

Original Research Article

NEUTROPHIL LYMPHOCYTE RATIO AND PLATELET LYMPHOCYTE RATIO AS AN ASSESSMENT TOOL FOR GLYCEMIC CONTROL IN TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: The Neutrophil lymphocyte ratio and Platelet lymphocyte ratio have advantage of being cost effective, widely available, reliable and easy lab detection as compared to other inflammatory markers hence can be used on large scale for screening purposes.

Objectives: The aim of our study is to find out the correlation between Neutrophil lymphocyte ratio, Platelet lymphocyte ratio and HbA1C.

Materials and Methods: The current observational, cross sectional, prospective study included 90 patients both male and female diagnosed with type 2 diabetes mellitus above 40 years of age. The subjects were divided into 3 categories based on degree of diabetic control according to American diabetic association (ADA) criteria. Patients in group A with HbA1C < 7% termed as excellent control, group B HbA1C 7-9% termed as poor control and patients in group C HbA1C >9 % termed as worst control. We recruited 30 subjects in each group. All patients were subjected fasting blood glucose, HbA1C and complete blood counts. The neutrophil lymphocyte ratio and Platelet lymphocyte ratio was calculated by dividing absolute neutrophil count by absolute lymphocyte count and absolute platelet count by absolute lymphocyte count respectively.

Results: On statistical comparison using ANOVA we found that the difference between NLR in three groups was statistically significant ($p < 0.01$) On applying Pearson's Correlation we found a significant positive correlation between HbA1C and NLR ($r = 0.634$). The results of our study showed a statistically significant relation between NLR and HbA1C although the relation between PLR and HbA1c was not statistically significant.

Conclusion: We concluded that NLR is easily available, safe, cost effective and simple test. It is not only a marker of subclinical inflammation but also an indicator of poor glycemic control in patients with type 2 diabetes.

Keywords: NLR and glycemic control, PLR and glycemic control, NLR PLR in type 2 diabetes mellitus.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder in which there is a chronically raised blood glucose levels. The cause of the disease could be an absolute or relative lack of insulin, The two main types of disease are: Type 1 and Type 2 Diabetes mellitus. Type 1 diabetes mellitus presents mainly in childhood and early adult life the cause of the

disease is absolute absence of insulin production by the pancreas due to destruction of beta cells. The more common form of diabetes is Type 2 Diabetes mellitus usually starts in middle age in it there is relative deficiency of production of insulin or impaired insulin action at the target receptors. Diabetes mellitus is a chronic condition, which accounts for high morbidity and mortality. [1] The burden of diabetes mellitus is on its rise due to

strong influence of urbanization, sedentary life style and nutritional transition.^[2]

Type 2 Diabetes mellitus is said to be a silent killer as the patient remains asymptomatic for years unless develops the related complications. Chronic complications of diabetes that develop several years after onset of diabetes affect small blood vessel (microangiopathy) in the eye, kidney and nerves and large vessels leading to coronary artery disease (atherosclerosis). Microangiopathy is related to the duration and severity of hyperglycemia. These complications associated with type 2 DM have an inflammatory pathology. Many inflammatory markers such as interleukin1 (IL1), IL6, IL8, transforming growth factor beta 1 (TGF- β 1) and tumor necrosis factor alpha (TNF α) have been found to be associated with these micro vascular complications. The measurement of these factors is not routinely used and not easily available in all settings in developing country like ours .^[3] The White blood cell counts and differential count of its subtypes are classic indicators of inflammation. Studies have shown that increased leukocyte counts are reliable markers of systemic inflammation. The Neutrophil lymphocyte ratio (NLR) and Platelet lymphocyte ratio (PLR) are potential markers for determining various cardiac and non-cardiac disorders.^[4,5] The neutrophil lymphocyte ratio because of its superior predictive, diagnostic and discriminative ability than total WBC count is rising as a marker of inflammation for various chronic disorders. The predictive value of Neutrophil lymphocyte ratio is comparable to C reactive protein, TNF and IL6. The Neutrophil lymphocyte ratio and Platelet lymphocyte ratio have advantage of being cost effective, widely available, reliable and easy lab detection as compared to other inflammatory markers hence can be used on large scale for screening purposes.^[6,7] The Neutrophil lymphocyte ratio and Platelet lymphocyte ratio are markers of inflammation in various conditions including neoplasm, cardiovascular diseases, stroke and micro and macro vascular complications associated with diabetes mellitus.^[4,5]

