

CORRELATION BETWEEN SERUM URIC ACID AND SEVERITY OF DIABETIC NEPHROPATHY IN TYPE 2 DIABETES MELLITUS

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Abstract

Background: Chronic diabetes mellitus (DM) is a condition where the pancreas either generates insufficient amounts of insulin or the body is unable to use the insulin that is produced. Diabetes is becoming more common over the the world at a startling rate. With an estimated 69 million individuals living with diabetes, India is the second-most diabetic capital in the world, after China. Diabetes is the primary cause of nontraumatic lower limb amputations, adult-onset blindness, and end-stage renal failure. **Materials and Methods:** 160 individuals made up the research population; of them, 100 diabetic patients, both with and without nephropathy, constituted the study group. As controls, 60 healthy individuals who were matched for age and sex were also investigated concurrently. Participants in the study were divided into two groups. **Group A:** Diabetic patients with or without nephropathy includes 100 patients. **Group B:** Non-diabetic control persons includes 60 patients All patients will be taken for this study after informed consent underwent detailed history, clinical examination, and laboratory testing. The data were collected on a specially designed proforma. **Result:** The minimum and maximum serum creatinine value(mg/dL) in Group A is, 0.5 and 3.5 respectively, mean is 1.2 ± 0.6 and in Group B minimum is 0.5 and maximum is 1.2, mean value is 0.8 ± 0.2 . However mean difference is statistically significant (p value 0.001) among cases and controls. The mean value of total cholesterol(mg/dL) was higher in group A (195.91 ± 83.72) as compared to group B (145.88 ± 31.44). Triglyceride(mg/dL) levels also followed the similar trend with group A having mean value of 153.79 ± 101.92 and group B having 92.08 ± 28.34 . Similar trend also with LDL values in group A having value of 129.74 ± 64.50 mg/dL and 77.95 ± 21.83 mg/dL in group B. Where HDL is higher in group B (54.43 ± 11.26 mg/dL) and lower in group A (45.71 ± 14.99 mg/dL). Comparison of lipid parameters among cases and controls is statistically significant (p value 0.001). **Conclusion:** T2DM and hyperuricemia are commonly associated. Patients with high blood sugar levels exhibit a greater propensity to develop diabetes mellitus and end-stage kidney disease. Dyslipidemia is linked to it as well. UACR, an early indicator of DN in individuals with type 2 diabetes, is significantly influenced by uric acid. For T2DM patients, hyperuricemia can hasten the worsening and advancement of renal disease. It will need further research to determine whether xanthine oxidase inhibitors can be used to treat hyperuricemia in T2DM patients.

INTRODUCTION

Chronic diabetes mellitus (DM) is a condition where the pancreas either generates insufficient amounts of

insulin or the body is unable to use the insulin that is produced. Diabetes is becoming more common over the the world at a startling rate. With an estimated 69 million individuals living with diabetes, India is the

second-most diabetic capital in the world, after China. Diabetes is the primary cause of nontraumatic lower limb amputations, adult-onset blindness, and end-stage renal failure.^[1-5]

A considerable percentage of individuals with both type 1 and type 2 diabetes have diabetic nephropathy, which is characterised by proteinuria and decreased GFR. Abnormal intra-renal hemodynamics and the glycosylation of circulating and intra-renal proteins are the likely causes. Hyperglycemia can cause mesangial cells to

produce more matrix and undergo apoptosis because it can raise the glucose content in these cells and cause matrix proteins to become glycated. Diabetes-related nephropathy may have matrix buildup due to cytokine activation, inflammation, and vascular growth factors. Blockade of the renin-angiotensin system is useful in the treatment of diabetes because glomerular hypertension and hyperfiltration can also contribute to the onset and progression of diabetic nephropathy. Age is one of the many variables that influences the development of diabetic nephropathy.^[6-11]

Serum uric acid concentrations more than 7 mg/dl in men and 6 mg/dl in women are indicative of hyperuricemia.^[8] Numerous investigations have demonstrated that hyperuricemia can result in a number of harms, including microvascular illness, glomerular hypertension, endothelial dysfunction, and arteriolopathy of the preglomerular arteries. One independent biomarker of obesity, diabetes mellitus, hypertension, and renal diseases is uric acid.^[12-15]

MATERIALS AND METHODS

160 individuals made up the research population; of them, 100 diabetic patients, both with and without nephropathy, constituted the study group. As controls, 60 healthy individuals who were matched for age and sex were also investigated concurrently. Participants in the study were divided into two groups
Group A: Diabetic patients with or without nephropathy includes 100 patients
Group B: Non-diabetic control persons includes 60 patients. All patients will be taken for this study after informed consent underwent detailed history, clinical examination, and laboratory testing. The data were collected on a specially designed proforma.

