ISSN: 0975-3583,0976-2833 VOL13, ISSUE 04, 2022

To Determine the Relationship Between Serum Uric acid and Renal Function in Diabetics with Normal Uric Acid Levels

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Abstract

Background: To determine the relationship between serum uric acid and renal function in diabetics with normal uric acid levels.**Material and Methods:**The Department of Medicine conducted this prospective open label observational research. The research included 50 type 2 diabetes mellitus patients ranging in age from 31 to 67 years. Serum uric acid, urine albumin to creatinine ratio (ACR), fasting blood glucose (FBG), glycated haemoglobin (HbA1c), lipid profile, and serum creatinine were also measured.**Results:**The mean blood creatinine levels and GFR of the study population were 0.97±0.32 mg/dl and 78.96±10.82 ml/min/1.73 m2, respectively. The normoalbuminuria population had levels of TG, LDL, and HDL of 120.70±20.77 mg/dl, 121.96±18.44 mg/dl, and 38.98±3.78 mg/dl, respectively, whereas the microalbuminuria group had values of 147.10±25.18 mg/dl, 144.07±12.59 mg/dl, and 39.91±2.99 mg/dl, respectively, and the macroalbuminuria group had The findings of our investigation revealed that albumin levels in diabetes patients had a statistically significant positive association with both triglyceride levels (r=0.44, p0.0001) and LDL levels (r=0.42, p0.0004), while no such link was detected with HDL levels (p=0.12).**Conclusion:**Because hyperuricemia is a frequent finding in this community of patients, and therapy is simple and inexpensive, early detection and treatment may be beneficial in preventing or slowing the progression of overt renal disease in this patient population.

Keywords: Hyperuricemia, albuminuria, and type 2 diabetes mellitus are all keywords.

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Introduction

Diabetic nephropathy (DN) is a catastrophic late consequence of diabetes that has traditionally required kidney replacement for one out of every four type 1 diabetic patients. The first clinical symptom is a modest increase in urine albumin excretion (microalbuminuria [MA]). Previously, it was thought that this leakage would eventually lead to extensive proteinuria, which would kill nephrons and lead to ESRD. Our recent follow-up analysis of a cohort of individuals with type 1 diabetes and MA, on the other hand, found more diversified outcomes within a few years of the disease's inception. The first was the reversal of MA to normoalbuminuria (NA) in around half of the sample. Type 2 diabetes is on the rise all across the globe, posing an increasingly serious danger to global health.[1] It has also become the major cause of end-stage renal disease worldwide, with an increasing number of individuals diagnosed each year with end-stage renal disease caused by type 2 diabetes.[2] According to the latest data from the International Diabetes Federation (IDF) 2015,[3] there are presently 415 million individuals living with diabetes worldwide, with this figure expected to climb to 592 million by 2035. According to IDF estimations, the Western area (138.2 million people with diabetes) has the most and Africa (19.8 million people with diabetes) has the least. As of 2013, India, the biggest nation in the South-east Asian area, has 65.1 million diabetics; this figure is anticipated to rise to 109 million by 2035.

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Glycosylated haemoglobin is a useful method for determining glycemic control in type II diabetes mellitus. HbA1C readings provide a reliable representation of the average plasma glucose levels during the previous 8 to 12 weeks. HbA1C is now used to identify diabetes instead of glycemic control, and the American Diabetes Association (ADA) has established criteria for diagnosing diabetes based on glycosylated haemoglobin readings.[4] Serum uric acid levels of 7 mg/dl (in males) or 6.0 mg/dl (in women) are considered hyperuricemia (in women).[5] Uric acid is a byproduct of purine metabolism, with one-third destroyed in the stomach and two-thirds eliminated by the kidneys.[6-8]Uric acid levels might rise due to increased production or reduced removal. Although hyperuricemia has been linked to impaired kidney function, According to several epidemiological research, hyperuricemia is an independent risk factor for renal damage in diabetic individuals (DM).[10] It has been proposed that higher serum uric acid levels are harmful to the kidneys. 11 Diabetic nephropathy is the major cause of end-stage renal disease (ESRD) globally, as well as the leading cause of DM morbidity and death. Diabetic nephropathy causes over 30% of chronic renal failure in India. According to several investigations on diabetic individuals, hyperuricemia is connected with kidney injury irrespective of hypertension.[11] Higher amounts of serum insulin, on the other hand, may reduce uric acid clearance by the kidneys.[12,13]Hyperinsulinemia is the most common cause of type 2 diabetes pathophysiology.[12] As a result, diabetic people are more vulnerable to uric acid damage. The purpose of this research is to assess serum uric acid levels and urine Albumin Creatinine Ratio (ACR) in T2DM patients.

