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# EVALUATION OF URINARY MICROALBUMIN LEVELS IN TYPE 1 DIABETES MELLITUS PATIENTS IN ASSOCIATION WITH THE GLYCEMIC CONTROL

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**ABSTRACT**

**Aims:** To evaluate the urinary microalbumin levels in Type 1 Diabetes Mellitus in association with the glycemic control. **Methodology:** 100 subjects were enrolled (50 controls and 50 type 1 diabetic patients) with age and sex matched. 50 Type 1 diabetic patients were grouped into 3 based on their glycemic status. Venous blood and urine is collected for the estimation of the urinary microalbumin, serum creatinine, fasting blood glucose and HbA1c. **Results:** The present study received significant correlations between MA and HbA1c with their respective controls with p –value < 0.005. The difference of means between Group 2 and Group 3 is statistically significant, and between Group 1 and Group 3 is also statistically significant (p value <0.05). **Conclusion:** The present study stated that urinary microalbumin was found to be higher in type 1 DM. The raised MA levels are found to be associated with poor glycemic control in Type 1 diabetes mellitus.

## INTRODUCTION

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. Several pathogenic processes are involved in the development of diabetes.[1]

Diabetic nephropathy (DN) is a devastating late complication and affects ~40% of diabetic patients. Its earliest clinical sign is microalbuminuria (MA).[2] Microalbuminuria, an early indicator of diabetic nephropathy due to basement membrane damage has been associated with elevated serum uric acid levels. Serum uric acid level was also strongly associated with microalbuminuria and reduced glomerular filtration rate in renal diseases. Early indication of these parameters may help in early diagnosis and management of diabetic complications and may help in preventing further progression of the complications in Type 1 Diabetes mellitus.[3]

The presence of microalbuminuria is said to precede and predict overt diabetic nephropathy. Known risk factors for microalbuminuria in the young include poor long term glycemic control, duration of diabetes and possible correlation with serum levels of uric acid.[4] The role of urinary microalbumin in the development of diabetic nephropathy has not been established as yet. Hence, there is a need to study the significance of urinary microalbumin acid in Type 1 Diabetes mellitus, which also helps to know the relationship between glycemic control and microalbumin levels. Thus, the present study aimed to evaluate the urinary microalbumin levels in type 1 diabetes mellitus patients in association with the glycemic control.

## Methodology

100 patients were enrolled for the present study out of which 50 patients were controls and 50 patients had Type 1 Diabetes Mellitus. Patients with Type 1 Diabetes Mellitus were selected from the outpatient department at Owaisi hospital and research center (OHRC) and the associated Princess Esra Hospital (PEH), Hyderabad were included in the study.

**The exclusion criteria were:**

- Type 1 Diabetes Mellitus patients with established micro & macro vascular complications.
- Patients on drugs which alter serum uric acid levels.
- All conditions which increase/decrease serum uric acid levels.
- Hypertensive patients.
- Patients with chronic kidney disease (CKD).

The controls included age and sex matched healthy individuals that were usually those who accompanied the patients.

The 50 cases were further categorized into three groups on the basis of glycemic control as follows:
**Group 1** – Patients with HbA1c ≤7%.
**Group 2** – Patients with HbA1c 7 to 9%.
**Group 3** – Patients with HbA1c >9%.

The present study was conducted after the approval of the institutional review board of Deccan College of Medical Sciences and Allied hospitals. The patients were informed and explained about the study in the language they understood and a written consent was obtained.

**Specimen collection:** A total of about 5 ml plain venous blood sample after overnight fasting was collected in sterile vacutainers. The blood samples were centrifuged at 3000 rpm for 10 minutes and the non-hemolysed sera obtained was used to estimate the levels of serum creatinine. For HbA1C estimation 2 ml of EDTA blood sample was collected. 24 hour urine sample was collected in a sterile, clean and dry container, centrifuged and was tested immediately for the estimation of urinary microalbumin.

Glycosylated hemoglobin was estimated by immunoturbidimetric method, on Cobas c311 and Fasting blood glucose by Hexokinase method, on Cobas c 311 and Urinary Microalbumin was estimated by immunoturbidimetry method, on Microlab 300.

**Statistical analysis**: Data was subjected to descriptive statistical analysis using MS Excel 2016 and Windowstat version 9.2 from indostat services software. Values are expressed as mean ± standard deviation (SD), standard error of mean (SEM). ANOVA or analysis of variance was used to test the differences among the three groups of cases (1, 2 & 3),

followed by post hoc L.S.D ( Fishers least significant difference) comparison test to estimate the significance of difference between the groups.

## RESULTS

Out of the total 100 subjects studied, 47% were females and 53% were males. 23 were males and 27 were females in the control group. 30 were males and 20 females in cases. The controls and cases were age and sex matched as far as possible.

