THE STUDY ON ASSOCIATION BETWEEN URIC ACID AND ALBUMINURIA IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

General Medicine

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ABSTRACT

Introduction: Diabetes Mellitus (DM) is a metabolic disorder characterized by the presence of chronic hyperglycemia accompanied by greater or lesser impairment in the metabolism of carbohydrates, lipids and proteins resulting from defects in insulin secretion, action or both. **Aims & objectives:** The aim of this study is to evaluate the association between serum uric acid & urinary Albumin to Creatinine Ratio (ACR) among patients with type 2 diabetes mellitus. **Material and Methods:** 83 patients aged between 40 to 80 years was selected from Medicine OPD and indoor wards, Department of General Medicine, KPC Medical College & Hospital, West Bengal from 1 August 2019 to 1 August 2020. Type 2 Diabetes Mellitus (T2DM) patients, Age: between 40 to 80 years. Age, Body weight, Height, BMI, serum uric acid, urinary albumin to creatinine ratio (ACR), Fasting Blood Glucose (FBG), HbA1C, lipid profile, serum creatinine. **Conclusion:** Present study found that positive correlation between serum uric acid with DBP, FBS, HbA1C, Serum Creatinine, TG and LDL. There was negative correlation between serum uric acid with GFR and HDL, which were statistically significant.

KEYWORDS

Uric acid, albuminuria and diabetes mellitus.

INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder characterized by the presence of chronic hyperglycemia accompanied by greater or lesser impairment in the metabolism of carbohydrates, lipids and proteins resulting from defects in insulin secretion, action or both.¹

The metabolic changes associated with diabetes mellitus leads to pathological changes in multi organ system which are responsible for micro and macro vascular complication among micro vascular complication kidney is most frequently affected organ in united state diabetes mellitus the leading cause of end stage renal disease ,scattering like silent epidemic in India and other developing countries.²

As per International Diabetes Federation (IDF) atlas 4th edition, the US accounts for 52.7% of the total diabetes spending worldwide, whereas, India, which has largest diabetes population, spends 1% of the global total. According to World Health Organization, 69.2 million (8.7%) of the global population remain undiagnosed for type 2 diabetes mellitus in 2015.³

More than 80% of the total diabetes spending is in the developed economies, while over 70% of people with diabetes live in developing nations. It has reduced quality of life and reduces life expectancy and it has set massive economic weight on patients families and government exchequer. with untreated diabetic nephropathy, a significant decrease in life expectancy of patients happens; therefore, prevention of this debilitating condition by early diagnosis and treatment is important. In the wake of current epidemics of diabetes mellitus, the prevalence diabetic nephropathy and end stage renal disease is supposed to rise.⁴

Natural history of diabetic nephropathy includes glomerular sclerosis, intra glomerular hypertension, hyperfiltration, intermittent microalbuminuria and finally frank proteinuria. If microalbuminuria stage remains unchanged and uncontrolled it result in end stage renal disease. Microalbuminuria means significant increase in albumin excretion rate, it is defined as 30- 300 mg albumin in 24 hr urine collection or 30-300 ug albumin/mg creatinine in a spot collection method. Microalbuminuria is the first manifestation of injury to glomerular filtration barrier and predict the development of overt nephropathy. One factor that has been associated with renal disease is serum uric acid. Emerging evidence that hyperuricemia is an independent risk factor for development of chronic kidney disease through endothelial damage.⁵

The aim of this study is to evaluate the association between serum uric acid & urinary Albumin to Creatinine Ratio (ACR) among patients with type 2 diabetes mellitus.

MATERIALS AND METHODS:

83 patients aged between 40 to 80 years was selected from Medicine OPD and indoor wards, Department of General Medicine, KPC Medical College & Hospital, West Bengal from 1 August 2019 to 1 August 2020.

STUDY VARIABLE:

Age, Body weight, Height, BMI, serum uric acid, urinary albumin to creatinine ratio (ACR), Fasting Blood Glucose (FBG), HbA1C, lipid profile, serum creatinine.

INCLUSION CRITERIA:

- Type 2 Diabetes Mellitus (T2DM) patients,
- Age: between 40 to 80 years.