The white blood cell (WBC) count and its subtypes are classical indicators of inflammation and their measurement is done routinely. The fact that chronic inflammation plays a significant role in development and progression of diabetes mellitus and its complications is now widely accepted.^[8] Also diabetes associated complications such as retinopathy; neuropathy and nephropathy are closely related with glycemic control. HbA1C is a widely available test advised by the clinicians to measure the level of glycemic control over a period of 2-3 months.^[9-12] Till date, only few researchers have studied the relationship between the glycemic control and these novel markers of inflammation. Hence we conducted the study to find out correlation between Neutrophil lymphocyte ratio, platelet lymphocyte ratio and HbA1C in patients diagnosed with Type 2 Diabetes Mellitus.

MATERIALS AND METHODS

The current observational, cross sectional, prospective study included 90 patients both male and female diagnosed with type 2 diabetes mellitus above 40 years of age randomly selected from the patients coming to diabetic clinic for regular follow up. (sample size estimation done using standard deviation

Formula:

$$\text{Sample size} = (Z)^2 (\sigma)^2 / (d)^2$$

Z = confidence interval: σ = standard deviation; d= estimate with in units of the true value

The Z=1.96 at 95% confidence interval

D= 0.2 units

σ = 0.5 (Standard deviation of NLR)

Calculating from the formula :

Sample size = 24

(Reference study: Hussain M, Babar M Z M, Akhtar L, Hussain M S. Neutrophil lymphocyte ratio (NLR): A well assessment tool of glycemic control in type 2 diabetic patients. *Pk J Med Sci*. 2017;33(6):1366-70.) The subjects were divided into 3 categories based on degree of diabetic control according to American diabetic association (ADA) criteria. Patients in group A with HbA1C < 7% termed as excellent control, group B HbA1C 7-9% termed as poor control and patients in group C HbA1C >9 % termed as worst control. (12) We recruited 30 subjects in each group. Patients were recruited after obtaining written consent and approval from ethical committee. The following inclusion and exclusion criteria were followed to recruit the subjects for the current study:

Inclusion Criteria

Diagnosed cases of type 2 diabetes mellitus both male and female above 40 years of age

Exclusion Criteria

Patients with acute or chronic inflammation /infection for past 2 months

Patients with autoimmune disorder

Patients on NSAIDs/opioids /steroids /immunosuppressive/immunomodulator drugs

Patients with Hematological disorders

Patients with Heart diseases

Patients with Liver or renal disorder

Pregnant females

Smokers

A detailed history including personal history, past history, family history was procured from all enrolled subjects. The study population was then subjected to haematological testing including : fasting blood glucose, HbA1C and complete blood counts. Blood sample was collected from the median cubital vein after an overnight fasting of 12 hours. Total Leukocyte counts were measured using automated haematology analyzer. The neutrophil lymphocyte ratio was calculated by dividing absolute neutrophil count by absolute lymphocyte count. Platelet lymphocyte ratio was calculated by dividing absolute platelet count by absolute

lymphocyte count. HbA1C level was measured using liquid Chromatography using automated ion exchange method.

Data collection was done according to the prescribed proforma and in the spread sheet. We calculated the mean and standard deviation of all variables: Age, fasting blood glucose, WBC count, HbA1C, NLR and PLR in each group. Data was represented as mean $\pm$ SD. Data analysis was done by latest version of SPSS. ANOVA test was used to compare the PLR and NLR in three groups. Pearson's correlation analysis was done to find out the correlation between HbA1C, NLR and PLR.