Inclusion Criteria

Case-1: Adult patients of both sexes who are older than 18 and have been diagnosed with type 2 diabetes according to ADA guidelines.

2. Patients open to participating in the research.

Control: according to ADA standards, healthy persons with appropriate glycemic status.

Exclusion Criteria

those who have already had hypothyroidism individuals with a history of alcohol abuse

Individuals with urinary tract infections. Gout instance that is known to exist. Individuals using medications such as cytotoxics, diuretics, and anti-tubercular medications like ethambutol and pyrazinamide. Individuals Affected by Myeloproliferative Disorders. Glomerulonephritis patients. Patients with cancer and hepatic disorders.

RESULTS

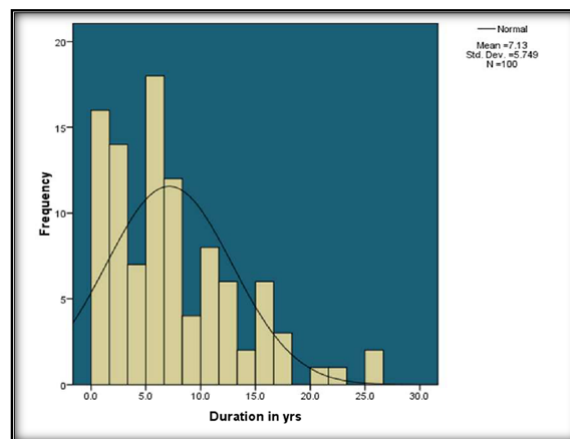


Figure 1: Duration wise distribution of cases

The minimum and maximum serum creatinine value (mg/dL) in Group A is, 0.5 and 3.5 respectively, mean is 1.2 ± 0.6 and in Group B minimum is 0.5 and maximum is 1.2, mean value is 0.8 ± 0.2 . However mean difference is statistically significant (p value 0.001) among cases and controls.

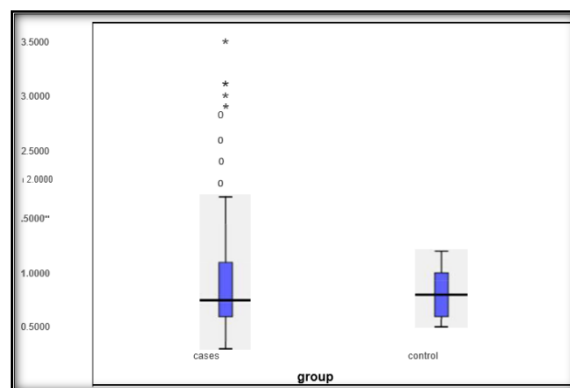


Figure 2: Box- Whisker plot showing the distribution of serum creatinine among cases and controls.

