ORIGINAL ARTICLE ASIAN JOURNAL OF MEDICAL SCIENCES

A cross sectional study to assess prediction of microalbuminuria using neutrophil-to-lymphocyte ratio and red blood cell distribution width in diabetic patients

Manoj Kumar Bind[1], Mayank Kumar[2], Archana Singh[3], Vinod Kumar[4], Dhananjay Kumar Singh[5]

[1,2,3]Assistant Professor, Department of Pathology, [5]Associate Professor, Department of Community Medicine, Rajarshi Dashrath Autonomous State Medical College, Ayodhya, [4]Assistant Professor, Department of General Medicine, Uma Nath Singh Autonomous State Medical College, Jaunpur, Uttar Pradesh, India

Submission: 30-09-2022 Revision: 29-11-2022 Publication: 01-01-2023

ABSTRACT

Background: This study was devised to evaluate the predictive value of neutrophil-to- lymphocyte ratio (NLR), mean platelet volume (MPV), and red blood cell distribution width (RDW) to detect microalbuminuria in type 2 diabetic patients. This can help in early detection of microalbuminuria and assessment of prognosis inn patients suffering from type 2 diabetes mellitus (DM). **Aims and Objectives:** The objectives of the study were to assess the diagnostic accuracy of microalbuminuria using neutrophil-to-lymphocyte ratio and red blood cell distribution width in diabetic patients. **Materials and Methods:** A total of 188 patients with type 2 DM were selected for this study. Subjects were classified into three groups based on hemoglobin A1c and microalbuminuria. Group A had 63 patients with controlled diabetes, Group B had 62 patients with uncontrolled diabetes, both without microalbuminuria, and Group C had 62 patients with uncontrolled diabetes with microalbuminuria. Levels of NLR, MPV, and RDW between the study groups were analyzed. **Results:** A significant difference in NLR was found between Group C and Groups A and B ($P<0.001$ and $P=0.005$, respectively). RDW was significantly different between Groups B and C ($P=0.014$). Receiver operating characteristic curve analysis was done between NLR and RDW. The area under curve was found to be of 0.678 for NLR (confidence interval: 0.59–0.75, $P<0.001$) and 0.616 for RDW (confidence interval: 0.49–0.73, $P=0.013$). The study shows that an NLR cutoff point of 2.54 has 39.7% sensitivity, 78.8% specificity, and 45% positive predictive value (PPV). An RDW cutoff point of 14.44 has 37.9% sensitivity, 76% specificity, and 41.5% PPV. **Conclusion**: NLR and RDW can be beneficial to detect microalbuminuria in diabetic patients.

Key words: Diabetic nephropathy; Inflammatory markers; Microalbuminuria; Neutrophil-to-lymphocyte ratio; Type 2 diabetes mellitus

Access this article online

Website: http://nepjol.info/index.php/AJMS

DOI: 10.3126/ajms.v14i1.48706

E-ISSN: 2091-0576

P-ISSN: 2467-9100

INTRODUCTION

The neutrophil-to-lymphocyte ratio (NLR) is considered as a newer marker of subclinical inflammation.[1] It is being used as a systemic inflammatory marker in chronic diseases as well as a predictor of prognosis in cardiovascular diseases, malignancies, and metabolic syndrome.[2,3] NLR is also used to detect systemic inflammation in different diseases such as chronic kidney disease (CKD), and diabetic nephropathy.[4,5] Still the role of NLR in predicting diabetic nephropathy has not yet researched.[6] During inflammation leukocytes gets activated also there is elevated levels of inflammatory mediators in the circulation that can lead to development of cardiovascular disease.[7,8] Other studies showed that elevated NLR in otherwise healthy subjects may be indicative of underlying impaired glucose metabolism, and moreover,

Address for Correspondence:
Dr. Vinod Kumar, Assistant Professor, Department of General Medicine, Uma Nath Singh Autonomous State Medical College, Jaunpur, Uttar Pradesh, India. **Mobile:** +91-7498346432. **E-mail:** drvinodbindkgmu@gmail.com

NLR should be used as a marker of diabetic control level in addition to HbA1c in type 2 diabetic subjects.[9]