RESULTS

The current study included 90 subjects with Type II Diabetes mellitus randomly selected from the patients visiting the diabetes clinic. There were 3 groups according to value of HbA1C i.e. Group A (HbA1C<7), Group B (HbA1C 7-9) and Group C (HbA1C>9) Each group included 30 subjects. Out of 90 patients there were 27 Males and 63 Females. The mean NLR of group A with HbA1C <7 was 1.91 ± 0.66 . The mean NLR of group B with HbA1C between 7-9 was 2.25 ± 0.94 . The mean NLR of group C with HbA1C >9 was 3.03 ± 1.04 . The mean

PLR of group A with HbA1C <7 was 90.72 ± 37.24 . The mean PLR of group B with HbA1C between 7-9 was 92.15 ± 41.93 . The mean PLR of group C with HbA1C >9 was 92.8 ± 37.34 . [Table 1]

On comparing the mean NLR in three groups using ANOVA the difference was found to be statistically significant ($p < 0.05$). On comparing the mean PLR in three groups using ANOVA the difference was found to be statistically non-significant ($p > 0.05$). (Table 2) On applying Post Hoc test between the groups the difference of mean NLR was found to be statistically significant in Group A versus Group C ($p < 0.05$) and between Group B versus Group C ($p < 0.05$) while the difference between Group A versus Group B was found to be statistically insignificant ($p = 0.308$). (Table 3)

Post Hoc test between the groups the difference of mean PLR was found to be statistically non-significant in Group A versus Group B ($p = 0.988$), Group B versus Group C ($p = 0.998$) and Group A versus Group C ($p = 0.975$) (Table 4) On applying Pearson's Correlation we found a significant positive correlation between HbA1C and NLR ($r = 0.634$) On applying Pearson's Correlation we did find a significant positive correlation between HbA1C and PLR ($r = 0.077$). (Table 5)

Table 1: Mean NLR and PLR of the three groups

Group	HbA1C	NLR (Mean $\pm$ SD)	Platelet Lymphocyte ratio (Mean $\pm$ Standard deviation)
A	<7	1.91 ± 0.66	90.72 ± 37.24
B	7-9	2.25 ± 0.94	92.15 ± 41.93
C	>9	3.03 ± 1.04	92.8 ± 37.34

Table 2: Statistical comparison using ANOVA for NLR and PLR in three groups

Neutrophil lymphocyte ratio (NLR)						Platelet lymphocyte ratio (PLR)				
	Sum of squares	Df	Mean square	F	Sig.	Sum of squares	Df	Mean square	F	Sig.
Between groups	19.67	2	9.83	12.29	0.00	68.13	2	34.06	0.02	0.98
Within groups	69.59	87	0.80			124020.78	87	1425.53		
Total	89.26	89				124088.90	89			

Table 3: Post Hoc test (dependent value NLR)

	(I) HbA1c groups	(J) HbA1c groups	Mean difference (I-J)	Std. Error	Sig.
Turkey HSD	HbA1c<7	HbA1c7-9	-0.34	0.23	0.31
		HbA1c>9	-1.12	0.23	0.00
	HbA1c7-9	HbA1c<7	0.34	0.23	0.31
		HbA1c>9	-0.78	0.23	0.00
	HbA1c>9	HbA1c<7	1.12	0.23	0.00
		HbA1c7-9	0.78	0.23	0.00
Games-Howell	HbA1c<7	HbA1c7-9	-0.34	0.21	0.25
		HbA1c>9	-1.12	0.23	0.00
	HbA1c7-9	HbA1c<7	0.34	0.21	0.25
		HbA1c>9	-0.78	0.26	0.01
	HbA1c>9	HbA1c<7	1.12	0.23	0.00
		HbA1c7-9	0.78	0.26	0.01

Table 4: Post hoc test (dependent variable PLR)

	(I) HbA1c groups	(J) HbA1c groups	Mean difference (I-J)	Std. Error	Sig.
Turkey HSD	HbA1c<7	HbA1c7-9	-1.43	9.75	0.99
		HbA1c>9	-2.08	9.75	0.98
	HbA1c7-9	HbA1c<7	1.43	9.75	0.99
		HbA1c>9	-0.65	9.75	1.00
	HbA1c>9	HbA1c<7	2.08	9.75	0.98
		HbA1c7-9	0.65	9.75	1.00

Games- Howell	HbA1c<7	HbA1c7-9	-1.43	10.24	0.99
		HbA1c>9	-2.08	9.16	0.98
	HbA1c7-9	HbA1c<7	1.43	10.24	0.99
		HbA1c>9	-0.65	9.81	1.00
	HbA1c>9	HbA1c<7	2.08	9.16	0.98
		HbA1c7-9	0.65	9.81	1.00

Table 5: Correlation between NLR and HbA1c PLR and HbA1c

Variable 1	Variable 2	Correlation	Count	Lower CI	Upper CI
HbA1c	NLR	0.634	90	0.491	0.743
HbA1c	PLR	0.077	90	-0.132	0.280

