10	43	477	158	

Discussion

Neutrophil lymphocyte ratio (NLR) and platelet lymphocyte ratio (PLR) are inexpensive and easily accessible parameters calculated from whole blood count. It has been shown to be associated with many medical conditions and pathologies (2-4). There have been reports of a correlation between metabolic and endocrinological diseases and this index and rates in studies (5,6). In a study, elevation of NLR levels and the presence of this elevation in sedimentation in elderly osteoporosis showed that inflammation may play an important role in bone remodeling (10). In our study, the mean NLR value in the diabetic and healthy group was 2.4 and 2.1, respectively. There was no significant difference in NLR between the two groups. In many epidemiological studies, chronic inflammation has been shown to play an effective role in the pathogenesis of chronic diseases such as metabolic syndrome, hypertension and diabetes (11,12).

Cross-sectional and prospective studies have shown a positive relationship between Type 2 DM and its complications and CRP, IL-6 and white cell count (13).

In the study of Onalan and et al(14) on 100 diabetic patients and 100 healthy controls, NLR and PLR values were found to be higher in diabetic group compared to healthy group and statistically significant.

In addition, it was found that NLR value increased significantly in diabetic retinopathy and diabetic nephropathy group compared to non-diabetic nephropathy group.

In a study evaluating the relationship between gestational diabetes and mean platelet volume (MPV), MPV value was found to be significantly higher in gestational diabetics than in control.

In addition, the researchers found a correlation between MPV and insulin resistance index (HOMA-IR) (15).

Some studies showed a significant correlation between MPV and neuropathy. However, Hekimsoy et al.'s study with 145 diabetic and 100 nondiabetic individuals found no significant statistical difference (16, 17). Similarly, in our study, we did not find any significant difference between the diabetic group and the healthy group in terms of MPV value. Increased NLR was found to be a poor predictor of prognosis in patients undergoing cardiovascular intervention.

In some studies, increasing NLR values have been shown to be parallel with the increase in mortality rates (16,17). For example, in a study evaluating the effect of smoking, NLR, PLR and platelet indices were found higher in smokers and were also associated with NLR and platelet smoking intensity (18). Therefore, these factors should be taken into consideration when studying NLR, PLR and other indices.

In our study, when we compared diabetic group and healthy population, we found differences in NLR, PLR and MPV values, but there was no statistically significant relationship. When we compared the diabetic group according to HbA1c value, we did not find any statistically significant relationship. Different and similar results from previous studies may be due to some limitations of our study.

The lack of homogeneous distribution of cross-sectional patients in terms of age, sex, oral antidiabetic drugs and body mass index are the deficiencies of our study.

Conclusion

As a result; In our study, when we compared the diabetic group and the healthy group and the diabetic group according to the HbA1c value, we found differences in some hematological parameters, although not statistically significant.

We found that hematocrit, MPV, NLR, PLR values found in a simple laboratory test such as hemogram are cost-effective parameters for demonstrating hyperglycemia. Further comprehensive research is needed to conclude concordance and lack of concordance between the studies and our studies.

Conflict of interest statement: The authors declare that there is no actual or potential conflict of interest.

Author's contributions: YD; Design of research, data collection and Patient examinations, preparation of article and revisions

Ethical issues: Author declare, originality and ethical approval of research. The study was conducted under defined rules by the Local Ethics Commission guidelines and audits.

