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Correlation of Serum Uric Acid and Urine Uric Acid in Patients with Type 2 Diabetes Mellitus and Hypertension

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ABSTRACT

Aims and objectives: To estimate the proportion of Hyperuricemia in patients with type 2 Diabetes Mellitus and Hypertension patients and to assess the correlation of serum uric acid and urine uric acid.
To assess the relationship between Urine Uric acid/ Creatinine ratio and subclinical Renal damage among these patients.
Materials and methodology: This cross-sectional study was conducted in Sri Manakula Vinayagar Medical College and Hospital Puducherry during a period of 6 months. Adults more than or equal to 18 years of age with Type 2 Diabetes Mellitus and Hypertension were included and a total of 56 patients were recruited. Patients were randomly included based on the inclusion and exclusion criteria
Results: Patients with Subclinical Renal damage were categorized and constitutes around 53.7%. Odds ratios on comparing the duration of Diabetes and Hypertension, shows inverse correlation with eGFR of both SRD and non-SRD patients (0.469,0.449 respectively) and with Urine Uric acid/ Creatinine ratio was found to have positive correlation (0.108 and 0.085). On comparing eGFR and Urine Uric acid/ Creatinine ratio of SRD and non-SRD patients, it showed positive correlation with value of 0.336.
Conclusion: Lower eGFR was associated with higher levels of Serum Uric Acid and Fractional excretion of uric acid (FEUA), but lower uUA/Cr levels. Thus this study suggests that urinary Uric Acid excretion was significantly associated with the risk of Subclinical Renal Damage and Urinary Uric acid can be used as a simple, noninvasive marker for early detection of decreased renal function in otherwise healthy subjects.

Key Words: Subclinical Renal Damage, Urinary Uric Acid, Fractional Excretion of Uric Acid

INTRODUCTION

Uric acid (UA) is the final oxidation product of purine catabolism in humans. Uric Acid is transported in the proximal tubule by secretory and reabsorbing transporters, and its handling is a useful marker of proximal tubular function. For decades, it has been hypothesized that the antioxidant properties of UA might be protective against oxidative stress, oxidative cell injury and ageing.[1] Hyperuricemia also confers increased risk for cardiovascular mortality, especially in women.[6] Several studies have found that an elevated UA level is an independent risk factor for cardiovascular disease after controlling the contribution of established risk factors by multivariate analyses. The lack of a mechanism by which UA can cause cardiovascular disease, coupled with the inconclusive clinical and epidemiological data, has left the issue unresolved.[6] Assessment of subclinical (or asymptomatic) target organ damage is a key

element in the evaluation of patients with arterial hypertension. Subclinical organ damage at cardiac, vascular, and renal levels often precedes and predicts the development of morbid events. It has been shown that a systematic in-depth search for multiple risk factors or organ damage significantly increases the likelihood of identifying high-risk individuals. Subclinical kidney damage is defined by the detection of eGFR between 30 mL/min/1.73m^2 and 60mL/min/1.73 m^2 or the presence of microalbuminuria (MAU), that is an amount of albumin in the urine of 30-300 mg/day or an albumin/creatinine ratio, preferentially on morning spot urine, of 30-300 mg/g.[1] In this study, the association of Serum uric acid and Urine uric acid with Subclinical renal damage in patients with both Systemic Hypertension and Type 2 Diabetes Mellitus and correlation of Urine Uric acid/ Creatinine ratio was done.

