

**A CROSS SECTIONAL STUDY OF ASSOCIATION OF SERUM URIC ACID WITH ALBUMINURIA AND CAROTID ATHEROSCLEROSIS IN TYPE 2 DIABETES MELLITUS PATIENTS**

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**Abstract:**

**Introduction:** Diabetes mellitus is a metabolic disease involving inappropriately elevated blood glucose levels. Diabetes mellitus causes both macro and micro vesicular complications. Microalbuminuria is the earliest sign of diabetes nephropathy and carotid intima-media thickness (IMT) of Common carotid artery gives an estimate of early lesion of atherosclerosis. Elevated serum uric acid is an risk predictor for cardiovascular and kidney diseases.

**Materials and Methods:** The present study comprised of 130 type II diabetes mellitus patients of both genders. All were informed regarding the study and their written consent was obtained. Data such as name, age, gender etc. was recorded. In all, uric acid (UA) was measured by enzymatic photometric test, urine albumin was measured by immunoturbidimetric assay, urine creatinine was measured using creatinine Jaffe method and albumin creatinine ratio (ACR) was calculated by dividing urine albumin concentration with urine creatinine concentration. Common carotid artery and internal carotid artery intima-media thickness (in centimetres) of both sides was recorded.

**Results:** Out of 130 patients, males were 70 and females were 60. Mean uric acid in males was 6.81 mg/dl and in females was 5.15 mg/dl. Albumin showed normoalbuminuria in 60, micromicroalbuminuria in 40 and macromicroalbuminuria in 30. IMT was between 0.4-0.5 cm in 24, 0.5- 0.6 cm in 28, 0.6-0.7 cm in 40 and 0.7-0.8 cm in 18 subjects. The difference was significant (P< 0.05). UA had positive correlation with logarithm of urine albumin excretion and IMT (P< 0.05)

**Conclusion:** In this study, we have found that asymptomatic hyperuricemia is highly prevalent in type 2 Diabetes mellitus patients. Serum UA concentration serves as early and independent marker of renal dysfunction in type 2 Diabetes mellitus patients. Serum UA concentration serves as early marker of carotid atherosclerosis in type 2 Diabetes mellitus patients.

**Key Words:** Diabetes mellitus, diabetic nephropathy, diabetic retinopathy.

## INTRODUCTION

Diabetes mellitus is a metabolic disease involving inappropriately elevated blood glucose levels. Diabetes mellitus causes both macro and micro vesicular complications. Microalbuminuria is the earliest sign of diabetes nephropathy and carotid intima-media thickness (IMT) of Common carotid artery gives an estimate of early lesion of atherosclerosis. Elevated serum uric acid is an risk predictor for cardiovascular and kidney diseases.

World Health Organization (WHO) defines the term Diabetes Mellitus (DM) as a metabolic disorder of multiple aetiology, characterized by chronic hyperglycaemia with disturbances of carbohydrate, protein and fat metabolism, resulting from defects in insulin secretion or insulin action or both.<sup>1</sup>

Diabetes mellitus is a leading public health problem with increasing incidence and long-term complications such as diabetic nephropathy, diabetic neuropathy, diabetic retinopathy etc. These complications are mainly a consequence of macro vascular and micro vascular damages of the target organs.<sup>2</sup> The top three countries are India, China and U.S. India is called Diabetic Capital of World, the estimates in 2019 showed that 77 million individuals had diabetes in india, which is expected to rise to over 134 million by 2045. Several factors contributing to this include greater longevity, obesity, unsatisfactory diet, sedentary lifestyle. The cause of clinical diabetes is absolute or relative deficiency of insulin. Diabetes mellitus of Type 2 or NIDDM, is characterized by insulin resistance and impaired insulin receptors. It is common type of diabetes and usually develops after the age of 40 years.<sup>3</sup>

