Section: Medicine

Original Research Article

STUDY ON THE RATIO OF MEAN PLATELET VOLUME AND LYMPHOCYTE COUNT AS A MARKER FOR DIABETIC NEPHROPATHY IN TYPE 2 DIABETES MELLITUS

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ABSTRACT

Background: Diabetic nephropathy (DN) is a significant complication of Type 2 Diabetes Mellitus (T2DM), contributing to renal failure. Early detection is critical for preventing disease progression. Mean Platelet Volume to Lymphocyte Ratio (MPVLR) has been proposed as a potential marker for diagnosing diabetic nephropathy. The study aimed to evaluate the role of MPVLR in predicting diabetic nephropathy in patients with T2DM.

Materials and Methods: This prospective study was conducted at the Tertiary Care Hospital of North India, over 18 months. The study included T2DM patients aged 35-75 years, with a urine albumin-to-creatinine ratio (UACR) greater than 30 mg/g. Patients were divided into two groups: those with proteinuria (Group II) and those without (Group I). MPVLR was compared between the two groups, and its diagnostic accuracy was assessed, including determining an optimal cut-off value.

Results: The study found a significant difference in MPVLR between the two groups. Group I had a mean MPVLR of 3.71 (SD = 0.55), while Group II had a mean MPVLR of 4.59 (SD = 1.35). The optimal cut-off value for MPVLR to predict diabetic nephropathy was found to be 4.40, with 52.0% sensitivity and 94.0% specificity. Comparisons with previous studies indicated that MPVLR is a useful marker for diagnosing diabetic nephropathy, though with variability in sensitivity and specificity.

Conclusion: MPVLR is a significant predictor of diabetic nephropathy in T2DM patients. The optimal cut-off value of 4.40 showed high specificity but lower sensitivity. MPVLR may serve as a useful diagnostic tool for diabetic nephropathy in clinical settings, though further research is needed to refine its sensitivity and applicability across different populations.

Keywords: T2DM, MPVLR, Diabetic nephropathy (DN).

INTRODUCTION

The rising incidence of type 2 diabetes mellitus (DM) has made it a major public health concern on a worldwide scale. In order to provide more effective therapies, clinical and experimental investigations are still concentrating on improving our knowledge of the pathophysiology of the illness.

Chronic low-grade inflammation is an important component of type 2 diabetes mellitus and an obvious symptom of the condition.[1] Studies have linked inflammatory indicators in the blood to a number of problems that might arise from diabetes.[1] The assessment of these inflammatory indicators may also be used to predict the management of diabetes, which is typically measured by glycated hemoglobin (HbA1c) values.[1] Research has shown a link between serum inflammatory indices and HbA1c levels in type 2 diabetics, highlighting the promise of

inflammatory indicators as diagnostic tools for disease control and therapy.[1]

The most common form of diabetic nephropathy (DN), a potentially fatal microvascular consequence of diabetes mellitus (DM), is ESRD in India. More than 40% of people with diabetes will have chronic kidney disease (CKD) at some point, and a large percentage of those people will get end-stage renal disease (ESRD) and need RRT, which includes dialysis and kidney transplants. As DN advances, the kidney damage indicator microalbuminuria gives way to macroalbuminuria and, finally, overt proteinuria.[2] In most cases, the decline from obvious proteinuria to renal failure is permanent if the condition is not addressed.[2] To avoid the serious complications of DN, early detection of microalbuminuria is essential.[2] In order to improve patient outcomes and decrease the risk of end-stage renal disease (ESRD), the American Diabetes Association (ADA) emphasizes the significance of routine screening for diabetic nephropathy.[2]

Recognizing microalbuminuria is the current gold standard for detecting diabetic nephropathy (DN).[2] Due to its limitations, such as insensitivity in the early stages of the illness, microalbuminuria is not always a good predictor of DN.[3] Additional DN indicators have been discovered and classified as oxidative stress, inflammation, glomerular, tubular, and other markers.[3] These indicators may show up before microalbuminuria is detected, but they aren't useful for making a correct diagnosis in the clinic.[3] Consequently, renal damage could start a long time before microalbuminuria is identified, which means that possible treatments might be postponed.[3] This emphasizes how critical it is to have accurate early DN predictors.[3]

It has been shown that inflammatory biomarkers including TNF-α and IL-1β contribute to the development and advancement of DN.[4] Early detection of DN may be possible using these markers.[4] However, issues including high price, limited availability, and inaccessibility in primary care settings mean that they are not used widely in India.[4] To identify the inflammatory process associated with DN, a cheap and conveniently accessible test is urgently required.

