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A Study of Micro-Albuminuria in Type 1 and Type 2 Diabetes Mellitus

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Abstract – Diabetes mellitus is the single most important metabolic disease which affects most of the organs in the body. It is the commonest endocrine disease found in general population. It is a syndrome (a collection of disorders in which hyperglycemia is the hall mark). Diabetes mellitus is characterized by hyperglycemia either due to a deficiency of insulin secretion or insulin resistance or a combination of both.

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INTRODUCTION

Type 1 Diabetes mellitus is an autoimmune disease in which pancreatic islet β cell destruction occurs by T lymphocytes reacting against poorly defined β- cell antigens. This form of Diabetes is characterized by severe lack of insulin. Type one Diabetes most commonly develops in childhood, progresses with age and symptoms develop at puberty.

Type 2 Diabetes mellitus is characterized by two metabolic defects which are as follows:

(i) Decreased ability of peripheral tissues to respond to insulin (insulin resistance)

(ii) β cell dysfunction which is manifested as inadequate insulin secretion in the face of insulin resistance and hyperglycemia.

In most cases insulin resistance is the primary event and is followed by increasing degrees of β cell dysfunction.

Currently, 19.4 million Indians are affected by this deadly disease.[1] According to the study in the Diabetes Indian Group, an overall prevalence of Diabetes mellitus was reported to be 4.3%, The prevalence in urban and rural areas was 5.6% and 2.7% respectively.[2]

Diabetes Mellitus is becoming a pandemic in times to come, more percentage being affected in urban area as compared to rural. The prevalence of diabetes for all age-groups worldwide was estimated to be 2.8% in 2000 and 4.4% in 2030. Around 80% of population is suffering with Diabetes above the age of 20 years in India. The percentage of adult population suffering from this disease in urban areas ranges between 10.9% and 14.2% and prevalence in rural India was 3.0-7.8% with a much higher prevalence among individuals with the age group of 50 years and above.[3]

Diabetes mellitus is also called as a disease of complications. Almost every organ of the body is directly or indirectly involved in this disease. The morbidity associated with long standing Diabetes of either type results from a number of serious complications involving both large and medium sized muscular arteries (macrovascular disease), as well as capillary dysfunction in target organs (microvascular disease). Macrovascular disease causes accelerated atherosclerosis among diabetics, resulting in increasing risk of myocardial infarction, stroke and lower extremity gangrene, whereas the effects of microvascular disease are most profound in the retina, kidneys and peripheral nerves resulting in diabetic retinopathy, nephropathy and neuropathy respectively.

Most of the available experimental and clinical evidence suggests that the complications of Diabetes mellitus are a consequence of the metabolic derangements in the patients suffering with mainly hyperglycemia for more than 10 years. Increased intracellular glucose will be converted to the glycosylated end products that crosslink proteins to promote glomerular dysfunction.[4]

Chronic renal disease is associated with long term diabetes mellitus (DM) and hypertension that leads to end-stage renal disease (ESRD). It has been found that around 20-30 % of population with both

types of Diabetes mellitus develop nephropathy, but in type two a considerably smaller fraction of these cases progress to end stage of renal disease. However, due to prevalent nature of type two Diabetes-mellitus, such patients constitute over half of those which convert to chronic kidney disease. Nearly 30% of chronic renal failure patients in India are due to diabetic nephropathy.[5]

Microalbuminuria is accepted as a CV risk marker for myocardial infarction and stroke, regardless of diabetes status. Although there is good evidence in those with type 2 diabetes that the presence of MA >100 mg/day is associated with higher CV events and greater likelihood of kidney disease development. Patients with long-standing, poorly controlled diabetes are more likely to have MA than those without diabetes[6,7]. Likewise, people with MA are at greater risk for developing hypertension, a risk factor known to increase CV risk.[8-10] The appearance of microalbuminuria in type 1 Diabetes mellitus is a very important predictor of progression to overt proteinuria (> 300 mg/day).