Albuminuria is a symptom of nephropathy which usually initiating with microalbuminuria, which is also considered as marker of vascular endothelial damage.[10] Albuminuria is one of the important predictor of poor renal prognosis in patients with type 2 diabetes.[11] Microalbuminuria is a microvascular complication of diabetes. Without prompt treatment and early intervention, diabetic patients with microalbuminuria can progress to proteinuria and overt diabetic nephropathy.[12] In addition, in type 2 diabetic patients, microalbuminuria is accompanied by elevated C-reactive protein, suggesting activation of inflammatory pathways in progression of renal and cardiovascular atherosclerotic disease.[13]

Mean platelet volume (MPV) is a measure of the average size of platelets found in blood that is commonly included in complete blood count (CBC) tests. Because average platelet size increases when the body produces more platelets, the MPV test results can be used to infer platelet production in bone marrow or platelet destruction problems. Elevated MPV is an indicator of inflammation due to increased destruction of platelets.[14]

Red blood cell distribution width (RDW) is a measure of the range of variation of red blood cell (RBC) volume that is also included in blood tests as part of the CBC. Studies showed that RDW might be considered as an effective predictive index in the evaluation of diabetic nephropathy or diabetes-associated complications.[15,16]

Diabetes is a systemic disease with severe microvascular and macrovascular complications. Diabetes is one of the most common causes of CKD, also known as end-stage renal disease (ESRD). Chronic inflammation, through immunologic inflammatory mechanisms, plays an important role in the development and progression of type 2 diabetes. Simple, low-cost inflammatory markers may aid in the detection of microalbuminuria. The purpose of this research is to investigate the relationship between NLR and RDW and microalbuminuria in type 2 diabetic patients.

Aims and objectives

The present study was conducted to assess the relationship between NLR and RDW and microalbuminuria in type 2 diabetic patients.

MATERIALS AND METHODS

This study was a hospital based study conducted in a tertiary care hospital. Five hundred and fifty-six medical records of patients with diabetes from the outpatient clinics during the years 2010–2021 were reviewed and examined. Of these, the data from 188 patients with type 2 diabetes mellitus (DM) met the inclusion criteria of the study. Inclusion criteria for this study were patients aged ≥40 years old who had type 2 DM for at least 4 years. Exclusion criteria was patients with recent diagnosis of acute infection or inflammation, leukocytosis, leukopenia, severe anemia, chronic infection, chronic systemic inflammatory disease, medications affecting the number of leukocytes, uncontrolled hypertension, and secondary hypertension, any chronic kidney injury, end stage kidney disease, hepatic failure, and/or manifest active heart disease such as cardiac failure, acute coronary syndrome, arrhythmia, and cardiac valve disease.

Patients were classified into three groups according to glycated hemoglobin A1c (HbA1c) and microalbuminuria: Group A, patients with controlled diabetes; Group B, patients with uncontrolled diabetes (both groups without microalbuminuria); and Group C, patients with uncontrolled diabetes with microalbuminuria. The study was reviewed and approved by Institutional Ethics Committee.

Demographic, clinical, and laboratory data from patient file records regarding plasma glucose, HbA1c, creatinine, albumin, total cholesterol, triglycerides (TG), high-density lipoprotein (HDL), and low-density lipoprotein (LDL) levels in the venous blood samples obtained in the morning after 8-h fasting was examined and recorded. Body mass index (BMI) (kg/m^2), body surface area (m^2), and blood pressure values were collected from patient files. Complete blood counts were analyzed in the hematology unit with a Beckman-Coulter Gen-S system device (Beckman-Coulter Inc.). MPV and RDW levels were gathered from patients' complete blood count, and NLR was calculated as the ratio of absolute number of neutrophil and lymphocyte counts. For each patient, two consecutive blood tests were evaluated and checked for consistency of the parameters listed above, to exclude irregularities. For the exclusion of a mild disease, all blood counts with WBC above 9000/μL were not included. All the measurements collected including CBC, electrolytes, NLR, RDW, MPV, and urine albumin were performed at the same time, and within 3 weeks of the last visit, all the groups their kidney function tests were within the normal range and suffering only from diabetes.