The mean age of cases was 19.24 ± 7.98years while that of controls was 20.74 ± 6.86 years. The mean FBS of cases was higher than the controls. The mean FBG of cases 187.7 ± 106.29mg/dl & that of controls was 81.34±13.08 mg/dl. The mean HbA1c of cases was 9.54±2.3 % and of controls was 4.69±0.53 %.The mean serum creatinine in cases was 0.95±0.18mg/dl & in controls was 0.64 ± 0.22mg/dl. The mean microalbuminuria of cases is 39.63 ± 32.98 mg/day & of controls is 15.13±2.98. (Table 1)

**Table 1: Comparative descriptive statistics of cases and controls**

| Variable | Cases | | Controls | | T-test | Probability |
|---|---|---|---|---|---|---|
| | Mean | Std. dev | Mean | Std. dev | | |
| **AGE years** | 19.24 | 7.98 | 20.74 | 6.86 | 1.00 | 0.316 |
| **FBG mg/dl** | 187.78 | 106.29 | 81.34 | 13.08 | 7.02 | 0.000*** |
| **HbA1c %** | 9.54 | 2.38 | 4.69 | 0.53 | 14.02 | 0.000*** |
| **S.cr mg/dl** | 0.95 | 0.18 | 0.64 | 0.22 | 7.400 | 0.000*** |
| **MA mg/d** | 39.63 | 32.98 | 15.13 | 2.98 | 5.23 | 0.000*** |

* is statistically significant (p-value < 0.05) .
** / *** is statistically highly significant (p-value <0.01)

**TABLE 2: Mean values of FBG, S.Cr & MA in group1, 2 & 3 and the respective F-value**

| | group1 | group2 | group3 | ANOVA (f-value) |
|---|---|---|---|---|
| FBG mg/dl | 108.25 | 156.9 | 248.9 | 0.00*** |
| S.cr mg/dl | 0.85 | 0.89 | 0.9 | 0.00*** |
| MA mg/day | 53.9 | 53.9 | 53.9 | 0.02* |

**Table 3: Microalbuminuria in relation to glycemic control**

| | MA (mg/d) | Std.Dev | Probability |
|---|---|---|---|
| **Group 1** | 18.94 | 7.31 | Group1 vs Group2. p-value >0.05 |
| **Group 2** | 33.17 | 23.97 | Group2 vs Group3* p-value < 0.05 |
| **Group 3** | 53.98 | 40.51 | Group1 vs Group3* p-value <0.05 |

The mean MA levels was found to be statistically significant among the groups and all the groups had similar levels. (Table 2) The mean urinary microalbumin of group 3 is the highest with a mean of 53.98 ±40.51 mg/day which is defined as microalbuminuria. The difference of means between Group 2 and Group 3 is statistically significant, and between Group 1 and Group 3 is also statistically significant (p value <0.05). (Table 3)

## DISCUSSION

Although the clinical course of diabetic nephropathy has been well described, its pathogenesis is not well understood.[5] Microalbuminuria in the present study was found to be above normal levels in cases while controls had normal levels. Nobukazu Ishizaka et al. and Golembiewska et al. had similar findings in their respective studies.[6]

Microalbuminuria is a well known early predictor of nephropathy. Several studies have shown the association of uric acid with microalbuminuria.[8, 9] Microalbuminuria was increased in overall cases and shows statistical significance of 1 percent. Serum uric acid levels were statistically significant at 5% level with microalbuminuria. Similar observations were made by Rosolowsky et al in which microalbuminuria was increased with high normal serum uric acid levels and decreased glomerular filtration rate indicating renal involvement.[3] A study led by Dandan Yan, MD, and Yinfang Tu, MD, of Shanghai Jiao Tong University also found that uric acid correlated positively with albuminuria and creatinine levels.[10]

Abundant evidence and guidelines have defined appropriate HbA1C levels, a marker of mean blood glucose levels, as a priority therapeutically. In previous studies, higher HbA1c levels has found to be been associated with CKD in patients with diabetes.[11] The results of the Diabetes Control and Complications Trial Research Group have confirmed that poor glycemic control is a major risk factor for the development of diabetic Microalbuminuria and nephropathy in insulin dependent diabetes mellitus nephropathy.[12] Microalbuminuria also was statistically significant at p-value <0.01 with poor glycemic control. Viswanathan et al got similar findings where the prevalence of MA increased with duration of diabetes and Peter Hovind et al. found that there were increased uric acids levels along with complications.[8]

## CONCLUSION

Within the limitations of the present study revealed that urinary microalbumin were found to be higher in type 1 DM. The raised MA levels are found to be associated with poor glycemic control in Type 1 diabetes mellitus. It can also be concluded that, raised HbA1c in monitoring Diabetes Mellitus raises an attention for complete evaluation of the renal functioning. Screening for microalbuminuria, to prevent renal impairment and measuring HbA1c level on a regular basis for good glycemic control are important in diabetic patients. Further study in non diabetic subjects with large sample size may be of clinical significance to clarify the role of MA in the development and progression of diabetic nephropathy.

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