DISCUSSION

In our study we found that the mean NLR of group A with HbA1c <7 was 1.91 ± 0.66 . The mean NLR of group B with HbA1c between 7-9 was 2.25 ± 0.94 . The mean NLR of group C with HbA1c >9 was 3.023 ± 1.039 . In our study the mean NLR increased with increasing value of HbA1c i.e. higher value of NLR with poorer glycemic control. On statistical comparison using ANOVA we found that the difference was statistically significant ($p < 0.01$). On applying Pearson's Correlation we found a significant positive correlation between HbA1c and NLR ($r = 0.634$). The findings of our study were consistent with Devamsh G N et al. In their study they found a positive correlation between neutrophil lymphocyte ratio in patients with type 2 diabetes mellitus and glycemic control. They noted that increased NLR is associated with elevated HbA1c and poor glycemic control and vice versa. We also found a higher value of NLR with poor glycemic control.^[13]

Also in a study conducted by Sefil et al, in Turkey in 2013 they observed an increased NLR is associated with elevated HbA1c in type 2 diabetes patients.^[14] Mazhar et al, in their research concluded that increased NLR is associated with elevated HbA1c and poor glycemic control in type 2 diabetes patients.^[15] Shiny et al, concluded that increased NLR has strong association with glucose intolerance and insulin resistance in type 2 diabetic patients.^[11] The findings of our study are consistent with the previous researchers.

Several studies have consistently shown that increased NLR is associated with microvascular complications like diabetic nephropathy, retinopathy and neuropathy. Wang et al in their study found elevated Neutrophil-to-lymphocyte ratio with the presence of Diabetic retinopathy among patients without family history. They concluded in their study that patients with type 2 diabetes without a family history of diabetes and hypertension raised NLR is closely related to Diabetic retinopathy.^[16] Ahmed et al in their study found that raised Neutrophil lymphocyte ratio (NLR) was significantly associated with the presence of diabetic nephropathy (DN).^[17] They concluded that high Neutrophil lymphocyte ratio (NLR) may be considered as a predictor and a prognostic risk marker of diabetic nephropathy.

On comparing HbA1c with PLR in our study, we found out that in group A, with HbA1c <7%, the PLR was 90.72 ± 37.24 . In group B, with HbA1c 7% - 9%, it was 92.15 ± 41.93 and in group C with HbA1c >9%, it was 92.8 ± 37.34 . The value of PLR increased with poorer glycemic control. Although on comparison using ANOVA, we found that the difference was not statistically significant. On applying Pearson's Correlation we did find a significant positive correlation between HbA1c and PLR ($r = 0.077$).

The findings of our study were consistent with Suguna S et al. The authors in their study on South Indian population showed that there was no statistically significant correlation between HbA1c levels monocyte-lymphocyte ratio and platelet-lymphocyte ratios in patients of type 2 diabetes mellitus.^[18] Dik Y et al in their study did not find a statistically significant positive relation between NLR, PLR and MPV. They retrospectively compared the demographic and laboratory parameters of the healthy and diabetic patients. MPV values in diabetic group and healthy group were 8.53 and 8.51, respectively but there was no significant relationship between them ($p = 0.81$). Also PLR value was 145.9 and 146.7 in diabetic group and healthy group, respectively with no significant relationship ($p = 0.97$). The findings of our study were consistent with Dik Y et al.^[19]

In contrary to the previous researchers Atak et al in their study found that PLR of type 2 diabetic patients was significantly higher than the PLR of healthy controls. They also reported that PLR was significantly and positively correlated with HbA1c, fasting plasma glucose, and C-reactive protein. They concluded that PLR may be useful in predicting the development of type 2 diabetes mellitus although correlation between PLR and HbA1c needs to be validated by larger prospective studies.