We used one-way analysis of variance tests to compare among the three study groups. Statistical significance and power required were 5% and 80%, respectively. Correlations were assessed using Pearson's test. Receiver operating characteristic (ROC) curve analysis was used to determine the optimum cutoff levels of inflammation markers NLR and RDW to predict microalbuminuria. Statistical analysis was performed using Statistical Package

for the Social Sciences (SPSS) version 21.0 (SPSS Inc.). Any P value <0.05 was considered statistically significant.

RESULTS

Group A and Group C subjects were significantly different in age variable (P=0.02) and in duration of diabetes (P=0.01). Significant difference was found between TG/HDL ratio in patients with controlled diabetes (Group A) compared to the other two groups (Groups A and B, P=0.02; Groups A and C P=0.01). Serum creatinine level was found to be higher in patients with DM with microalbuminuria (Group C) than the other two study groups and difference was statistically significant (P<0.001). No significant difference between groups was found in other parameters such as gender, blood pressure, BMI, albumin, or LDL (Table 1).

A significant difference was found in NLR and RDW in the three groups (P<0.001; P=0.016). No significant difference was found in MPV among the groups (P=0.889).

A *post hoc* analysis for examination of the differences in NLR and RDW as performed is shown Table 2. NLR was found be significantly different between Groups A and C (P<0.001) and between Groups B and C (P=0.005). A statistically significant difference in RDW was found between Groups B and C (P=0.014). No significant difference was found between Groups A and B. Graphical representation of NLR distribution is shown by box plot in Figure 1 and of RDW distribution in Figure 2.

Creatinine levels in the study Group C had a higher creatinine level above the normal range (31 patients, 36.2% of the group), compared to the other two study groups (2.4% in Group A and 8% in Group B).

Table 1: Association between demographic, clinical, and laboratory features of the study groups

Demographic, Clinical, and Laboratory features	Group A: Controlled DM without microalbuminuria	Group B: Uncontrolled DM without microalbuminuria	Group C: DM with microalbuminuria	P-value
	Mean±SD	Mean±SD	Mean±SD	
Age (years)	67±11	63±10	67±10	0.02
years of diabetes	11±6	13±8	16±7	0.01
Male/female (N)	24/29	27/30	33/25	
BMI (kg/m^2)	28.33±5.63	28.06±4.33	28.90±4.57	0.56
HbA1c (%)	6.31±0.56	9.13±1.08	8.55±1.88	0.00
MAP (mm Hg)	98±7	98±8	98±9	0.8
Albumin (g/dL)	4.58±0.54	4.55±0.32	4.42±0.34	0.60
Serum creatinine (mg/dL)	0.80±0.14	0.82±0.34	1.11±0.57	0.00
TG/HDL ratio	2.87±1.34	4.16±3.12	4.78±3.56	0.04
LDL-C (mg/dL)	88.45±27.43	84.63±36.31	85.88±32.13	0.77
microalbumin: creatinine ratio (mcg/mg)	6.25±6.17	9.27±7.05	230.79±325.56	0.00
NLR	2.05±0.75	2.06±0.80	2.61±1.20	<0.001
MPV (fL)	9.96±1.53	10.06±1.53	10.09±1.44	0.88
RDW (%)	15.04±0.97	13.85±1.17	14.48±1.34	0.016

BMI: Body mass index. DM: Diabetes mellitus, HbA1c: Glycated hemoglobin, LDL-C: Low-density lipoprotein cholesterol level, MAP: Mean arterial pressure, MPV: Mean platelet volume, N: Number of patients included per group, NLR: Neutrophil-to-lymphocyte ratio, RDW: Red blood cell distribution width, Std. Dev: Standard deviation, TG/HDL ratio, TG: Triglyceride, HDL: High-density lipoprotein

Table 2: Post hoc analysis of the differences in NLR and RDW between the study groups