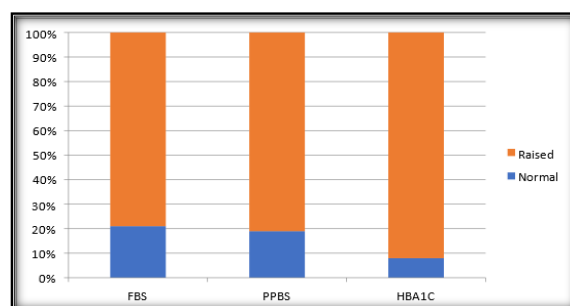


Figure 3: 13- FBS, PPBS, HBA1C among cases

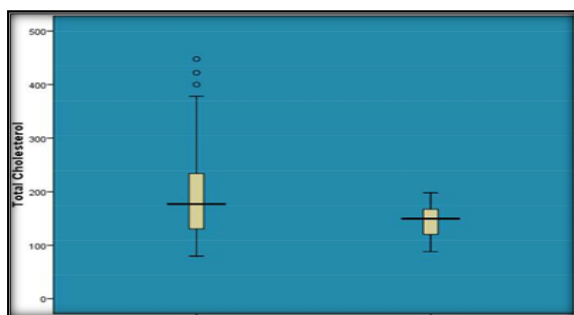


Figure 4: Distribution of total cholesterol among cases and controls

Table 1: Serum creatinine levels among study groups

Group	Number (N)	Minimum (mg/dL)	Maximum (mg/dL)	Mean	SD	P value
Cases	100	0.50	3.50	1.208	0.681	0.001*
Control	60	0.50	1.20	0.815	0.217	

*Mann Whitney U Test

Table 2: serum uric ACID (mg/dl) among study groups

Group	Number(N)	Minimum	Maximum	Mean	SD	P value
Cases	100	2.30	13.00	5.64	2.45	0.001*
Control	60	2.10	6.00	3.90	1.11	

*Mann Whitney U Test

The Mean uric acid in Group A is 5.64 ± 2.45 mg/dL and in Group B is 3.90 ± 1.11 mg/dL. The mean difference is statistically significant (p value 0.001).

So results showed that T2DM patients had higher levels of serum uric acid when compared to healthy controls.

Table 3:

Parameter	Cases (Mean \pm SD)	Control (Mean \pm SD)	P value
FBS (mg/dL)	221.63 \pm 104.81	84.05 \pm 10.72	0.001*
PPBS (mg/dL)	300.53 \pm 121.75	112.32 \pm 13.34	0.001*
HbA1C (%)	8.25 \pm 1.92	5.37 \pm 0.67	0.001*

*Mann Whitney U Test

The Mean FBS and PPBS in Group A is 221.63 ± 104.81 and 300.53 ± 121.75 , in Group B is 84.05 ± 10.72 and 112.32 ± 13.34 . The Mean HbA1C (%) in Group A is 8.25 ± 1.92 , in Group B is 5.37 ± 0.67 respectively. Comparison of all blood sugar parameter between two group is statistically significant (p value 0.001).

Table 4: Lipid Profile (mg/dL) among study groups

Parameter	Cases (Mean \pm D)	Control (Mean \pm SD)	P value
Total Cholesterol	195.91 \pm 83.72	145.88 \pm 31.44	0.001*
Triglyceride	153.79 \pm 101.92	92.08 \pm 28.34	0.001*
HDL	45.71 \pm 14.99	54.43 \pm 11.26	0.001**
LDL	129.74 \pm 64.50	77.95 \pm 21.83	0.001*

*Mann Whitney U Test

** Independent T test

The mean value of total cholesterol(mg/dL) was higher in group A (195.91 ± 83.72) as compared to group B (145.88 ± 31.44). Triglyceride(mg/dL) levels also followed the similar trend with group A having mean value of 153.79 ± 101.92 and group B having 92.08 ± 28.34 . Similar trend also with LDL values in group A having value of 129.74 ± 64.50 mg/dL and 77.95 ± 21.83 mg/dL in group B. Where HDL is higher in group B (54.43 ± 11.26 mg/dL) and lower in group A (45.71 ± 14.99 mg/dL). Comparison of lipid parameters among cases and controls is statistically significant (p value 0.001).

Box whisker plot showing distribution of total cholesterol, TG, HDL, LDL among cases and controls-

Table 5: correlation between SUA level with lipid profile

	Correlation Coefficient	P value
Serum Uric Acid – Total Cholesterol	0.350	0.001
Serum Uric Acid – Triglyceride	0.121	0.232
Serum Uric Acid – HDL	0.122	0.226
Serum Uric Acid – LDL	0.287	0.004

Table 6: Correlation of Serum Uric Acid with UACR and EGFR Among Cases

	Correlation Coefficient	P value
Serum Uric Acid – Urine ACR	0.527	0.001
Serum Uric Acid – eGFR	-0.509	0.001