Materials and Methods

The Department of Medicine conducted this prospective open label observational research. The research included 50 type 2 diabetes mellitus patients ranging in age from 31 to 67 years. Serum uric acid, urine albumin to creatinine ratio (ACR), fasting blood glucose (FBG), glycated haemoglobin (HbA1c), lipid profile, and serum creatinine were also measured. Patients taking diuretics, angiotensin converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARB), alcohol abusers, urinary tract infections, and cancer patients were excluded from this research.

Methodology

The patient was diagnosed with diabetes mellitus using American Diabetes Association (ADA) criteria. A fasting plasma glucose (FPG) of more than 126 mg/dL, a two-hour plasma glucose of more than 200 mg/dL, or a HbA1c of more than 6.5 percent indicates diabetes mellitus. A random plasma glucose concentration of >200 mg/dL combined with standard diabetes mellitus symptoms (polyuria, polydipsia, and weight loss) is adequate for diabetes mellitus diagnosis.

Statistical investigation

SPSS 25.0 statistical software was used to analyse the data, while Microsoft Word and Excel were utilised to create graphs and tables. The acquired data was evaluated and reported as Mean SD, with P values less than.05 deemed significant.

Results

The age range of the sample of 50 type 2 DM patients was 31-67 years, with a mean age of 56.89±7.58 years and a male: female ratio of 1.27:1. The mean BMI of the study population was 27.40±1.17kg/m2, and the mean systolic and diastolic blood pressures were 128.8610.52 mmHg and 79.126.688 mmHg, respectively. The study population's mean fasting blood sugar level was 160.08±24.02mg/dl, and the mean HbA1c level was 7.2±1.41 percent. The mean

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 04, 2022

value of the study population's lipid profiles, which included triglycerides, LDL, and HDL, was 128.52±0.72mg/dl, 128.37±21.77mg/dl, and 38.98±3.27 mg/dl, respectively. The mean blood creatinine levels and GFR of the study population were 0.97±0.32 mg/dl and 78.96±10.82 ml/min/1.73 m2, respectively. The mean urine ACR recorded in our research sample was 149.11±35.18 (g/mg).

Albuminuria was classified into three categories in the current research based on urine ACR: normoalbuminuria (ACR less than 30 ug/mg), microalbuminuria (ACR between 30 ug/mg and 299 ug/mg), and macroalbuminuria (ACR more than 300 ug/mg). In these three research groups, the mean urine ACR values were 23.8±2.89, 142.02±59.08, and 418.22±51.55, respectively.

The normoalbuminuria population had levels of TG, LDL, and HDL of 120.70±20.77 mg/dl, 121.96±18.44 mg/dl, and 38.98±3.78 mg/dl, respectively, whereas the microalbuminuria group had values of 147.10±25.18 mg/dl, 144.07±12.59 mg/dl, and 39.91±2.99 mg/dl, respectively, and the macroalbuminuria group had The findings of our investigation revealed that albumin levels in diabetes patients had a statistically significant positive association with both triglyceride levels (r=0.44, p0.0001) and LDL levels (r=0.42, p0.0004), while no such link was detected with HDL levels (p=0.12).

Patients with normouricemia exhibited normoalbuminuria in 61.11 percent, microalbuminuria in 25%, and macroalbuminuria in 13.89%. In hyperuricemia patients, 57.14 percent had microalbuminuria, 28.57 percent had macroalbuminuria, and 14.28 percent had normoalbuminuria. As a result, albuminuria was shown to be substantially linked with hyperuricemia. Serum uric acid concentrations were 4.99±1.43 mg/dl, 7.99±0.97 mg/dl, and 6.92±1.68 mg/dl in individuals with normoalbuminuria, microalbuminuria, and macroalbuminuria, respectively. In comparison, the findings were statistically significant. The univariate R value was 0.93, indicating a modest positive connection. R2, also known as the coefficient of determination, was 0.70. Serum uric acid was revealed to be a significant factor that could predict only 42 percent (R2 = 0.70) variance in albumin creatinine ratio based on the R2 value. After utilising an adjusted R2 value, it was discovered that serum uric acid was an independent predictor of albumin creatinine ratio.