EXCLUSION CRITERIA:

- Patients on uric acid lowering agents.
- Patients using diuretics or any other medication that influences serum uric acid level.
- Patients on angiotensin converting enzyme (ACE) inhibitor or Angiotensin Receptor Blocker (ARB)
- Alcoholic
- Acute illness
- UTI
- Patients with malignancy
- Glomerular Filtration Rate (GFR) < 60 ml / min

Study design: Observational, prospective and descriptive study

Study group: 83 Patients

Statistical Method

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 24.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5. Paired t-tests were a form of blocking and had greater power than unpaired tests. Unpaired proportions were compared by Chi-square test or Fischer's exact test, as appropriate. Correlation was calculated by Pearson correlation analysis. The Pearson product-moment correlation coefficient was a measure of the linear dependence between two variables X and Y. p-value ≤ 0.05 was considered for statistically significant.

RESULT AND DISCUSSION

This study was hospital based observational and prospective study to find out relationship between serum uric acid level & albuminuria in type 2 Diabetes Mellitus patients.

83 patients aged between 40 to 80 years was selected from Medicine OPD and indoor wards, Department of General Medicine, KPC Medical College & Hospital, West Bengal from 1 August 2019 to 1 August 2020.

Latif H et al⁹ (2017) found that 29%(n=58) were between 16-40 years of age while 71%(n=142) were between 41-65 years of age, Mean $\pm$ SD was calculated as 48.1 $\pm$ 10.26 years, 48.5%(n=97) were male and 51.5%(n=103) were females.

We found that 26(31.3%) patients had $\leq$ 50 years of age, 23(27.7%) patients had 51-60 years of age, 25(30.1%) patients had 61-70 years of age and 9(10.8%) patients had 71-80 years of age. The mean age (mean $\pm$ s.d.) of the patients was 57.0000 $\pm$ 9.7505 years. 37(44.6%) patients had female and 46(55.4%) patients had male. Male: Female ratio was 1.243:1.

Vijay et al have reported age to be associated with proteinuria.¹⁰ Present study found that in Normoalbuminuria, the mean age (mean $\pm$ s.d.) of the patients was 56.2683 $\pm$ 8.7893 years. In Microalbuminuria, the mean age (mean $\pm$ s.d.) of the patients was 54.6154 $\pm$ 10.2492 years. In Macroalbuminuria, the mean age (mean $\pm$ s.d.) of the patients was 62.7500 $\pm$ 9.5951 years. Distribution of mean age vs. albuminuria was statistically significant (p=0.0234).

In Normoalbuminuria, 18(43.9%) patients had female and 23(56.1%) patients had male. In Microalbuminuria, 12(46.2%) patients had female and 14(53.8%) patients had male. In Macroalbuminuria, 7(43.8%) patients had female and 9(56.3%) patients had male. Association of sex vs. Albuminuria was not statistically significant (p=0.9811).

Behradmanesh S et al¹¹ (2013) found that mean of serum creatinine was 0.98 $\pm$ 0.028 mg/dL, mean of serum uric acid was 4.5 $\pm$ 0.15 mg/dL.

It was found that the mean BMI (mean $\pm$ s.d.) of the patients was 24.9668 $\pm$ 2.0646 kg/m². The mean SBP (mean $\pm$ s.d.) of the patients was 129.3253 $\pm$ 13.1159 mmHg. The mean DBP (mean $\pm$ s.d.) of the patients was 79.0361 $\pm$ 5.5468 mmHg. The mean FBS (mean $\pm$ s.d.) of the patients was 155.5060 $\pm$ 55.1354 mg/dL. The mean HbA1C (mean $\pm$ s.d.) of the patients was 6.8506 $\pm$ 1.2471%. The mean serum creatinine (mean $\pm$ s.d.) of the patients was .8639 $\pm$.2196 mg/dL. The mean GFR (mean $\pm$ s.d.) of the patients was 80.9734 $\pm$ 14.4233. The mean urinary ACR (mean $\pm$ s.d.) of the patients was 140.2501 $\pm$ 173.1238. The mean serum uric acid (mean $\pm$ s.d.) of the patients was 5.7855 $\pm$ 1.6571 mg/dL. The mean TG (mean $\pm$ s.d.) of the patients was 129.1325 $\pm$ 28.4728 mg/dL. The mean LDL (mean $\pm$ s.d.) of the patients was 125.7590 $\pm$ 23.3178 mg/dL. The mean HDL (mean $\pm$ s.d.) of the patients was 46.8072 $\pm$ 5.9847 mg/dL.