Dependent variable	(I) Group	(J) Group	Mean difference (I-J)	P-value
NLR	A: Controlled DM without microalbuminuria	B: Uncontrolled DM without microalbuminuria	−0.156	0.660
		C: DM with microalbuminuria	−0.722	<0.001
	B: Uncontrolled DM without microalbuminuria	A: Controlled DM without microalbuminuria	0.159	0.659
		C: DM with microalbuminuria	−0.551	0.005
	C: DM with microalbuminuria	A: Controlled DM without microalbuminuria	0.710	<0.001
		B: Uncontrolled DM without microalbuminuria	0.548	0.005
RDW %	A: Controlled DM without microalbuminuria	B: Uncontrolled DM without microalbuminuria	0.198	0.677
		C: DM with microalbuminuria	−0.444	0.138
	B: Uncontrolled DM without microalbuminuria	A: Controlled DM without microalbuminuria	−0.197	0.677
		C: DM with microalbuminuria	−0.6286	0.014
	C: DM with microalbuminuria	A: Controlled DM without microalbuminuria	0.439	0.138
		B: Uncontrolled DM without microalbuminuria	0.6286	0.014

NLR: Neutrophil-to-lymphocyte ratio, RDW: Red blood cell distribution width, DM: Diabetes mellitus

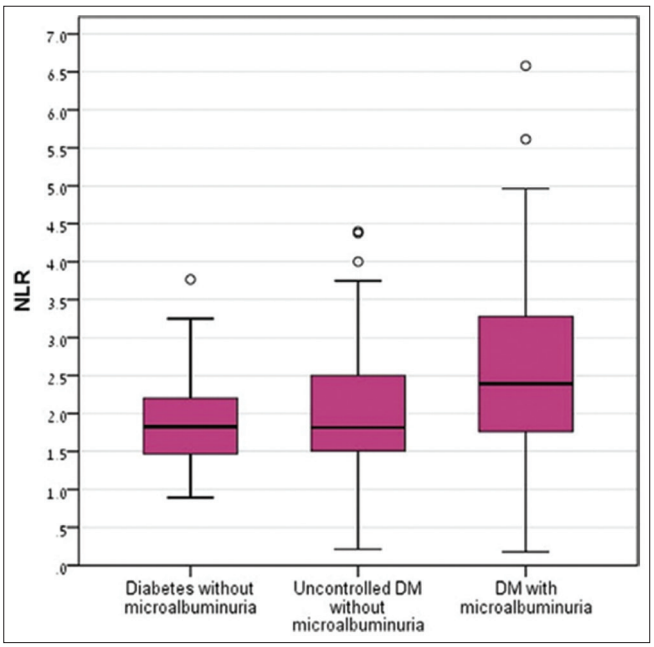

Figure 1: Neutrophil-to-lymphocyte ratio distribution in the study groups

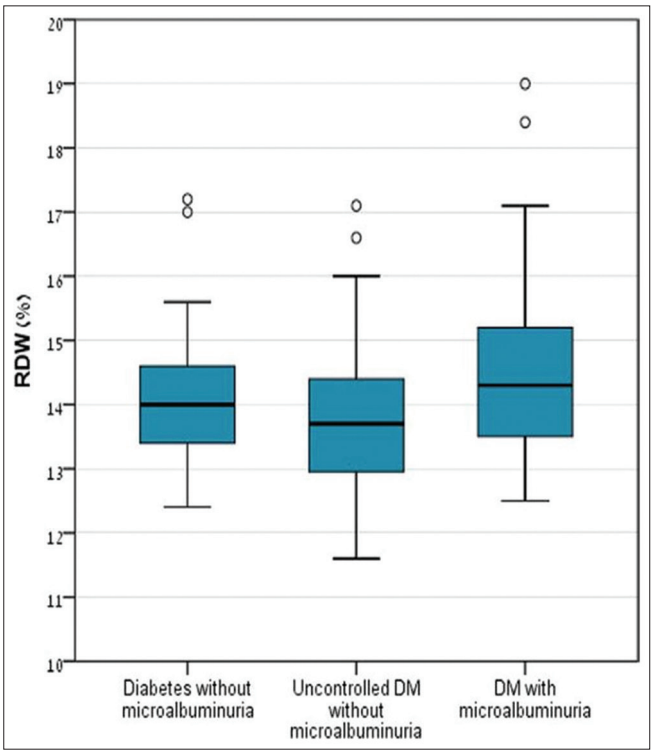

Figure 2: Red blood cell distribution width in the study groups diabetes mellitus