Uric acid is end product of purine metabolism. Hyperuricemia is a condition that is significantly associated with markers of metabolic syndrome such as dyslipidaemia, glucose intolerance, insulin resistance, high blood pressure, and central obesity, which are accepted as risk factors for developing cardiovascular and other complications. Because it has paradoxical action, it acts as an antioxidant at physiological level but shows a pro-oxidant property while the levels are elevated. Hyperuricemia has been described as a strong predictor of well-defined cerebrovascular complications (stroke) in patients with type 2 diabetes.<sup>4</sup>

Hyperuricemia is an independent risk factor for kidney dysfunction in diabetes mellitus. Increased uric acid will damage the kidney by causing Hyperuricemia induced endothelial injury. Association between Hyperuricemia and diabetes includes: (a) uric acid induced activation of renin angiotensin system and action on glomerular apparatus (b) increased insulin resistance and hyperinsulinemia, causing decreased excretion of uric acid, sodium, potassium from renal tubules; and (c) uric acid action in proliferation of vascular smooth muscle, endothelial dysfunction with decreased nitric acid production.<sup>5</sup>

Urinary micro albumin assesses glomerular endothelial function and micro vascular integrity. The higher the urinary micro albumin level, the higher the risk for development of kidney disease, particularly in type 2 diabetes mellitus and hypertension.<sup>6</sup>

Some investigators have suggested that uric acid plays a causal role in the development of CVD whereas others have concluded that uric acid merely reflects other concomitant risk factors, such as hypertension, insulin resistance, or dyslipidemia. The present study was conducted to assess association of serum uric acid with albuminuria and carotid atherosclerosis in type 2 diabetes mellitus patients.

## MATERIALS AND METHODS

**Study design:** A Cross Sectional Study.

**Study duration:** February 2022 to March 2023.

**Study Location:** Department of General Medicine, Mallareddy Medical College for Women, Hyderabad, Telangana.

**Sample size:** 130 patients.

The present study comprised of 130 type II diabetes mellitus patients of both genders. All were informed regarding the study and their written consent was obtained. Data such as name, age, gender etc. was recorded. In all, uric acid (UA) was measured by enzymatic photometric test, urine albumin was measured by immunoturbidimetric assay, urine creatinine was measured using creatinine Jaffe method and albumin creatinine ratio (ACR) was calculated by dividing urine albumin concentration with urine creatinine concentration. Common carotid artery and internal carotid artery intima-media thickness (in centimetres) of both sides was recorded. The degree of plaque was graded for each segment using the following criteria: Grade 0: no observable plaque, grade 1: one small plaque (< 30% of the vessel diameter), grade 2: one medium plaque (30-50% of the vessel diameter) or multiple small plaques, grade 3: one large plaque (> 50% of the vessel diameter) or multiple plaques with at least one medium plaque. Results were tabulated and assessed statistically. P value less than 0.05 was considered significant.

## RESULTS

S.No	Gender	N (%)
1	Male	70 (54%)
2	Female	60 (46%)

**Table 1: Gender distribution**

Out of 130 patients, males were 70 and females were 60.