Several studies have consistently shown that increased PLR is associated with microvascular complications like diabetic nephropathy, retinopathy and neuropathy. Wang et al in their study found elevated Systemic inflammatory response indexes NLR and PLR associated with the presence of Diabetic retinopathy (DR) among patients without related family history. They concluded that in people with type 2 diabetes without a family history of diabetes and hypertension, systemic inflammation indicators NLR and PLR are closely related to Diabetic retinopathy. Higher NLR and PLR

increase the risk of DR.^[16] Ahmed et al in their study found that NLR and PLR were significantly associated with diabetic nephropathy (DN). They concluded that high NLR and PLR values may be considered as a predictor and prognostic marker of diabetic nephropathy (DN).^[17] Demirtas et al in their study confirmed that elevated PLR levels were found to be independent predictor of diabetes, impaired glucose regulation and diabetic nephropathy.^[10] In our study we found higher NLR value associated with poorer glycemic control although we could not establish the statistically significant relation between PLR and Glycemic control. Although the mean value of PLR increased with increase in HbA1C level the difference was not statistically significant.

Chronic inflammation plays a role in development and progression of type 2 diabetes mellitus. Prolonged hyperglycemia or impaired glycemic control leads to development of different complications such as retinopathy, nephropathy and neuropathy. There is an important role of chronic inflammation in the initiation and progression of type 2 diabetes mellitus and deterioration of microvascular and macrovascular complications in patients with diabetes.^[20] Previous studies have evidenced that peripheral blood leukocytes and their subgroups are associated with macrovascular and microvascular complications among patients with type 2 diabetes.^[4] Peripheral blood leukocytes include lymphocytes, basophils, neutrophils, eosinophils, and monocytes, each type has a unique role in systemic inflammation. Elevated NLR can be a manifestation of an increased number of neutrophils, which tend to adhere to the vascular endothelial cell, leading to endothelial damage, and leads to chronic inflammation.^[21] Lymphocytes are the blood cells concerned with the body's immune response. They have the ability to control the inflammatory responses and act as anti-atherosclerotic factor. The fewer lymphocyte indicates the possibility of insufficient immunoregulation. Elevated NLR indicating increased neutrophils and decreased lymphocytes creates an imbalance between the pro-inflammatory and anti-inflammatory cells leading to chronic inflammatory response. The increased inflammation leads to expression of several proteins that suppress the insulin signaling pathway making the cells less responsive or resistant to insulin hence leading to the poor glycemic control.^[22] The predictive value of Neutrophil lymphocyte ratio is comparable to other inflammatory markers like C reactive protein, TNF and IL6. NLR and PLR are cost effective easily available as compared to other inflammatory markers. The limitation of the study is that it was performed on a small sample size and hence there is a need to conduct the study on larger population for validation.

CONCLUSION

In the light of available literature and comparing our results with them we concluded that increased NLR is significantly associated with poor glycemic control although we did not find a statistically significant association between PLR and glycemic control. Thus the early detection of abnormal Neutrophil Lymphocyte ratio can be helpful to detect poor glycemic control and also to assess the progression of the disease in diabetic patients. It is an easily available, safe, cost effective and simple test. NLR is not only a marker of subclinical inflammation but also an indicator of poor glycemic control in patients with type 2 diabetes. NLR can be used as a screening test to identify type 2 diabetes patients more likely to develop diabetes related complications due to uncontrolled blood sugar levels. NLR can also act as a guide to the physician in the resource limited settings like primary health centres (PHC) so as when to evaluate a patient with type 2 diabetes for microvascular and macrovascular complications and glycemic control.