DISCUSSION

Diabetic problems must be identified early in order to Avoid the negative consequences of tardy issues. Serum indicators that are sensitive and linked to diabetes and its problems. When these characteristics are estimated, early intervention can be used to postpone or reverse the onset of chronic diabetic problems.^[16,17]

Numerous illnesses and ailments, such as gout, hypertension, cardiovascular disease, myocardial infarction and stroke, and renal disease, have been related to hyperuricemia. Nevertheless, it's still unclear if elevated uric acid levels cause or result from certain of these ailments. There has long been a link between uric acid and postponed diabetic consequences.^[18]

There are several reasons of elevated blood uric acid levels, including both acute and long-term ones. Large alcohol consumption, tumour lysis syndrome (a side effect of cancer treatment), and a diet heavy in purines or proteins are among the acute causes of hyperuricemia. Conversely, disorders that lead to a decrease in uric acid excretion, an increase in total tubular absorption, or a reduction in glomerular filtration rate can also result in chronic hyperuricemia.^[19,20]

Numerous theories have been put out as to why uric acid levels are raised. Rosalowsky demonstrated that elevated serum uric acid is linked to a decline in renal function and a malfunction in the URAT1 transporter, which is in charge of urate reabsorption from the kidney. It has been demonstrated that increased uric acid levels are an independent marker for a number of illnesses, including hypertension, diabetes mellitus, stroke, cardiovascular disease, and renal disease. It's yet unclear if these illnesses cause increased uric acid concentrations or if these circumstances themselves result in them.^[21-23]

The purpose of the study was to determine the significance of serum uric acid levels and their relationship to the severity of diabetic nephropathy. The study included 60 controls and 100 Type 2 diabetic patients. The results showed that, regardless of age, sex, or duration of diabetes, Type 2 diabetic patients had significantly higher serum uric acid and microalbuminuria values and decreased GFR levels compared to controls. However, the values were not pathologic levels.^[24]

In both groups, the average age was 60.21 ± 11.89 and 58.87 ± 13.39 years. The age of patients and serum uric acid level have a positive link that is statistically significant (p value of 0.012 and correlation coefficient of 0.249), suggesting that the prevalence of hyperuricemia increases with age. Elderly age groups also showed hyperuricemia in a number of other investigations. Age and the blood uric acid level of diabetes patients were found to positively correlate in a 2010 study by Adlija Causevic, Sabina Semiz, et al. They discovered that as diabetes patients aged, their blood uric acid levels rose. This impact was

significantly more pronounced in male diabetics than in female diabetics. Hence, my research indicates that as people age,^[25]

The average blood uric acid levels in diabetes patients, both male and female, were 5.58 ± 1.93 mg/dL and 5.70 ± 2.87 mg/dL, respectively. These results are not statistically significant (p value > 0.05). This demonstrates that in my investigation, there is no correlation between gender and serum uric acid level. The association between SUA and the frequency of DN and eGFR levels was similar in boys and females, according to identical findings in a research by Qun Xia, et al. that was published in April 2020.^[26-28]

Serum uric acid levels significantly increased in patients compared to controls with longer duration of diabetes, regardless of age or sex; the mean SUA (mg/dL) in cases was 5.64 ± 2.45 and in controls it was 3.90 ± 1.11 .^[29]

According to Woyesa, et al individuals with diabetes diagnosed less than ten years ago had higher levels of hyperuricemia than those with a longer history of the condition. In contrast, individuals with a diagnosis of 10 years or more had higher levels of hyperuricemia, according to research by Fouad et al. In my study, the mean length was 7.3 years. The duration of diabetes and serum uric acid have a positive link with a statistically significant correlation value of 0.497.^[30]

CONCLUSION

T2DM and hyperuricemia are commonly associated. Patients with high blood sugar levels exhibit a greater propensity to develop diabetes mellitus and end-stage kidney disease. Dyslipidemia is linked to it as well. UACR, an early indicator of DN in individuals with type 2 diabetes, is significantly influenced by uric acid. For T2DM patients, hyperuricemia can hasten the worsening and advancement of renal disease. It will need further research to determine whether xanthine oxidase inhibitors can be used to treat hyperuricemia in T2DM patients.

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