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Evaluation of the Relationship Between Serum C-Reactive Protein, Urinary Albumin-to-Creatinine Ratio and Lipid Profile in Patients with Diabetes

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ABSTRACT

Background: This study looked at the levels of a protein called C-reactive protein (CRP), a kidney marker called urinary albumin-to-creatinine ratio (ACR), and blood fats (lipid profile) in people with diabetes to see how they are related.
Methodology: We studied 150 people with diabetes divided into three groups of 50 each: Group I had diabetes for less than 5 years, Group II for 5 to 10 years, and Group III for more than 10 years. We tested their blood fats, CRP, and ACR levels.
Results: Analysis showed significant differences across all groups for all parameters ($P < 0.05$). Comparing Group I to Group III, hs-CRP increased from 0.34 ± 0.02 mg/dl to 0.95 ± 0.17 mg/dl (a 179.4% increase) and ACR rose from 100.4 ± 12.2 to 127.5 ± 12.5 (a 27.0% increase). Lipid parameters also showed an upward trend from Group I to Group III: Triglycerides increased from 219.4 ± 25.8 mg/dl to 260.3 ± 27.8 mg/dl (18.6% increase), Total Cholesterol from 208.5 ± 35.2 mg/dl to 233.3 ± 27.1 mg/dl (11.9% increase), and LDL from 132.5 ± 30.4 to 145.2 ± 37.5 (9.6% increase). HDL showed a slight rise from 48.2 ± 4.5 to 50.1 ± 4.9 (3.9% increase). Pearson correlation confirmed that hs-CRP was significantly associated with ACR in all groups.
Conclusion: People who have had diabetes for a longer time tend to have higher levels of CRP and ACR.

Keywords: C-reactive protein, diabetes, lipid profile.

INTRODUCTION

Diabetes is a systemic metabolic disorder marked by persistently high blood glucose levels due to impaired insulin secretion, insulin resistance, or both [1]. It affects almost every organ system in the body and is a major cause of morbidity and mortality in both developed and developing countries, including India, Bangladesh, Nepal, and Bhutan [2]. Since there is no permanent cure for diabetes, effective management is crucial to prevent long-term complications. Diabetes has serious effects on the kidneys, eyes, cardiovascular system, central nervous system, and urinary tract, requiring special attention. Individuals with diabetes are at a significantly higher risk of developing kidney failure compared to non-diabetic individuals [3].

Microalbuminuria refers to the presence of a small but abnormal amount of albumin in the urine, typically ranging from 30 to 300 mg/day. It is an early indicator of diabetic nephropathy, a common complication of

diabetes mellitus [4]. According to the American Diabetes Association, microalbuminuria is best confirmed through a 24-hour urine collection, which is considered the gold standard. However, the National Kidney Foundation recommends measuring the urinary albumin-to-creatinine ratio (ACR) as a more practical and reliable method. Routine screening using these tests is advised for all diabetic patients, and ACR is also an important parameter in the classification of chronic kidney disease [5].

C-reactive protein (CRP) levels increase in response to infections, inflammation, and tissue injury. High-sensitivity CRP (hs-CRP) is a sensitive marker of low-grade inflammation and has been found to be elevated in patients with increased urinary ACR [6]. This study was conducted to assess serum hs-CRP levels, urinary ACR, lipid profiles, and to examine the association between these parameters in individuals with diabetes.

MATERIALS & METHODS

This comparative study was carried out with 150 diabetic patients of both genders who voluntarily agreed to participate. The study took place over a period of six months. Before starting, approval was obtained from the relevant committee (Ref. code: XXII-PGSC-IIA/P7) after reviewing the patient enrollment and risk assessment process.

The study included confirmed diabetic patients aged between 25 and 65 years. Patients with a history of heart or kidney disease, other hormone-related disorders, those using certain long-term medications like cyclosporine, beta-lactam antibiotics, thiazides, or pregnant women were excluded. Each patient underwent a thorough physical examination. They were then divided into three groups of 50 based on how long they had diabetes: Group I had diabetes for less than 5 years, Group II for 5 to 10 years, and Group III for more than 10 years. Blood samples of 5 milliliters were taken from a vein to measure fasting and random blood sugar levels as well as HbA1c, a marker of long-term blood sugar control. Lipid profiles, including cholesterol, LDL (bad cholesterol), HDL (good cholesterol), and triglycerides, were also measured.Additionally, the patients' blood was tested for serum CRP to assess inflammation levels. Urine samples were collected to measure albumin and creatinine levels, using automatic or semi-automatic analyzers. All the collected data were combined and sent to a statistician who analyzed the results using statistical tests (ANOVA and post hoc analysis), with significance set at a p-value less than 0.05.

RESULT

Table 1 shows that there were 31 males and 19 females in Group I, 22 males and 28 females in Group II, and 26 males and 24 females in Group III.