Diabetes nephropathy (DN) has been a major health issue for a long time because of the high expense it causes and the fact that it increases the risk of kidney disease and death. As doctors seek new ways to foretell outcomes like mortality and the onset of end-stage renal disease (ESRD), it continues to be a hot subject in the treatment of type 2 diabetic mellitus (T2DM). Clinical variables such as eGFR, blood pressure, proteinuria, diabetes duration, hemoglobin A1c (HbA1c), and a few tubular markers are being used extensively for DN progression prediction. It is nevertheless vital to find other, more readily detectable clinical indicators that may aid in DN progression and prediction.

A promising new biomarker that may be determined with regular blood testing is the platelet-to-lymphocyte ratio (PLR). Many disorders, like as cancer, cardiovascular disease, and diabetes mellitus with its microvascular consequences, are influenced by platelet activation and systemic inflammatory state, which are both reflected in the PLR. The promise of PLR as a predictive tool has been piqued because to its simplicity, cost, and ease of assessment.

New research raises the possibility that PLR might help in the prediction of diabetes- related problems, both their beginning and their development. But how exactly PLR contributes to diabetic nephropathy is still a mystery.

The purpose of this research is to determine if the mean platelet volume to lymphocyte ratio (or a comparable measure) is a valid and economical way to predict the development of diabetic nephropathy. In order to better understand how to diagnose and monitor diabetic nephropathy early on, we want to see whether this readily available diagnostic can supplement current clinical markers.

Aim and Objectives

Aim:

Study on the ratio of mean platelet volume and lymphocyte count as a marker for diabetic nephropathy in type 2 diabetes mellitus.

Objectives:

1. To assess Mean platelet volume to lymphocyte ratio as a predictor inflammatory marker for diabetic nephropathy in patients with type 2 diabetes mellitus.
2. To compare MPV to lymphocyte ratio in type 2 diabetics with diabetic nephropathy to type 2 diabetics without diabetic nephropathy.

MATERIALS AND METHODS

Study Design: This is a Case Control study which is done on 100 diabetic subjects, 50 of which are included in “Group II” and have diabetic nephropathy who presented to the Medicine department (indoor/ outdoor department) of Tertiary Care Hospital of North India and fulfilled the inclusion criteria of the study and 50 diabetics without diabetic nephropathy are included in “Group I” serving as controls.

Study Place: The is conducted in the Tertiary Care Hospital of North India.

Study Population: All type 2 diabetes mellitus patients.

Study Duration: 18 months (1 year for data collection and 6 months for data analysis).

Sample Size: Subjects are 100 people with diabetes for this case-control study. Half of them, 50 people with diabetic nephropathy, are part of "Group II" who presented to the Medicine department (indoor/ outdoor department) of Tertiary Care Hospital of North India; the other half, 50 people with diabetes who do not have diabetic nephropathy, are part of "Group I" serving as controls. Completed cases are taken up for the statistical evaluation. The statistical review and final assessment do not include any

dropouts. Inclusion and exclusion criteria are used to recruit patients.

- Group I: 50 diabetic patients without nephropathy.
- Group II: 50 diabetic patients with diabetic nephropathy.

Randomization Technique: Since this is not a comparative study, patients are recruited without any randomization.

Inclusion Criteria:

- Patients of T2DM willing to give Informed consent
- Age between 35 to 75 years of both genders.
- Known case of type 2 diabetes mellitus.
- Known case of diabetes mellitus with urine albumin creatinine ratio
- (UACR) >30 mg/g will be taken as cases.

Exclusion criteria:

- Pregnant women.
- Hypertensive patients (not related to diabetic complications) with mean blood pressure ≥ 140/90 mm of Hg or patient already on antihypertensive medication.
- Patients with uncomplicated or complicated urinary tract infection (UTI).
- Patients with systemic disorder such as chronic liver disease, blood disorders, autoimmune disorders. 5. Patients on Anti-inflammatory drugs, systemic or topical steroids.
- Patients having diseases affecting urinary protein excretion such as nephritic syndrome, renal artery stenosis or dehydration state.
- Patients of T2DM refusing to give Informed consent.