References

1. American Diabetes Association. Diagnosis and Classification of Diabetes Mellitus. *Diabetes Care* 2005; 28: 37- 42. Diagnosis and classification of diabetes mellitus *Diabetes Care* 2007; 30: 42-47.
2. Tulgar YK, Cakar S, Tulgar S, et al. The effect of smoking on neutrophil/lymphocyte and platelet/lymphocyte ratio and platelet indices: a retrospective study. *Eur. Rev. Med. Pharmacol. Sci.* 2016;20: 3112-8.
3. Koh C-H, Bhoo-Pathy N, Ng K-L, et al. Utility of pre-treatment neutrophil-lymphocyte ratio and platelet-lymphocyte ratio as prognostic factors in breast cancer. *Br. J. Cancer.* 2015;113:150-8.
4. Akdag S, Akyol A, Asker M, et al. Platelet-to-Lymphocyte Ratio May Predict the Severity of Calcific Aortic Stenosis. *Med. Sci. Monit.* 2015;21: 3395-3400.
5. Demirtas L, Degirmenci H, Akbas EM, et al. Association of hematological indices with diabetes, impaired glucose regulation and microvascular complications of diabetes. *Int. J. Clin. Exp. Med.* 2015;8: 11420-7.
6. Yilmaz H, Ucan B, Sayki M, et al. Usefulness of the neutrophil-to-lymphocyte ratio to prediction of type 2 diabetes mellitus in morbid obesity. *Diabetes Metab. Syndr.* 2015;9: 299-304.
7. Manabe I: Chronic inflammation links cardiovascular, metabolic and renal diseases. *Circ J* 2011;75: 2739-48
8. Azab B, Zaher M, Weiserbs KF, Torbey E, Lacossiere K, Gaddam S, Gobunsuy R, Jadonath S, Baldari D, McCord D, Lafferty J: Usefulness of neutrophil to lymphocyte ratio in predicting short- and long-term mortality after non-ST-elevation myocardial infarction. *Am J Cardiol* 2010;106:470-476
9. Chua W, Charles KA, Baracos VE, Clarke SJ: Neutrophil/lymphocyte ratio predicts chemotherapy outcomes in patients with advanced colorectal cancer. *Br J Cancer* 2011;104:1288-95
10. Onalan E, Gozel N, Donder E. Can hematological parameters in type 2 diabetes predict microvascular complication development? *Pak J Med Sci.* 2019 Nov-Dec;35(6):1511-1515. doi: 10.12669/pjms.35.6.1150.
11. Pitsavos C, Tampourlau M, Panagiotakos DB, Skoumas Y, Chrysoshoou C, Nomikos T, et al. Association between low-grade systemic inflammation and type 2 diabetes mellitus among men and women from the ATTICA Study. *Rev Diabet Stud* 2007;4(2):98-104.
12. Bell DS, O'Keefe JH. White cell count, mortality, and metabolic syndrome in the Baltimore longitudinal study of aging. *J Am Coll Cardiol* 2007;50(18):1810-81.
13. Denghan A, Kardys I, de Maat MP, Uitterlinden AG, Sijbrands EJ, Bootsma AH, et al. Genetic variation, C-reactive protein levels, and incidence of diabetes. *Diabetes* 2007;56(3): 872-8.
14. Onalan E, Gokalp Y. Evaluation of bone mineral density in geriatric age group with hematological parameters. *Family Practice and Palliative Care.* 2020;4(1): 1-5.
15. Baldane S, Ipekci SH, Kebapcilar A. Relationship Between Insulin Resistance and Mean Platelet Volume in Gestational Diabetes Mellitus. *J. Lab. Physicians.* 2015;7: 112-5.
16. Tamhane UU, Aneja S, Montgomery D, Rogers EK, Eagle KA, Gurm HS. Association between admission neutrophil to lymphocyte ratio and outcomes in patients with acute coronary syndrome. *Am J Cardiol* 2008;102(6): 653-7.
17. Duffy BK, Gurm HS, Rajagopal V, Gupta R, Ellis SG, Bhatt DL. Usefulness of an elevated neutrophil to lymphocyte ratio in predicting long-term mortality after percutaneous coronary intervention. *Am J Cardiol* 2006;97(7): 993-6.
18. Tulgar YK, Cakar S, Tulgar S, et al. The effect of smoking on neutrophil/lymphocyte and platelet/lymphocyte ratio and platelet indices: a retrospective study. *Eur. Rev. Med. Pharmacol. Sci.* 2016;20: 3112-8.