Significant correlation was found between NLR and creatinine, HbA1c, and microalbuminuria, and NLR and RDW (Table 3). ROC curve analysis was done between NLR and RDW. The area under curve was found to be of 0.678 for NLR (confidence interval: 0.59–0.75, P<0.001) and 0.616 for RDW (confidence interval: 0.49–0.73, P=0.013). This suggests sufficient accuracy and the data

Table 3: Correlation analysis of NLR with other hematological markers

NLR	Creatinine	HbA1c (%)	Microalbumin (mcg/mg)	RDW
Pearson's correlation (r)	0.320	0.188	0.228	0.184
P-value	0.000	0.011	0.003	0.017

HbA1c: Glycated hemoglobin, NLR: Neutrophil-to-lymphocyte ratio, RDW: Red blood cell distribution width

are presented graphically in Figures 3 and 4. NLR and RDW are newer diagnostic parameters so the mean values of NLR and RDW found in Group C, diabetic patients with microalbuminuria are considered as cutoff points for predicting microalbuminuria. The data show that an NLR cutoff point of 2.54 has 39.7% sensitivity, 78.8% specificity, and 45% positive predictive value (PPV). An RDW cutoff point of 14.44 has 37.9% sensitivity, 76% specificity, and 41.5% PPV (Table 4).

DISCUSSION

The aim of this study was to analyze predictive value of hematological indices to predict microalbuminuria in type 2 diabetic patients. The study subjects were classified into three groups according to their levels of HbA1c and microalbuminuria. Levels of inflammatory markers were compared among the three groups of diabetic patients with and without microalbuminuria. The study findings suggest that high levels of NLR and RDW were found in diabetic patients with micro- albuminuria compared to patients with controlled and uncontrolled diabetes without microalbuminuria. Moreover, NLR and RDW had a PPV for microalbuminuria in diabetic patients.

NLR is inexpensive, easy to use, reliable predictor of nephropathy, retinopathy, and CAD in Indian T2DM.[17] Elevated NLR in otherwise healthy subjects may be indicative of underlying impaired glucose metabolism. NLR should be used as a marker of diabetic control level in addition to HbA1c in type 2 diabetic subjects.[18] A higher NLR level was associated with an increased prevalence of CVD and DKD, other than DR, in diabetic adults.[19] NLR can be used as efficient, cheaper, and readily available marker of inflammation, and it is one of the important predictor for the existence of microvascular complications in subjects with type 2 diabetes.[2]

Low RDW was found to be associated with increased incidence of DM independently of other risk factors. One study proposed that low RDW could be a surrogate marker of reduced RBC survival, with lower HbA1c due to shorter duration of glucose exposure. RDW is a biomarker that

Table 4: ROC curve analysis for prediction of microalbuminuria using NLR and RDW cutoff values

Parameter	Cutoff value	Sensitivity (%)	Specificity (%)	Positive predictive value (%)
NLR	2.54	39.7	78.8	45
RDW	14.55	37.9	76	41.5

ROC: Receiver operating characteristic, NLR: Neutrophil-to-lymphocyte ratio, RDW: Red blood cell distribution width

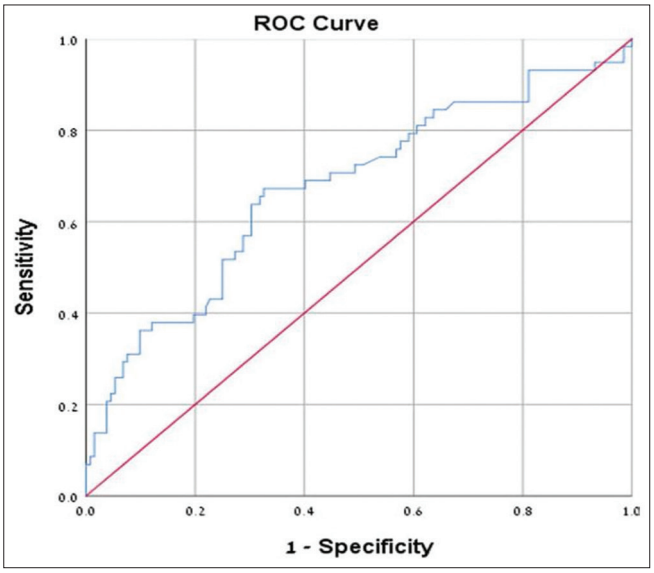

Figure 3: Receiver operating characteristic curve analysis of neutrophil-to-lymphocyte ratio for microalbuminuria prediction