MATERIALS & METHODS

This cross-sectional study was conducted in Sri Manakula Vinayagar Medical College and Hospital, Puducherry during a period of 6 months. A total of 56 patients were included. All consecutive patients presenting to the General Medicine Outpatient Clinics, and those who got admitted under General medicine Department meeting the inclusion criteria were recruited in the study after getting written informed consent from the participants and Institutional ethical committee approval. Inclusion criteria: Adults more than or equal to 18 years of age with Type 2 Diabetes Mellitus and Hypertension [Type 2 Diabetes Mellitus: FBS >126 mg/dl or RBS >200 mg/dl or HbA1C > 6.5% Hypertension: Systolic Blood pressure ranging 140 – 159 mm Hg and above, Diastolic Blood pressure of 90 – 99 mmHg and above]. Exclusion criteria: Type 1 Diabetes Mellitus, Pregnancy and Lactating mothers, Patients with Major organ system involvement/ End organ damage including Chronic Kidney disease, H/o Drug Intake (which are known to increase serum uric acid like levodopa, diuretics, nicotinic acid), H/o Familial Hyperuricemia, Alcohol intake. The following parameters were studied which includes demographic data, brief history, anthropometric measurements, Blood pressure, Fasting Blood glucose, post prandial Blood glucose, HbA1c.2 ml of venous blood is drawn from the patient and 5 ml of urine sample will be obtained from the patient. In those who met the inclusion criteria , correlation of Serum uric acid and Urine uric acid levels were estimated and ratio of Urine uric acid and Spot Urine Creatinine levels were calculated and correlated with Subclinical Renal Damage.

STATISTICAL METHODS

Data were entered and analysis were done using STATA Software. Data are expressed as the means±standard deviations for normally distributed values, as geometric mean for non-normally distributed values, and as percentages. The differences between the groups were calculated using the $\chi 2$ - test, Student's t-test as appropriate. We performed logistic regression analyses to test associations of SRD with UA in serum and urine (cross-sectional analyses). The dependent variables were the risk of SRD while the potential confounders were age, gender, hypertension, diabetes, BMI). Statistical significance is set as a 2-sides P value of <0.001.

RESULTS

A total of 56 patients were enrolled in this study. The baseline demographic and risk characteristics of the patients are shown in Table 1. Mean age of the study population is around 57.96 years. Out of 56 patients, Female patients were more than male, constituting 61.8%. In this study population, the average duration of Type 2 Diabetes Mellitus and Systemic Hypertension were 8 years and 10.5 years respectively.

Table 1: Demographic details

CHARACTERISTICS	
AGE (YEARS)	57.96 (30-85)
GENDER (FEMALE)	34 (61.8 %)
DIABETES MELLITUS (YEARS)	8 (5-19)
HYPERTENSION (YEARS)	10.5 (7-18)
BMI (Kg/m2)	22.2 (19.6-26.4)
eGFR(ml/min/1.72m2)	60 (57-80.5)

Table 2 shows biochemical test values of the study population. Average serum Uric acid levels is 5.3mg/dl, urine uric acid(mg/dl) is 28.6mg/dl , FEUA is 12.32 , uUA/Cr ratio is 0.45

Table 2: Biochemical parameters

BIOCHEMICAL TESTS	MEAN
SERUM URIC ACID (mg/dl)	5.3 (3.5-6.45)
URINE URIC ACID(mg/dl)	28.6 (17.15-41.15)
FEUA	12.32 (9.55-19.24)
uUA/Cr ratio	0.45 (0.345-0.610)

Figure 1 shows scattered plot diagram showing correlating eGFR and duration of Hypertension. It was found that eGFR is inversely proportional to the duration of hypertension.

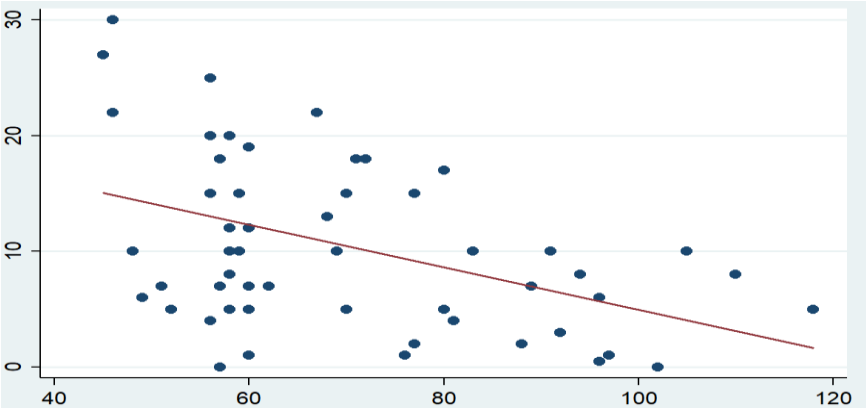

Figure 1: X axis showing eGFR with Y axis showing Hypertension (years).

