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Study of CRP correlation with microalbuminuria in diabetic patients: A cross-sectional study

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***Abstract*---**Background: The pathogenesis of cardiovascular disease and chronic kidney disease are similar, suggesting that vascular inflammation can play a role in kidney dysfunction, especially in diabetic patients. We hypothesized that C-reactive protein (CRP), an easily assessed and commonly used marker of early kidney injury, is positively correlated with microalbuminuria. Materials & methods: This cross-sectional study included sixty diabetic patients attending the outpatient department of general medicine from Jan 2018 to March 2019. The subjects were divided into four age groups, namely <30 years, 31-40 years, 41-50 years, and >50 years. Blood samples were taken in the morning after 8 to 12-hours of overnight fast. FBG, HbA1C, and CRP levels were measured, and data were analyzed. Results: The study consisted of 60 patients (32 males and 28 females), most of the patients were in the 41-50 years age group (46.6%), and 38% were >50 years of age. Fasting blood glucose was significantly higher (p- 0.036) in patients with microalbuminuria than in normoalbuminuria. In addition, an inflammatory marker, CRP, was significantly higher in diabetic patients with microalbuminuria (14.24±7.21) than control diabetics without microalbuminuria (6.28±3.38). Conclusion: Early detection of microalbuminuria and high CRP levels, and proper glycaemic control can reduce the burden of kidney diseases in diabetic patients.

***Keywords*---**microalbuminuria, kidney disease, type 2 diabetes, FBG, C-reactive protein.

Introduction

End-stage renal disease is common and causes significant morbidity and medical costs.[1,2] The estimated glomerular filtration rate (eGFR) and albuminuria degree

are the most accurate markers of rapid kidney function decline and are used to diagnose and stage kidney disease. However, albuminuria's diagnostic accuracy for CKD is only modest. Most studies report an area under the ROC curve of 0.80–0.85, making it difficult to predict which CKD patients will advance more quickly.[3,4] Diabetic nephropathy is responsible for 30% of the renal failures in India, with the first clinical sign being microalbuminuria. Diabetic patients have an increased risk of developing cardiovascular diseases, and the risk is further compounded by nephropathy.[5]

Vascular inflammation can be the cause or a potentiator of kidney disease, and in diabetes, the kidneys are affected in stages. The pathogenesis of atherosclerosis and its complications is complicated by inflammation. CRP belongs to the pentraxin class of acute-phase reactants and is almost entirely produced in hepatocytes and regulated by cytokines.[6,7] CRP can play an active role in atherosclerosis. In uncontrolled diabetic patients, hyperglycemia is linked to a rise in serum CRP levels. Excessive formation of early glycation products can have a negative impact on a number of functions related to diabetic complications. A rise in inflammatory marker CRP may lead to early functional changes in the kidneys resulting in microalbuminuria.[8]

Hence, HbA1C estimation, as an indicator of long-term glycemia, aids diabetic patients and treating doctors by offering treatment goals to minimize the risks associated with the initiation and progression of diabetic complications. Therefore, this study estimated the CRP levels and glycemic control status to determine the correlation between microalbuminuria (MA) and CRP in diabetic patients.

Aim

To estimate CRP levels and glycaemic control status and determine the correlation between microalbuminuria and CRP in diabetic patients.

Materials & Methods

This cross-sectional study included sixty diabetic patients attending the outpatient department of general medicine during the period Jan 2018 to March 2019. Institutional ethical committee approval has been received. Informed consent was obtained from all study patients before the study start, and they were subjected to microalbuminuria screening. The subjects included 32 males and 28 females divided into age groups, namely <30 years, 31-40 years, 41-50 years, and >50 years. Patients with a comorbid illness like heart disease, hypertension>160mm/Hg, patients under corticosteroid therapy, pregnant and lactating patients were excluded from the study.

Blood samples were collected the following morning after an overnight fast of8 to 12-hours. Fasting (FBG) level and glycosylated hemoglobin (HbA1C) concentration were measured. Particle-enhanced immunologic agglutination was used to calculate C-reactive protein (CRP). The collected data was entered in Microsoft Excel and analyzed. The Pearson correlation coefficient was used to find out the correlation between albuminuria and CRP. P-value <0.05 was considered

significant. The test's diagnostic value was confirmed by measuring the sensitivity, specificity, and ROC of the curve. SPSS version 21 was used for data analysis.