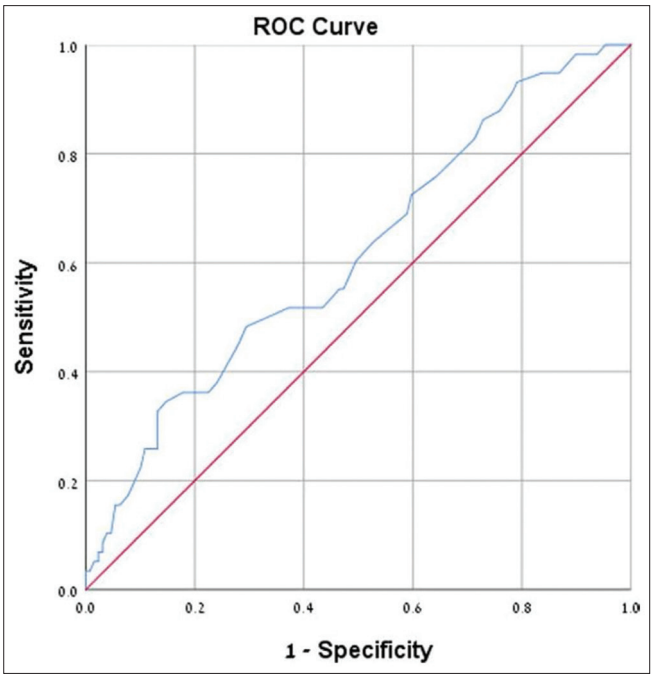

Figure 4: Receiver operating characteristic curve analysis of red blood cell distribution width for microalbuminuria prediction

could improve risk assessment for individuals at risk of developing DM.[20]

In additional study reported that high RDW was associated with risk of all-cause mortality in DKA patients in the ICU. RDW was an independent prognostic factor for these patients.[20] The occurrence of microalbuminuria showed a direct relationship with increasing age and increasing duration of diabetes since diagnosis. A HbA1c value above 7% was reported to be associated with 50% or higher incidence of microalbuminuria.[21]

One study also have showed that the MPV to lymphocyte ratio is an easily calculated and efficient index that can be considered a powerful and independent predictor of diabetic nephropathy in diabetic patients.[22] The current study shows that there was no correlation between HbA1c and NLR or RDW. Furthermore, the current study did not find any significant relationship between microalbuminuria and MPV.

The differences between the study groups can be attributed to demographic variables of age, years of diabetes, and clinical parameters such as triglycerides/HDL (TG/HDL) ratio and serum creatinine level. Diabetes is a chronic disease and so it is likely that older patients will be included in the group of patients with microalbuminuria, as seen in the results of this study.

The difference reported in TG/HDL ratio between the study groups can be attributed to metabolic syndrome and the fact that patients with complicated diabetes also have worsening metabolic syndrome. Further analysis found no correlation between higher TG/HDL ratio to elevated levels of inflammatory markers (NLR, RDW, and MPV) and so it is not likely that increased TG/HDL ratio was the cause for higher NLR or RDW in patients with microalbuminuria. A higher level of serum creatinine was found in patients with microalbuminuria. Because of the change in homeostasis of renal function as represented by microalbuminuria, an increase in serum creatinine is seen. Higher serum creatinine levels were also in significantly correlated with increased NLR in this group. The professional literature seems to report no known direct correlation between an increase in serum creatinine and higher levels of inflammatory markers. Hence, we assume that the correlation found was comprised of independent elevations of serum creatinine and NLR in these patients. Diabetic nephropathy was the only cause for this increment of creatinine level. Since NLR was found to be significantly higher only in diabetic patients with microalbuminuria, compared to both controlled diabetes and uncontrolled diabetes, with no difference found between the latter two,

we conclude that the elevations of NLR are primarily due to the presence of microalbuminuria. The results showed a low sensitivity and PPV for using NLR and RDW as markers of microalbuminuria, specificity for both parameters is above 70%. The use of these parameters can be used for patient follow-up. Further prospective study is needed for testing of hypothesis.