Table 1: Gender-wise patient distribution

Groups	Group I	Group II	Group III
Male	31	22	26
Female	19	28	24

Table 2 shows that mean hs CRP in Group I was 0.34 ± 0.02 mg/dl, in Group II, it was 0.56 ± 0.09 mg/dl, and in Group III, it was 0.95 ± 0.17 mg/dl. ACR was 100.4 ± 12.2 in Group I, in Group II, it was 113.2 ± 15.8, and in Group III, it was 127.5 ± 12.5. TG level was 219.4 ± 25.8 mg/dl in Group I, 245.2 ± 26.2 mg/dl in Group II, and 260.3 ± 27.8 mg/dl in Group III. The mean cholesterol level in Group I was 208.5 ± 35.2 mg/dl in Group I, 226.6 ± 30.4 mg/dl in Group II, and 233.3 ± 27.1 mg/dl in Group III. LDL level was 132.5 ± 30.4 in Group I, 140.2 ± 31.6 in Group II, and 145.2 ± 37.5 in Group III. HDL level was 48.2 ± 4.5 in Group I, 49.1 ± 4.6 in Group II, and 50.1 ± 4.9 in Group III. ANOVA test showed a statistically significant difference between all groups ($P < 0.05$).

Table 2: Assessment of parameters in each group

Variable	Mean ± SD			*P*
	Group I	Group II	Group III	
CRP	0.34±0.02	0.56±0.09	0.95±0.17	0.01
ACR	100.4±12.2	113.2±15.8	127.5±12.5	0.05
TG	219.4±25.8	245.2±26.2	260.3±27.8	0.01
Cholesterol	208.5±35.2	226.6±30.4	233.3±27.1	0.04
LDL	132.5±30.4	140.2±31.6	145.2±37.5	0.03
HDL	48.2±4.5	49.1±4.6	50.1±4.9	0.05

hs CRP: High-sensitivity c-reactive protein, ACR: Albumin-to creatinine ratio, TG: Triglyceride, LDL: Low-density lipoprotein, HDL: High-density lipoprotein, SD: Standard deviation

Table 3 shows that there was significant correlation between hS CRP with ACR and triglyceride in Group I. In group II hS CRP showed significant correlation with ACR whereas in Group III significant correlation was observed with ACR, low density lipoprotein (LDL) and cholesterol.

Table 3: Assessment of Pearson coefficient between high- sensitive C- reactive protein and albumin to creatinine ratio, and lipid profile.

Groups	Parameter	Correlation coefficient	P- value
Group 1	ACR	0.602	0.001
	TG	0.241	0.002
	Cholesterol	0.672	0.09
	LDL	0.223	0.08
	HDL	-0.061	0.124
Group 2	ACR	0.595	0.02
	TG	0.167	0.18
	Cholesterol	0.237	0.09
	LDL	0.379	0.05
	HDL	0.138	0.281
Group 3	ACR	0.61	0.01
	TG	0.014	0.954
	Cholesterol	0.631	0.02
	LDL	0.005	0.03
	HDL	0.632	0.902

ACR: Albumin-to-creatinine ratio, TG: Triglyceride, LDL: Low density lipoprotein, HDL: High-density lipoprotein.

DISCUSSION

Diabetes is a condition in which blood sugar levels remain high. It can lead to several complications such as kidney disease (diabetic nephropathy), eye damage (diabetic retinopathy), nerve damage (diabetic neuropathy), and foot ulcers. Microalbuminuria is considered an early sign of diabetic kidney disease and is also seen as a marker for increased risk of heart disease in people with diabetes [7]. The development of microalbuminuria is related to how long a person has had diabetes. It usually appears after about 5 years of diabetes, while high levels of urinary protein (>300 mg/day) commonly develop after 10–15 years [8,9]. More than half of patients with type 1 diabetes may develop end-stage kidney disease after 10–15 years [10].

The present study included 150 diabetic patients. They were divided into three groups based on the duration of diabetes: Group I had diabetes for less than 5 years, Group II for 5–10 years, and Group III for more than 10 years. A similar study by Acharjya et al. [11] included 120 diabetic patients aged 30–60 years and divided them into the same three groups. Their results showed that levels of hs-CRP and urinary ACR increased steadily with the duration of diabetes, while lipid

profile parameters did not show a similar trend. A significant relationship was found between hs-CRP, ACR, total cholesterol, and LDL cholesterol.

In our study, the average hs-CRP levels were lowest in Group I and highest in Group III. Similarly, urinary ACR values increased from Group I to Group III. These findings support the results of Shin et al. [12], who reported that urinary ACR is independently associated with hs-CRP levels in patients with type 2 diabetes, showing that inflammation increases as kidney damage progresses.

Lipid levels also showed an increasing trend with longer duration of diabetes. Triglycerides, total cholesterol, and LDL cholesterol were higher in patients with longer disease duration, while HDL cholesterol showed a slight increase. Statistical analysis showed significant differences between the groups. A study by Varghese et al. [13] found that more than one-third of South Indian patients with type 2 diabetes had microalbuminuria, and its occurrence increased with longer duration of diabetes. Factors such as age, blood pressure, blood sugar levels, HbA1c, and duration of diabetes were strongly associated with microalbuminuria.

Another study by Asegaonkar et al. [14] showed that hs-CRP is an important and independent marker of cardiovascular risk in type 2 diabetic patients, even when their lipid profile is normal. Higher hs-CRP levels were linked to a much greater risk of heart disease. The main limitation of this study was its small sample size.

CONCLUSION

The study concludes that the duration of diabetes is a critical determinant of a patient's inflammatory status, renal health, and lipid metabolism. As the duration of the disease increases, there is a significant and progressive rise in serum hs-CRP and urinary ACR, both of which serve as vital markers for low-grade inflammation and early-stage kidney damage, known as diabetic nephropathy.

Declaration by Authors

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