Results

The study consisted of 60 patients (32 males and 28 females) who satisfied the inclusion criteria Tab.1. The majority of the patients were in the 41-50 years age group (46.6%), and 38% were >50 years of ageTab.2.

Table.1 Gender distribution

Gender	Frequency
Male	32
Female	28

Table.2 Age distribution

Age group	Frequency
<30	2
31-40	7
41-50	28
>50	23

The mean duration of diabetes was 6.24±3.12 years with a p-value of 0.008, indicating that a longer duration of diabetes is associated with a significantly high risk of microalbuminuria. Traditional risk factors like systolic and diastolic BP, obesity were associated with microalbuminuria but not significantly correlated. The mean BMI was 25.12±3.61, with a p-value of 0.346. The mean systolic and diastolic BP are 134.52±14.28, (p-0.082) and 92.51±9.54, (p=0.148), respectively, Tab.3.

Fasting blood glucose level was significantly higher in patients with microalbuminuria than in normoalbuminuria patients (p=0.036). Similarly, HbA1Cwas higher in diabetic patients with microalbuminuria than control diabetics, but it was not statistically significantly correlated (p=0.143). No significant changes were observed in the serum creatinine levels in both groups. Inflammatory marker CRP was significantly higher in diabetic patients with microalbuminuria (14.24±7.21) compared with control diabetics without microalbuminuria (6.28±3.38) (p-value <0.0001). Tab.3.

Table.3 Comparison of biochemical parameters in patients with diabetes

	Normoalbuminuria		Microalbuminuria		
	Mean	Std dev	Mean	Std dev	P-value
Duration of Diabetes (years)	5.28	2.38	6.24	3.12	0.008
BMI	24.28	3.24	25.12	3.61	0.346

FBS	132.28	22.41	146.44	28.52	0.036
HbA1c	6.51	1.61	7.28	2.34	0.143
SBP	135.24	10.31	134.52	14.28	0.082
DBP	89.14	8.26	92.51	9.54	0.148
Creatinine	1.04	0.21	1.02	0.18	0.693
CRP	6.28	3.38	14.24	7.21	<0.0001

CRP levels were found to increase significantly in patients with albuminuria values between 30-300 mg/g (P-value =0.01) Tab.4. There is a moderate correlation between CRP and albuminuria in diabetic patients with a p-value of 0.005. (Fig 1)

Table.4 Table indicating the number of patients with increased CRP and albuminuria levels