Limitations of the study

Major limitations are the cross-sectional design and lack of association with relevant outcome data. A larger-scale research study is needed to further evaluate the application of NLR and RDW as prognostic factors.

CONCLUSION

The study reports that high levels of NLR were found in diabetic patients with microalbuminuria compared to control and uncontrolled diabetic patients without microalbuminuria. High levels of RDW levels were found in patients with diabetes with microalbuminuria compared to diabetic patients without microalbuminuria. The elevations of NLR and RDW levels may be attributed to presence of microalbuminuria. Elevations of NLR and RDW levels may be the presence of microalbuminuria.

ACKNOWLEDGMENT

The authors take this opportunity to thank the Department of Pathology, General medicine and Community Medicine for their whole hearted support for this study.

REFERENCES

1. Hussain M, Saeed M, Babar MZ, Atif MA and Akhtar L. Nebivolol attenuates neutrophil lymphocyte ratio: A marker of subclinical inflammation in hypertensive patients. Int J Hypertens. 2017;2017:7643628.
   https://doi.org/10.1155/2017/7643628
2. Fawwad A, Butt AM, Siddiqui IA, Khalid M, Sabir R and Basit A. Neutrophil-to-lymphocyte ratio and microvascular complications in subjects with Type 2 diabetes: Pakistan's perspective. Turk J Med Sci. 2018;48(1):157-161.
   https://doi.org/10.3906/sag-1706-141
3. Lopez-Candales A, Hernández Burgos PM, Hernandez-Suarez DF and Harris D. Linking chronic inflammation with cardiovascular disease: From normal aging to the metabolic syndrome. J Nat Sci. 2017;3(4):e341.
4. Study of Neutrophil-lymphocyte Ratio as Novel Marker for Diabetic Nephropathy in Type 2 Diabetes. Available from: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5434720 [Last accessed on 2022 Aug 22].
5. Paulus I, Palguna KA, Wirasugianto J, Supadmanaba IG, Semadi IM and Suastika, K. Neutrophil lymphocyte ratio (NLR) was significantly associated with diabetic nephropathy at sanglah general hospital, Denpasar, Bali, Indonesia: A case-control study. World J Curr Med Pharm Res. 2021;3(3):50-54.
   https://doi.org/10.37022/wjcmpr.vi.173
6. Winter L, Wong LA, Jerums G, Seah JM, Clarke M, Tan SM, et al. Use of readily accessible inflammatory markers to predict diabetic kidney disease. Front Endocrinol (Lausanne). 2018;9:225.
   https://doi.org/10.3389/fendo.2018.00225
7. Granger DN and Senchenkova E. Leukocyte-endothelial cell adhesion. In: Inflammation and the Microcirculation. California: Morgan and Claypool Life Sciences; 2010. Available from: https://www.ncbi.nlm.nih.gov/books/NBK53380 [Last accessed on 2022 Aug 22].
8. Chen L, Deng H, Cui H, Fang J, Zuo Z, Deng J, et al. Inflammatory responses and inflammation-associated diseases in organs. Oncotarget. 2017;9(6):7204-7218.
   https://doi.org/10.18632/oncotarget.23208
9. Varma S, Khande M, Gupta P, Toppo A, Khare RL, Malhotra Y, et al Correlation of neutrophil lymphocyte ratio with HbA1c in patients of Type 2 diabetes mellitus. Int J Adv Med. 2021;8(7):952-956.
   https://doi.org/10.18203/2349-3933.ijam20212407
10. Stehouwer CD and Smulders YM. Microalbuminuria and risk for cardiovascular disease: Analysis of potential mechanisms. J Am Soc Nephrol. 2006;17(8):2106-2111.
    https://doi.org/10.1681/ASN.2005121288
11. Ninomiya T, Perkovic V, De Galan BE, Zoungas S, Pillai A, Jardine M, et al. Albuminuria and kidney function independently predict cardiovascular and renal outcomes in diabetes. J Am Soc Nephrol. 2009;20(8):1813-1821.
    https://doi.org/10.1681/ASN.2008121270
12. Eboh C and Chowdhury TA. Management of diabetic renal disease. Ann Transl Med. 2015;3(11):154.
    https://doi.org/10.3978/j.issn.2305-5839.2015.06.25
13. Mojahedi MJ, Bonakdaran S, Hami M, Sheikhian MR, Shakeri MT and Aiatollahi H. Elevated serum C-reactive protein level and microalbuminuria in patients with Type 2 diabetes mellitus. Iran J Kidney Dis. 2009;3(1):12-16.
14. Korniluk A, Koper-Lenkiewicz OM, Kamińska J, Kemona H, Dymicka-Piekarska V. Mean Platelet Volume (MPV): New Perspectives for an Old Marker in the Course and Prognosis of Inflammatory Conditions. Mediators Inflamm. 2019;2019:9213074.
    https://doi.org/10.1155/2019/9213074
15. Gu L and Xue S. The association between red blood cell distribution width and the severity of diabetic chronic kidney disease. Int J Gen Med. 2021;14:8355-8363.
    https://doi.org/10.2147/IJGM.S332848
16. Magri CJ and Fava S. Red blood cell distribution width and diabetes-associated complications. Diabetes Metab Syndr. 2014;8(1):13-17.
    https://doi.org/10.1016/j.dsx.2013.10.012
17. Chittawar S, Dutta D, Qureshi Z, Surana V, Khandare S and Dubey TN. Neutrophil-lymphocyte ratio is a novel reliable predictor of nephropathy, retinopathy, and coronary artery disease in Indians with Type-2 diabetes. Indian J Endocrinol Metab. 2017;21(6):864-870.
    https://doi.org/10.4103/ijem.IJEM_197_17
18. Duman TT, Aktas G, Atak BM, Kocak MZ, Erkus E and Savli H. Neutrophil to lymphocyte ratio as an indicative of diabetic control level in Type 2 diabetes mellitus. Afr Health Sci. 2019;19(1):1602-1606.
    https://doi.org/10.4314/ahs.v19i1.35
19. Wan H, Wang Y, Fang S, Chen Y, Zhang W, Xia F, et al.