32(38.6%) patients were taking anti hypertensive therapy except angiotensin converting enzyme (ACE) inhibitor or angiotensin Receptor Blocker and 72(86.7%) patients were already taking anti diabetic treatment.

Gul CB et al¹² (2015) found that normoalbuminuria in 163 (73.0%) subjects, microalbuminuria in 45 (20.18%) subjects, and macroalbuminuria in 15 (6.72) patients.

We found that 41(49.4%) patients had Normoalbuminuria, 26(31.3%) patients had Microalbuminuria and 16(19.3%) patients had Macroalbuminuria. 37(44.6%) patients had Hyperuricemia and 46(55.4%) patients had Normouricemia. 25(30.1%) patients had ALT. We showed that in Normoalbuminuria, 39(95.1%) patients had anti diabetic treatment. In Microalbuminuria, 19(73.1%) patients had anti diabetic treatment. In Macroalbuminuria, 14(87.5%) patients had anti diabetic treatment. Anti diabetic treatment was significantly associated with deceased incidence of albuminuria (p=0.0345).

Vijay et al have reported systolic and diastolic BP and age to be associated with proteinuria.¹⁰

In study conducted by Verghese et al, age, diastolic blood pressure, HbA1C, and fasting plasma glucose were reported to be the risk factors.¹³

We showed that in Normoalbuminuria, the mean SBP (mean $\pm$ s.d.) of the patients was 126.6341 $\pm$ 10.9402 mmHg. In Microalbuminuria, the mean SBP (mean $\pm$ s.d.) of the patients was 132.3846 $\pm$ 15.0521 mmHg. In Macroalbuminuria, the mean SBP (mean $\pm$ s.d.) of the patients was 131.2500 $\pm$ 14.2712 mmHg. Distribution of mean SBP vs. albuminuria was not statistically significant (p=0.1760). In

Normoalbuminuria, the mean DBP (mean $\pm$ s.d.) of the patients was 77.8537 $\pm$ 4.9069 mmHg. In Microalbuminuria, the mean DBP (mean $\pm$ s.d.) of the patients was 79.0769 $\pm$ 5.5203 mmHg. In Macroalbuminuria, the mean DBP (mean $\pm$ s.d.) of the patients was 82.0000 $\pm$ 6.3246 mmHg. Distribution of mean DBP vs. albuminuria was statistically significant (p=0.0381).

Ansar MM et al¹⁴ (2017) found that Microalbuminuria was significantly associated with increased fasting plasma glucose, and diastolic blood pressure.

In Normoalbuminuria, the mean FBS (mean $\pm$ s.d.) of the patients was 111.9268 $\pm$ 18.5626 mg/dL. In Microalbuminuria, the mean FBS (mean $\pm$ s.d.) of the patients was 182.5769 $\pm$ 32.0252 mg/dL. In Macroalbuminuria, the mean FBS (mean $\pm$ s.d.) of the patients was 223.1875 $\pm$ 51.4059 mg/dL. Distribution of mean FBS vs. albuminuria was statistically significant (p<0.0001).

Kamińska J et al¹⁵ (2012) found that the highest albumin excretion in urine was reported with poor glycemic control, a slightly lower level of albuminuria was found in the group with good glycemic control, however the lowest level of albumin excretion was noticed in the control group.

We found that in Normoalbuminuria, the mean HbA1C (mean $\pm$ s.d.) of the patients was 5.9073 $\pm$.5331%. In Microalbuminuria, the mean HbA1C (mean $\pm$ s.d.) of the patients was 7.4385 $\pm$.7441%. In Macroalbuminuria, the mean HbA1C (mean $\pm$ s.d.) of the patients was 8.3125 $\pm$ 1.2290%. Poor control of HbA1C was significantly associated with albumin excretion in urine (p<0.0001).