Methodology: After selection for the study, detailed history is taken and thorough physical examination is conducted including measurements of vitals, other examinations relevant to the diabetic nephropathy. Initial blood samples are drawn after an overnight fasting of 8 hours, which is meant for testing of plasma glucose, HbA1c, complete blood count and renal function tests. Postprandial plasma glucose is measured. HbA1c is measured by fully automated serum analyzer (Cobas c311 by Roche). Plasma glucose, urea, creatinine, bilirubin, SGPT, SGOT, Albumin and Globulin is estimated by standard protocols on Semi-auto analyzer. Albuminuria, which is the hallmark of diabetic nephropathy is examined using spot urine albumin creatinine ratio (UACR). Patients with UACR of >30mg/g is classified as micro albuminuria positive and >300mg/g as macro albuminuria positive. MPV and absolute lymphocyte count (ALC) is calculated using cell counter (ABX Pentra 80) and then ratio is calculated by dividing MPV to ALC. Urine complete examination is done microscopically. Fundus examination is done by direct ophthalmoscope to rule out retinopathy. Utah Early Neuropathy Scale includes temperature or pinprick sensation, vibration sensation using 128-Hz tuning fork and monofilament testing. This is done to rule out diabetic neuropathy. Abdominal ultrasonography and ECG is done wherever required.

Diagnostic criteria for diabetes mellitus:

Diabetes is diagnosed if:

- HbA1c ≥6.5%
- Fasting plasma glucose (FPG) is ≥ 126 mg/dl
- Postprandial plasma glucose ≥ 200 mg/dl.

Statistical data analysis and software: Suitable statistical significance tests are applied. Software SPSS 17/20 and STATCALC 2 is used. The p value < 0.05 is considered for Statistical Significance. Missing data is not considered and the patient's missing data rendered non-inclusion of the patient in the final analysis. Dummy tables are made for data analysis.

RESULTS

The mean age of Group I was 57.22 ± 11.18 years and Group II was 57.84 ± 12.73 years. There was no statistically significant difference in age or sex distribution between the groups. MPVLR was significantly elevated in diabetic nephropathy patients. Group I demonstrated a mean MPVLR of 3.71 ± 0.55, whereas Group II demonstrated a mean MPVLR of 4.59 ± 1.35. ROC analysis identified an MPVLR cut-off value of 4.40 with sensitivity of 52% and specificity of 94% for diabetic nephropathy prediction. Comparisons with previous studies indicated that MPVLR is a useful marker for diagnosing diabetic nephropathy, though with variability in sensitivity and specificity.

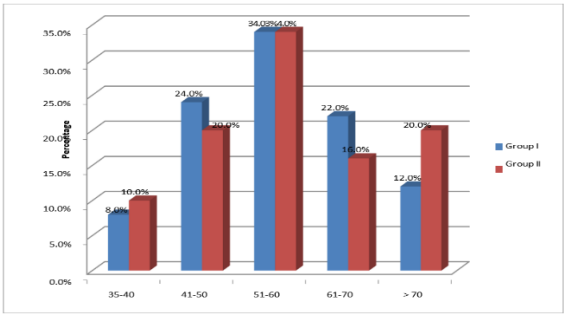

Table 1: Distribution of Patients according to age

		Group I		Group II		Chi- square value	p- value
		No. of cases	%age	No. of Cases	%age		
AGE GROUP	< 40	4	8.0%	5	10.0%	1.767	0.779
	41-50	12	24.0%	10	20.0%		
	51-60	17	34.0%	17	34.0%		
	61-70	11	22.0%	8	16.0%		
	> 70	6	12.0%	10	20.0%		
Total		50	100.0%	50	100.0%		

The Chi-square value is 1.767 and the p-value is 0.779. A p-value greater than 0.05 indicates that there is no significant difference between the age distributions of Group I and Group II in this study. Therefore, the difference in the age groups between these two groups is statistically insignificant

Table 2: Distribution of Patients according to gender

		Group I		Group II		Total	Chi- square value	p- value
		No. of Cases	%age	No. of cases	%age			
Sex	Female	25	50.0%	23	46.0%	48	0.160	0.689
	Male	25	50.0%	27	54.0%	52		
Total		50	100.0%	50	100.0%	100		

Table 3: Mean Platelet Volume to Lymphocyte Ratio (MPVLR) between Group I and Group II

	Group I		Group II		Z	p-value
	Mean	SD	Mean	SD		
MPVLR	3.71	0.55	4.59	1.35	-4.303	0.001

The data presents a comparison of the MPVLR variable between two groups, Group I and Group II. Group I has a mean of 3.71 and a standard deviation of 0.55, while Group II shows a higher mean of 4.59 with a larger standard deviation of 1.35. The Z-value of - 4.303 indicates a significant difference between the two groups, with Group II having a higher value for MPVLR than Group I. The p-value of 0.001 is well below the commonly used threshold of 0.05.