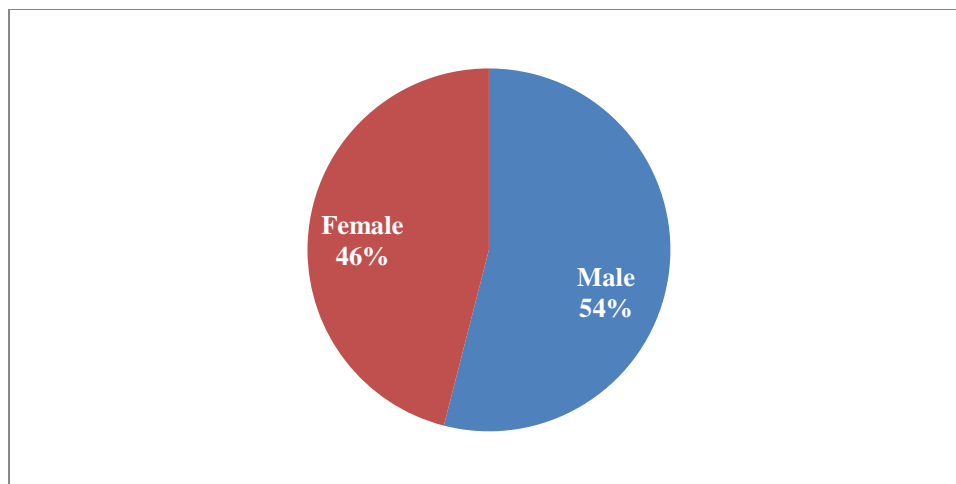


Figure 1: Gender distribution

Parameters	Variables	Mean	P value
Uric acid (mg/dl)	Males	6.81	0.04
	Females	5.15	
Albumin	Normoalbuminuria	60	0.03
	Micromoalbuminuria	40	
	Macromoalbuminuria	30	
IMT	0.4-0.5 cm	24	0.02
	0.5-0.6 cm	28	
	0.6-0.7 cm	40	
	0.7-0.8 cm	18	

Table 2: Assessment of parameters

Mean uric acid in males was 6.81 mg/dl and in females was 5.15 mg/dl. Albumin showed normoalbuminuria in 60, micromoalbuminuria in 40 and macromoalbuminuria in 30. IMT was between 0.4-0.5 cm in 24, 0.5- 0.6 cm in 28, 0.6-0.7 cm in 40 and 0.7-0.8 cm in 18 subjects. The difference was significant ( $P < 0.05$ ). UA had positive correlation with logarithm of urine albumin excretion and IMT ( $P < 0.05$ )

## DISCUSSION

Hyperuricemia has been reported to be associated with increased risk of renal insufficiency as well as cardiovascular events. Epidemiologic studies have found that hyperuricemia is an independent risk factor for renal dysfunction in a general population in patients with hypertension and in patients with diabetes. The present study was conducted to assess association of serum uric acid with albuminuria and carotid atherosclerosis in type 2 diabetes mellitus patients.<sup>7</sup>

We found that out of 130 patients, males were 70 and females were 60. Kang et al<sup>8</sup> hypothesized that elevated serum uric acid levels are a strong predictor of albuminuria in patients with type 1 diabetes. For every 1-mg/dl increase in serum uric acid levels at baseline,

there was an 80% increased risk of developing micro- or macroalbuminuria at 6 years. Additional covariates considered in the stepwise model were sex, age, duration of diabetes, angiotensin-converting enzyme inhibitor or angiotensin II receptor blocker treatment, waist circumference, waist/hip ratio, body mass index, systolic and diastolic blood pressure, smoking, serum creatinine, cystatin C, high-density lipoprotein cholesterol and triglycerides.<sup>8</sup>

We observed that albumin showed normoalbuminuria in 60, micromicroalbuminuria in 40 and macromicroalbuminuria in 30. IMT was between 0.4-0.5 cm in 24, 0.5- 0.6 cm in 28, 0.6-0.7 cm in 40 and 0.7-0.8 cm in 18 subjects. We found that UA had positive correlation with logarithm of urine albumin excretion and IMT ( $P < 0.05$ ). Singh et al found that prevalence of hyperuricemia was found to be high (46%) in type 2 diabetic patients.<sup>9</sup> It was also higher in females (73.7%) than males (25.8%). There was positive correlation between serum UA concentrations with logarithm of urine albumin excretion ( $P < 0.023$ ) and carotid intima-media thickness (IMT) ( $P < 0.027$ ). Plaque index also showed a positive correlation with UA ( $P < 0.019$ ). However, there was no positive correlation with UA and other variable such as age, duration of diabetes, systolic blood pressure, diastolic blood pressure, HbA1c, lipid profiles, urea, and creatinine.<sup>10</sup>

## CONCLUSION

In this study, we have found that asymptomatic hyperuricemia is highly prevalent in type 2 Diabetes mellitus patients. Serum UA concentration serves as early and independent marker of renal dysfunction in type 2 Diabetes mellitus patients. Serum UA concentration serves as early marker of carotid atherosclerosis in type 2 Diabetes mellitus patients.

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