Associations between the neutrophil-to-lymphocyte ratio and diabetic complications in adults with diabetes: A cross-sectional study. J Diabetes Res. 2020;2020:6219545.

https://doi.org/10.1155/2020/6219545

20. Engström G, Smith JG, Persson M, Nilsson PM, Melander O and Hedblad B. Red cell distribution width, haemoglobin A1c and incidence of diabetes mellitus. J Intern Med. 2014;276(2):174-183.

https://doi.org/10.1111/joim.12188

21. Bhavya N and Kumar VA. Study of association between microalbuminuria and microvascular complications in Type II diabetes mellitus patients in RajaRajeswari Medical college and hospital, Karnataka. J Med Sci. 2017;3(1):6-10.

22. Kocak MZ, Aktas G, Erkus E, Duman TT, Atak BM and Savli H. Mean platelet volume to lymphocyte ratio as a novel marker for diabetic nephropathy. J Coll Physicians Surg Pak. 2018;28(11):844-847.

https://doi.org/10.29271/jcpsp.2018.11.844

Author's Contribution:
MKB- Study design and concept of the study, manuscript preparation**; MK-** Interpretation of the results; **AS-** Literature review**; VK-** Collection of the data; **DKS-** Statistical analysis and interpretation.

Work attributed to:
Department of Pathology, Uma Nath Singh Autonomous State Medical College, Jaunpur, Uttar Pradesh, India.

Orcid ID:
Dr. Manoj Kumar Bind - https://orcid.org/0000-0001-6462-5649
Dr. Mayank Kumar - https://orcid.org/0000-0002-9913-3553
Dr. Archana Singh - https://orcid.org/0000-0002-8927-6999
Dr. Vinod Kumar - https://orcid.org/0000-0002-8203-7135

Source of Support: Nil, **Conflicts of Interest:** None declared.