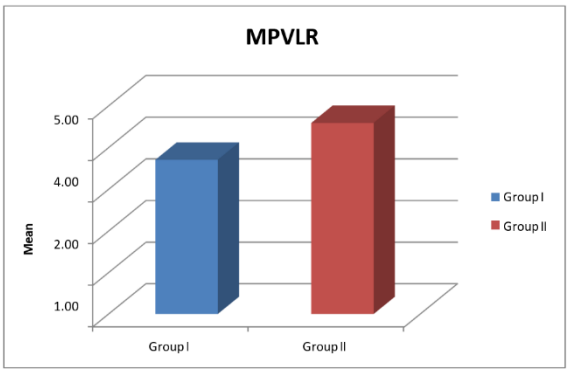

Figure 2: Mean Platelet Volume to Lymphocyte Ratio (MPVLR) between Group I and Group II

DISCUSSION

The study took place at the Tertiary Care Hospital of North India, over a period of 18 months, including one year for data collection and six months for data analysis. Inclusion criteria included T2DM patients aged 35-75 years, willing to provide informed consent, and those with a urine albumin creatinine ratio (UACR) >30 mg/g.

Gender Distribution: In Present study 48 Percent were female and 52 percent were male. In study conducted by Kocak MZ et al 2018 [44] there was 79 females and 83 males.

In study conducted by Kemal A et al 2024 there was 28.3% of the participants were male and 71.7% were female.

Mean Platelet Volume to Lymphocyte Ratio (MPVLR)

The comparison of MPVLR between Group I and Group II shows a statistically significant difference. Group I has a mean MPVLR of 3.71 (SD = 0.55), while Group II has a higher mean of 4.59 (SD = 1.35). The Z-value of -4.303 indicates a strong difference between the two groups, and the p-value of 0.001. Compare to study conducted by Kocak MZ et al. (2018), MPVLR in patients with diabetic nephropathy and non- nephropathic diabetic groups were 4.1 (2.09-11.84) and 3.4 (1.37-25.56), respectively.

Cut off value: The findings from the current study show that MPVLR has a coefficient of 0.686, with a standard error of 0.056, indicating a statistically significant positive relationship with the outcome variable, as evidenced by the p-value of 0.001. Furthermore, the 95% confidence interval for the coefficient suggests a reliable estimate, ranging from 0.577 to 0.796.

MPVLR predicted diabetic nephropathy the optimal cut-off value for MPVLR was found to be 4.40 at this value the predicted 52.0% sensitivity and 94.0% specificity at this level. When comparing these results to the study conducted by Kocak MZ et al. (2018), the optimal cut-off value for MPVLR was found to be 3.66, with an AUC of 0.733 and a p- value of less than 0.001, indicating statistical significance. At this cut-off, MPVLR predicted diabetic nephropathy with 71.1% sensitivity and 67.4% specificity. While the sensitivity in the current study (52.0%) is lower than that of Kocak MZ et al.44 (71.1%), the specificity is notably higher in the current study (94.0% vs. 67.4%), suggesting that the model used here is more effective at correctly identifying non-cases of diabetic nephropathy. Xu B et al 2022 exhibited a modest diagnostic performance for the assessment of inflammation in non-dialysis patients with CKD stages 1-4, with an area under the curve (AUC) of 0.706, and the sensitivity, specificity being 46.2% and 83.2%, respectively.

CONCLUSION

The present study demonstrates that MPVLR is a significant predictor of diabetic nephropathy in patients with Type 2 Diabetes Mellitus. MPVLR predicted diabetic nephropathy the optimal cut-off value for MPVLR was found to be 4.40 at this value

the predicted 52.0% sensitivity and 94.0% specificity at this level.

These findings highlight the potential utility of MPVLR as a diagnostic marker in clinical settings, although further research and validation are needed to refine its clinical applicability and improve its sensitivity. Future studies may also explore optimal cut-off values for different populations to enhance diagnostic accuracy.

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