Table 1: Basic parameter of the patients

Parameters	**Maen values (Mean±SD)**
Age (years)	56.89± 7.58
Gender (%age) Male Female	 56% 44%
BMI (kg/m^2)	27.40±1.17
SBP (mmHg)	128.86±10.52
DBP (mmHg)	79.12±6.88
HTN (%age)	52%
Fasting blood sugar (mg/dl)	160.08±24.02
HbA1C (%)	7.2±1.41
Triglycerides (mg/dl)	128.5±20.72
LDL (mg/dl)	128.37±21.77
HDL (mg/dl)	38.98±3.27
Serum creatinine (mg/dl)	0.97±0.32
GFR (ml/min/1.73 m^2)	78.96±10.82
Urinary ACR (µg/mg)	149.1±135.18
Serum uric acid (mg/dl)	6.58±1.69

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Table 2: Comparison of mean urinary ACR among three groups

Groups	No. of patients (n)	Mean urinary ACR (µg/mg)
Normo albuminuria(Group 1)	25	23.8±2.89
Micro Albuminuria(Group 2)	15	142.02±59.08
Macro Albuminuria (Group 3)	10	418.22±151.55

Table 3: mean values of TG, LDL& HDL in relation to different groups of albuminuriain

Variable	Normo albuminuria (Group 1)	Micro albuminuria (Group 2)	Macro albuminuria (Group 3)	Correlation coefficient (R value)	Significance (p value)
TG (mg/dl)	120.70±20.77	147.10±25.18	129.19±21.78	0.44	0.0001*
LDL(mg/dl)	121.96±18.44	144.07±12.59	128.54±20.23	0.42	0.0004*
HDL(mg/dl)	38.98±3.78	39.91±2.99	38.51±2.98	0.12	0.370

Table 4: Association of albuminuria with serum uric acid

	Serum uric acid			
Albuminuria	**Normouricemia**	**Hyperuricemia**	**Total**	**p Value**
Normalbuminuria	22(61.11)	2(14.28)	24(48)	<0.001
Microalbuminuria	9(25)	8(57.14)	17(34)	
Macroalbuminuria	5(13.89)	4(28.57)	9(18)	
Total	36(100)	14(100)	50(100)	

Table 5: Evaluation of relationship of mean value of serum uric acid in relation to different groups of albuminuriain

Variable	Normo albuminuria (Group 1)	Micro albuminuria (group 2)	Macro albuminuria (Group 3)	Correlation coefficient (R value)	Coefficientof determination (R^2)
Uric acid	4.99±1.43	7.99±0.97	6.92±1.68	0.93	0.70

Discussion

Diabetes mellitus is a metabolic condition characterised by varying degrees of insulin resistance and insulin secretion impairment. Insulin is a hormone that controls how the body uses glucose. Diabetes is characterised by hyperglycemia and inadequacy of endogenous insulin production or action. In these three research groups, the mean urine ACR values were 23.8±2.89, 142.02±59.08, and 418.22±51.55, respectively. Kaifee M et al,[14] classified their research participants as normoalbuminuric, microalbuminuric, or macroalbuminuric based on mean urine ACR levels in T2DM patients, with mean values of 22.28±4.09 g/mg, 134.79±70.65 g/mg, and 469.83± 120.14 g/mg, respectively. The age range of the sample of 50 type 2 DM patients was 31-67 years, with a mean age of 56.89± 7.58 years. This is the age of greatest social and economic responsibility, as well as a risk factor for increasing renal impairment. Chin-Hsiao Tseng et al reported a mean age of 62.8±10.8 years in their research cohort, which is similar to ours.[15]According to Bonakdaran S et al, the average age in the study population was 52.45±10.11 years.[16]

In terms of gender distribution, the overall male: female ratio in the current research was 1.27:1, indicating male preponderance. Prabhuswamy K M revealed male preponderance in their research, which is consistent with our findings.[17] However, few studies have indicated a female majority as well. This may be rationalised by stating that variations in biology,

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 04, 2022

culture, lifestyle, environment, and socioeconomic level have an influence on differences in propensity between males and females in these research. This gap in the current research may also indicate the health-seeking behaviour of hospitalised patients, since this is a hospital-based study rather than a population-based one.

Furthermore, females predominated in only the macroalbuminuria group, while men predominated in the other two groups. In the current investigation, no significant link was discovered between gender distribution and urinary ACR levels. Kaifee M et al,[14] observed that normoalbuminuria and micro+ macroalbuminuria groups were 49 percent female, 51 percent male, and 56.9 percent female and 43.1 percent male, respectively. In contrast, Yakoob Ahmedani et al showed that microalbuminuria was more common in men (37.1 percent vs. 29.9 percent) than females.[18]

The study population's mean fasting blood sugar level was 160.08±24.02mg/dl, and the mean HbA1c level was 7.2±1.41 percent. Chin-Hsiao Tseng et al,[15] reported comparable findings in their research, however Bonakdaran S, Hami M et al,[16] found that the mean of FBS in patients with T2DM in their study was greater than ours. The elevated mean HbA1C in their study subjects might be attributed to inadequate glycemic management.