Vijay et al have reported serum creatinine levels to be associated with proteinuria.¹⁰

We found that in Normoalbuminuria, the mean serum creatinine (mean $\pm$ s.d.) of the patients was .7539 $\pm$.1355 mg/dL. In Microalbuminuria, the mean serum creatinine (mean $\pm$ s.d.) of the patients was .9315 $\pm$.2431 mg/dL. In Macroalbuminuria, the mean serum creatinine (mean $\pm$ s.d.) of the patients was 1.0356 $\pm$.2091 mg/dL. Distribution of mean serum creatinine vs. albuminuria was statistically significant (p<0.0001). In Normoalbuminuria, the mean GFR (mean $\pm$ s.d.) of the patients was 90.0555 $\pm$ 12.1957. In Microalbuminuria, the mean GFR (mean $\pm$ s.d.) of the patients was 76.0523 $\pm$ 10.5706. In Macroalbuminuria, the mean GFR (mean $\pm$ s.d.) of the patients was 65.6975 $\pm$ 6.1688. Distribution of mean GFR vs. albuminuria was statistically significant (p<0.0001).

Latif H et al¹⁶ (2017) found that mean serum uric acid level was calculated as 6.99 $\pm$ 1.01 mg/dL while microalbuminuria was calculated as 5.63 $\pm$ 1.08 mg/dL. The results of our study concluded that level of serum uric acid and microalbuminuria are significantly correlated to nephropathy in patients having Type-2 diabetes mellitus.

We found that in Normoalbuminuria, the mean TG (mean $\pm$ s.d.) of the patients was 117.3171 $\pm$ 25.4661 mg/dL. In Microalbuminuria, the mean TG (mean $\pm$ s.d.) of the patients was 131.6538 $\pm$ 23.1187 mg/dL. In Macroalbuminuria, the mean TG (mean $\pm$ s.d.) of the patients was 155.3125 $\pm$ 26.2290 mg/dL. Distribution of mean TG vs. albuminuria was statistically significant (p<0.0001). In Normoalbuminuria, the mean LDL (mean $\pm$ s.d.) of the patients was 115.5366 $\pm$ 20.6919 mg/dL. In Microalbuminuria, the mean LDL (mean $\pm$ s.d.) of the patients was 127.1538 $\pm$ 21.3854 mg/dL. In Macroalbuminuria, the mean LDL (mean $\pm$ s.d.) of the patients was 149.6875 $\pm$ 12.9857 mg/dL. Distribution of mean LDL vs. albuminuria was statistically significant (p<0.0001). In Normoalbuminuria, the mean HDL (mean $\pm$ s.d.) of the patients was 48.0000 $\pm$ 5.4083 mg/dL. In Microalbuminuria, the mean HDL (mean $\pm$ s.d.) of the patients was 46.7308 $\pm$ 5.7727 mg/dL. In Macroalbuminuria, the mean HDL (mean $\pm$ s.d.) of the patients was 43.8750 $\pm$ 7.0131 mg/dL. Distribution of mean HDL vs. albuminuria was not statistically significant (p=0.0631).

Bonakdaran S et al¹⁷ (2011) found that there was a significant relationship between hyperuricemia and serum triglyceride, fasting blood glucose, hemoglobin A1c, glomerular filtration rate, and serum creatinine levels (P < .001). No significant correlation was found between hyperuricemia and cholesterol levels, age, and body mass index. Serum uric acid level correlated positively with urinary albumin-creatinine ratio (P = .04). They showed that higher serum uric acid concentrations were associated with a greater probability of albuminuria in patients with type 2 diabetes mellitus.

There was positive correlation between serum uric acid with DBP, FBS, HB1AC, Serum Creatinine, TG and LDL and those correlations were statistically significant. Positive correlation was found between age, BMI, SBP with serum uric acid but it was not statistically significant.

There was negative correlation between serum uric acid with GFR and HDL, which were statistically significant.

CONCLUSION

Prevalence of albuminuria was seen in patients with type 2 diabetes. Hypertension, raised HbA1C levels, high blood sugar levels and raised serum creatinine levels are the major risk factors. Hence early detection of high risk patients and the early initiation of renal and cardiovascular protective agents helps in reducing morbidity and mortality due to type 2 diabetes mellitus.

Albuminuria was associated with higher age, high DBP, Low GFR, High serum Uric acid which was statistically significant.

Lipid profile like high TG and high LDL was significantly associated with albuminuria.

There was positive correlation between urine ACR with serum uric acid, BMI, DBP, FBG, HB1AC, Serum Creatinine, TG and LDL.

The negative correlation was found between urine ACR with GFR and HDL, which were statistically significant.

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