ALBUMINURIA	CRP		P value
	<10	>10	
<30	26	4	
30-300	17	13	0.01

Table.5 Pearson correlation between CRP and albuminuria

		Albuminuria
CRP	Pearson Correlation	0.457
	P-value	0.005
	N	60

Figure.1 Correlation between CRP and albuminuria in diabetic patients

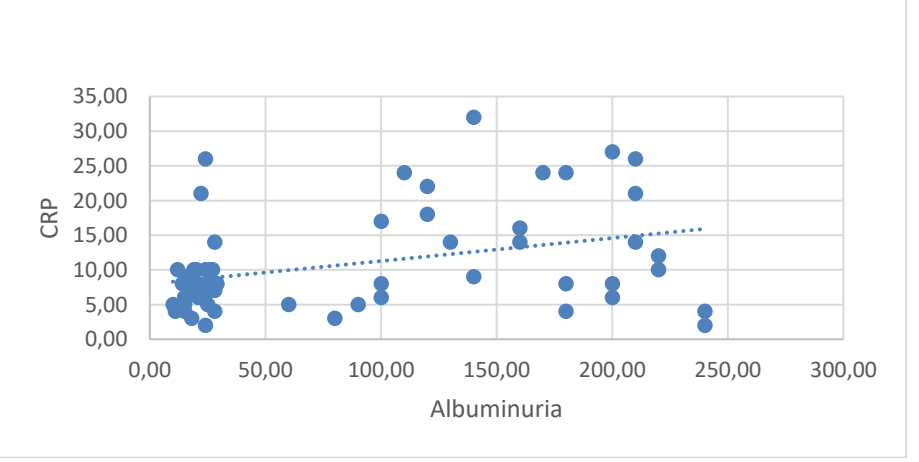
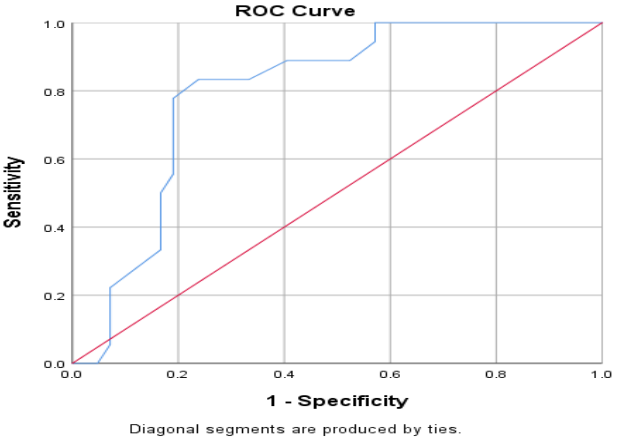


Fig.2. Sensitivity, specificity and AUC were measured to evaluate the significance of the diagnostic value of CRP in diabetic patients with microalbuminuria. The sensitivity was 83.3% and specificity was 76.20% and AUC was 79.70% compared to patients with normoalbuminuria. The cut-off value for albuminuria was 95 Tab.6.

Table.6 Sensitivity & specificity of the diagnostic test

Area under curve	79.70%
Cut off the value of albuminuria	95
Sensitivity	83.30%
Specificity	76.20%

Figure.2 ROC curve



Discussion

CRP was significantly correlated with microalbuminuria in this cross-sectional study; the association was strong with elevated CRP levels. The two factors remained associated even after controlling the various microalbuminuria determinants like age, obesity, and hypertension. The findings support the hypothesis that vascular inflammation is a factor in microalbuminuria and that early renal disease is related to cardiovascular disease. In our study, we attempted to find the correlation between CRP and microalbuminuria in patients with diabetes.

The level of HbA1C in our study was higher in patients with microalbuminuria than in those with normoalbuminuria (p 0.143), which is consistent with previous study findings.[9,10] This marked rise in HbA1C level in diabetic patients with microalbuminuria may be due to permanently elevated blood glucose levels or uncontrolled diabetes, as indicated by excessive haemoglobin glycosylation. This is consistent with the study findings of Piarulli et al.[11] The absence of an adequate compensatory response from the endogenous antioxidant network has been linked to oxidative.

The duration of diabetes is also significantly associated with elevated microalbuminuria, according to our study. For example, in a study by Chowta et al., patients with diabetes between 5 and 10 years had a 50% occurrence of albuminuria, and those with diabetes between 10 and 15 years had a 90.9%

occurrence of albuminuria.[12] Obesity and hypertension were not significantly associated with microalbuminuria incidence in diabetic patients in our study. Still, the values were slightly higher in the MA group than in patients without microalbuminuria. In addition, serum Creatinine was within the normal range in all patients in our study.

The CRP levels in MA diabetic patients were increased significantly in our study with a p-value of <0.0001. This is convincing evidence that the inflammatory parameter is increased in diabetic patients, opening the way for kidney damage. Furthermore, Kshirsagar, in his study, also demonstrated the association of CRP with microalbuminuria.[13,14] The Pearson correlation between CRP and microalbuminuria in our study was 0.457, which shows a strong association between the two. Therefore, a rise in CRP levels may indicate an alarming state in diabetics, and early screening can help prevent renal complications. Our study is not based on the general population, which might have affected the study outcome. A larger study, including more patients and diverse populations, may be needed to confirm the study findings.

Conclusion

The CRP levels were increased in diabetic patients with microalbuminuria, indicating a sub-clinical inflammation and endothelial dysfunction. The duration of diabetes is significantly associated with microalbuminuria, and poor glycaemic control may also aggravate the condition. Therefore, early CRP screening may reduce the burden of end-stage renal diseases in diabetic patients.

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