Figure 2 shows scattered plot diagram showing correlating eGFR and duration of Diabetes. It was found that eGFR is in negative correlation with the duration of Type 2 Diabetes Mellitus.

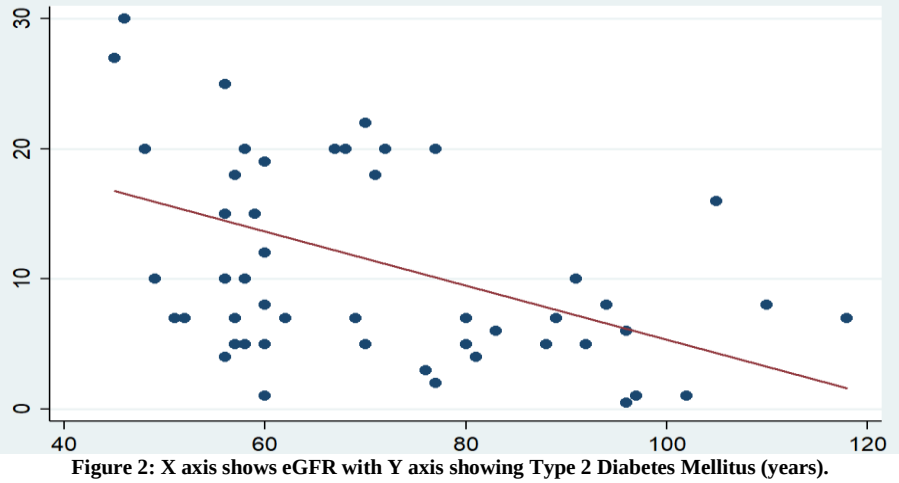

Figure 2: X axis shows eGFR with Y axis showing Type 2 Diabetes Mellitus (years).

Table 3 shows association between various characteristics of patients and presence of Subclinical Renal Damage. The statistical significance with p value of <0.001 is seen for Age, Serum uric acid levels, Fractional excretion of Uric acid and Urine uric acid/ Creatinine ratio.

Table 3: Association between various characteristics and presence of Subclinical Renal Damage (n=56)

CHARACTERISTICS	ODDS RATIO (CONFIDENCE INTERVAL)	P VALUE
AGE (YEARS)	0.904 (0.855-0.955)	<0.001
GENDER (MALE)	1.125 (0.384-3.290)	0.830
DIABETES MELLITUS (YEARS)	0.908 (0.840-0.981)	0.015
HYPERTENSION (YEARS)	0.911 (0.839-0.990)	0.028
BMI (Kg/m2)	0.957 (0.809-1.131)	0.608
SERUM URIC ACID (mg/dl)	0.093 (0.027-0.319)	<0.001
FEUA	0.713(0.595-0.856)	<0.001
uUA/Cr ratio	1.974 (1.243 – 2.864)	<0.001

DISCUSSION

In this study, among 56 patients, Female patients are more compared to Male patients of around 60.7%. Patients with Subclinical Renal damage were categorized and constitutes around 53.7%. Odds ratio comparison of Patients with Subclinical Renal damage with that of patients without Subclinical Renal damage through logistic regression analysis was done. Odds ratio with regression analysis on comparing duration of Diabetes and Hypertension, shows inverse correlation with eGFR of both SRD and non-SRD patients (0.469 and 0.449 respectively). Odd's ratio on comparing duration of Diabetes and Hypertension with Urine Uric acid/ Creatinine ratio was found to have positive correlation (0.108 and 0.085). On comparing eGFR and Urine Uric acid/ Creatinine ratio of SRD and non-SRD patients, it showed positive correlation with value of 0.336.

CONCLUSION

Lower eGFR was associated with higher levels of Serum Uric Acid and Fractional excretion of uric acid (FEUA), but lower uUA/Cr levels in these patients. This study suggests that urinary Uric Acid excretion was significantly associated with the risk of Subclinical Renal Damage. Thus, Urinary Uric acid may be used as a simple, noninvasive marker for early detection of decreased renal function in otherwise healthy subjects. Limitation of this study includes: Small sample size and small number of patients with Subclinical Renal damage, and needs follow-up to assess for progression of Subclinical Renal Damage.

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Conflict of Interest: None

Source of Funding: None

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