REFERENCES

1. Mertoglu C, Gunay M. Neutrophil lymphocyte ratio and platelet lymphocyte ratio as useful predictive markers of prediabetes and diabetes mellitus. *Diabetes and metabolic syndrome : clinical research and reviews*. 2017;11(1):S127-131.
2. Hu FB. Globalization of diabetes. *Diabetes care*. 2011;34(6):1249-1257.
3. Hussain M, Babar M Z M, Akhtar L, Hussain M S. Neutrophil lymphocyte ratio (NLR): A well assessment tool of glycemic control in type 2 diabetic patients. *Pk J Med Sci*. 2017;33(6):1366-70.
4. Tong PC, Chan WB, Lee KF, Lo MK, So WY, Chan NN. White blood cells is associated with macro microvascular inflammation complications in Chinese patients with type 2 diabetes. *Diabetes Care*. 2004;27:216-222.
5. Madjid M, Fatemi O. Components of the complete blood count as risk predictor for coronary heart disease: a review. *Tex Heart J*. 2013;40(1):17-29.
6. Imtiaz F, Shafique K, Mirza SS, Ayoob Z, Vart P, Rao S. Neutrophil lymphocyte ratio as a measure of systemic inflammation in prevalent chronic diseases in Asian population. *International Arch Med*. 2012;5:2. (published online)
7. Chittawar S, Dutta D, Qureshi Z, Surana V, Khandare S, Dubey T N. Neutrophil lymphocyte ratio is a novel reliable predictor of nephropathy and coronary artery disease in Indians with type 2 diabetes. *Indian J Endocr Metab*. 2017;21:864-70.
8. Das A, Mukhopadhyay S. The evil axis of obesity, inflammation and type 2 diabetes. *Endocr Metab Immune Disord Drug Targets*. 2011;11(1):23-31.
9. Lyons TJ, Basu A. Biomarkers in diabetes :HbA1C, Vascular and tissue markers. *Translational Res*. 2012;159(4):303-312.
10. Demirtas L, Degirmenci H, Akbas EM, Ozcicek A, Timuroglu A, Gurel A et al. Association of hematological indices with diabetes, impaired glucose regulation and microvascular complications of diabetes. *Int J Clin Exp Med*. 2015;8(7):11420-7.
11. Shiny A, Bibin YS, Shanthirani CS, Regin BS, Anjana RM, Balasubramanyam M et al. Association of neutrophil lymphocyte ratio with glucose intolerance: an indicator

- of systemic inflammation in patients with type 2 diabetes. *Diabetes Technol Ther*. 2014;16(8):524-30.
12. American diabetes association (ADA) Standards of medical care in Diabetes-2014. *Diabetes care*. 2014; 37(Suppl 1): S14-80.
 13. Devamsh GN, Parvathi M, Madhumathi R, Raghavan L. Study of neutrophil lymphocyte ratio in patients with type 2 diabetes mellitus and its correlation with glycemic control. *International journal of advances in medicine*. 2019;6(5):1637-41.
 14. Selfil F, Ulutas KT, Dokuyucu R, Sumbul AT, Yengil E, Yagiz AE, et al. Investigation of neutrophil lymphocyte ratio and blood glucose regulation in patients with type 2 diabetes mellitus. *J Int Med Res*. 2014;42(2):581-8.
 15. Hussain M, Babar MZM, Akhtar L, Hussain MS. Neutrophil lymphocyte ratio (NLR): A well assessment tool of glycemic control in Type- 2 diabetic patients. *Pak J Med Sci*. 2017;33(6):1366-70.
 16. Wang JR., Chen, Z., Yang, K. et al. Association between neutrophil-to-lymphocyte ratio, platelet-to-lymphocyte ratio, and diabetic retinopathy among diabetic patients without a related family history. *DiabetolMetab Syndr* 12, 55 (2020).
 17. Ahmed Ateia Abdelaziz, El-Sayed El-Meghawry El-Sayed, Tarek Mustafa Emran ,Ali Ibrahim Abdallah Study of neutrophil lymphocyte ratio (NLR) and platelet lymphocyte ratio (PLR) as a predictor inflammatory marker for diabetic nephropathy in type 2 diabetic patients. *The Egyptian Journal of Hospital Medicine* .2018;72 (7):4800-4807.
 18. Suguna S, M.S. Kusumadevi. Correlation of HbA1c Levels with Monocyte-lymphocyte and Platelet-lymphocyte Ratios in Type 2 Diabetics of Bengaluru City *International Journal of Physiology*. 2019;7(4):99-103
 19. Dik Y. How is NLR and PLR affected in Type 2 diabetes mellitus compared to healthy population?. *Medical Science and Discovery*, 2020; 7(2), 405-408
 20. Fujita T, Hemmi S, Kajiwarra M, Yabuki M, Fuke Y, Satomura A, et al. Complement-mediated chronic inflammation is associated with diabetic microvascular complication. *Diabetes Metab Res Rev*. 2013;29:220–6.
 21. Sala A, Folco G. Neutrophils, endothelial cells, and cysteinyl leukotrienes: a new approach to neutrophil-dependent inflammation? *BiochemBiophys Res Commun*. 2001;283:1003–6.
 22. Wang RT, Zhang JR, Li Y, Liu T, Yu KJ. Neutrophil-Lymphocyte ratio is associated with arterial stiffness in diabetic retinopathy in type 2 diabetes. *J Diabet Compli*. 2015;29:245–9.