The mean value of the study population's lipid profiles, which included triglycerides, LDL, and HDL, was 128.5±20.72mg/dl, 128.37±21.77mg/dl, and 38.98±3.27 mg/dl, respectively. The mean blood creatinine levels and GFR of the study population were 0.97±0.32 mg/dl and 78.96±10.82 ml/min/1.73 m2, respectively. The findings of our investigation revealed that albumin levels in diabetes patients had a statistically significant positive association with both triglyceride levels (r=0.44, p0.0001) and LDL levels (r=0.42, p0.0004), while no such link was detected with HDL levels (p=0.12). According to Yakoob Ahmedani et al,[18] the microalbuminuria positive group had a more disordered lipid profile, with higher serum total cholesterol, triglycerides, LDL cholesterol, and lower HDL values than the microalbuminuria negative group. FBS, HbA1c, and serum creatinine levels were shown to have a substantial and positive connection with albumin levels in the study group. GFR, on the other hand, showed a substantial but mild negative connection with albumin levels in the study sample.

The mean blood uric acid concentration was 6.58±1.69 mg/dL, which compares well to the research done by Kaifee M, et al.(2017),[14] which found that the mean serum Uric Acid in patients with T2DM in the study group was 6.18 0.89mg/dl. According to Bonakdaran S et al (2011),[16] the mean blood uric acid level in individuals with T2DM in the study population was 5.55 1.47 mg/dl. Chin-Hsiao Tseng et al (2005),[15] found that the mean uric acid level in patients with T2DM was 5.6 1.9 mg/dl.

Serum uric acid concentrations were 4.99±1.43 mg/dl, 7.99±0.97 mg/dl, and 6.92±1.68 mg/dl in individuals with normoalbuminuria, microalbuminuria, and macroalbuminuria, respectively. Similarly, Chin- Hsiao Tseng et al (2005),[13] found that the mean serum uric acid levels in T2DM patients with normoalbuminuria, microalbuminuria, and macroalbuminuria were 5.2± 1.6 mg/dL, 5.6± 1.9 mg/dL, and 6.7± 2.1 mg/dL, respectively. Several authors, including Kopaei MR et al,[19] Razi F et al,[20] and Kuwabara M et al,[21] have demonstrated that serum uric acid is related with reduced GFR and albuminuria and may be utilised as an indication of diabetic nephropathy. There were significant positive relationships between serum uric acid concentration and SBP, DBP, FBG, HbA1c, lipids, LDL, serum creatinine, and urine ACR (P.001). Whereas a negative association of serum uric acid was seen in factors such as age, BMI, and HDL, this link was statistically insignificant.

In individuals with T2DM, Kaifee M et al. (2017),[14] found that hyperuricemia linked favourably with FBG, HbA1C, serum creatinine, LDL, and triglycerides. There was no significant relationship discovered between hyperuricemia and age, gender, weight, height, BMI, or HDL.

ISSN: 0975-3583,0976-2833 VOL13, ISSUE 04, 2022

Overall, the findings of our research show that albuminuria is substantially linked with hyperuricemia. According to our findings, Bonakdaran S et al,[16] discovered a strong relationship between serum uric acid and urine ACR. The Pearson correlation coefficient r between blood uric acid and urine ACR is 0.097 (P = 0.05).
According to Neki NS et al,[22] serum uric acid levels show a linear positive correlation with the quantity of proteinurea. Diabetic nephropathy may be predicted by rising serum uric acid levels, and serum uric acid level correlates well with proteinuria, blood urea, and serum creatinine level. Liang CC et al,[23] found that a higher blood uric acid level was substantially linked with the degree of albuminuria in another research of Taiwanese individuals with type 2 DM. In another investigation, De Cosmo S et al,[24] discovered that serum uric acid was substantially linked with albuminuria, suggesting that moderate hyperuricemia is strongly connected with the risk of CKD in type 2 diabetic patients.

Conclusion

The blood uric acid content was shown to be considerably and more likely to be connected with albuminuria in individuals with type 2 diabetes mellitus in this investigation. Because hyperuricemia is a frequent finding in this community of patients, and treatment is simple and inexpensive, early identification and therapy may be beneficial in preventing or slowing the progression of overt renal disease in this population of individuals.

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