The present study was designed to study mean albumin creatinine ratio in patients of type one and type two diabetes mellitus and study the effect of long-term diabetes on the mean albumin creatinine ratio.

METHODOLOGY

The present study was conducted in the Department of Biochemistry, Santosh Medical College & Hospital, Ghaziabad, India. The subjects were identified cases of diabetes-mellitus from department of medicine, Santosh hospital, Ghaziabad.

Urinary albumin estimation and urinary creatinine estimation was done in 200 cases of Diabetes mellitus with a history of the disease for 10 years or more and 100 cases of normal healthy individuals.

The subjects were divided into three different groups.

Group- I: The Control Group

Urinary albumin estimation and urinary creatinine estimation was done in 100 normal healthy individuals of both sexes in the age group ranging from 20-50 years. This group comprised of 59 males and 41 females.

Group-II: Type one Diabetes Mellitus

Albumin creatinine ratio was estimated in 90 cases of type I Diabetes mellitus. The cases were selected as per inclusion criteria from Outpatient and inpatient department of Medicine, Santosh Medical College & Hospital, Ghaziabad.

This group was comprised of 47 males and 43 females.

Group-III: Type two Diabetes mellitus

Albumin creatinine ratio was estimated in 110 case of type 2 Diabetes mellitus. The cases were selected as per inclusion criteria from OPD and IPD, Department of Medicine, Santosh Medical College & Hospital, Ghaziabad.

This group was comprised of 62 males and 48 females.

Inclusion Criteria

i. chronic Diabetes mellitus for 10 years or more who are being treated for Diabetes.

ii. Normotensive subjects {BP-≤120/80mm of Hg}

iii. Age- 20-50 years.

Exclusion criteria

i. Cases having proteinuria detectable by dipstick tests.

ii. Cases having any evidence of infection.

Variables/Parameters:

1. Spot urinary albumin.

2. Spot urinary creatinine.

3. Fasting Plasma Glucose.

Collection of Urine Sample

Urine sample was collected in clean, sterile plastic container**.** Patients were told to take rest and not to do physical exercise before the collection of urine sample. Collected urine sample was tested by dipsticks for the presence of frank proteinuria. Dipstick negative urine samples, were used for quantitation of albumin and creatinine within 4 hours of voiding.

Collection of Blood Sample

Blood samples were collected after 12 hours of fasting after cleaning the antecubital fossa with all antiseptic precautions. Approximately 1 ml of venous blood was drawn by a dry and sterilized syringe, it was transferred to sodium fluoride vial and then mixed gently. Then it was centrifuged at 3000 rpm for 5 minutes. Plasma was pipetted out and kept in a clean sterile vial.

METHOD OF URINARY ALBUMIN ESTIMATION

Urinary albumin was estimated by immunoturbidimetric method. [Diasys Diagnostic system, Holzhein, Germany]

Urinary creatinine was estimated by Jaffe's Method (Modified).

STATISTICAL ANALYSIS

Data obtained during study were recorded in tabulated forms and were analyzed by student's t test.

The p-value is obtained from standard table value of t distribution based on degree of freedom and level of significance.

RESULTS:

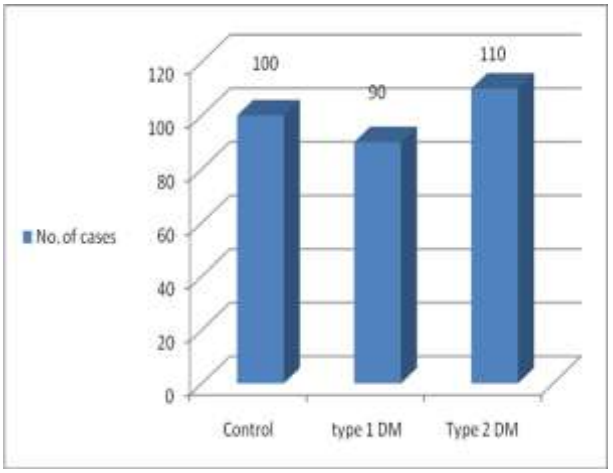

Figure- 1 Distribution of Cases

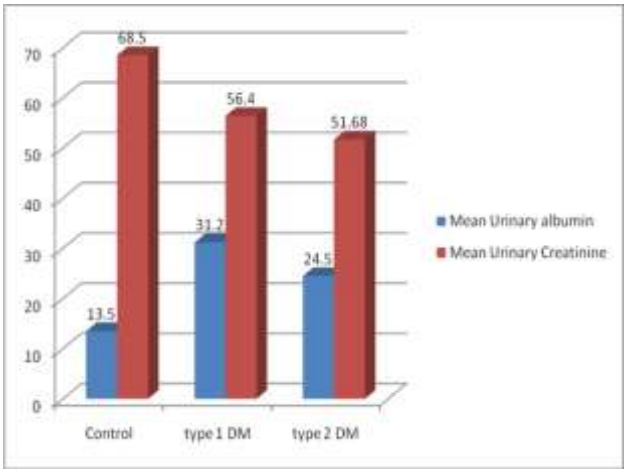

Figure –2 Mean values of Urinary Albumin and Urinary creatinine in healthy controls, type I and type 2 DM.

TABLE-III Number of cases, range, mean, standard deviation and standard error of mean values of albumin creatinine ratio in healthy controls in comparison to type 1 and type 2 Diabetes- Mellitus.

Group	No. of cases	Albumin Creatinine ratio in µg/mg of creatinine			
		Range	Mean	SD	S.E.M (±)
Control	100	8-29 (µg/mg of creatinine)	18.59	4.90	0.46
Type 1 Diabetes mellitus	90	19-162	54.27	36.9	3.89
Type 2 Diabetes mellitus	110	12-124 µg/mg of creatinine	47.36	29.61	4.54

S.D- Standard Deviation

S.E.M- Standard error of mean. (ACR= Albumin creatinine ratio)

TABLE-IV Numbers of cases, range, mean, standard deviation and standard error of mean values of fasting plasma glucose in healthy controls, in comparison with type 1 and type 2 diabetes mellitus cases.

Group	No. of cases	Fasting venous plasma glucose(mg/ dl)			
		Range (mg/dl)	Mean	SD	S.E.M (±)
Control	100	78-108	88.41	5.68	0.81
Type 1 Diabetes mellitus	90	80-190	115.11	30.82	3.25
Type 2 Diabetes mellitus	110	72-236	119.43	39.27	3.74

TABLE –V Mean values of Urinary Albumin and Urinary creatinine with respect to duration of diabetes in cases of type 1 DM.

S. No	type of cases	No of cases	Urinary Albumin (mg/l)	Urinary Creatinine (mg/dl)
1	Group I (10-14 yrs)	54	23.3	61.2
2	Group II (15-19 yrs)	24	39.9	53.8
3	Group III (≥ 20 yrs)	12	42.6	51.6

Table – VI Mean values of Urinary Albumin and Urinary creatinine with respect to duration of diabetes in cases of type 2 DM.

S. No.	Type of Cases	No of cases	Urinary Albumin (mg/l)	Urinary Creatinine (mg/dl)
1	Group I (10-14 yrs)	89	8.6	75.4
2	Group II (15-19 yrs)	13	31.2	47.3
3	Group III (≥ 20 yrs)	08	43.3	41.8

DISCUSSION AND CONCLUSION

Diabetes mellitus is a global problem. Presently 150 million people worldwide are affected by this disease. It has found that phenotype in Asia and India has an increased susceptibility to Diabetes mellitus.[11] As per WHO, the maximum cases of diabetes have been reported from South East Asian countries. [12] India comprises of around 85-90% of the adult population of South Asia and hence the major contributor of diabetic population in this area with around forty million diabetic patients with an increase of 20% in another decade. As adult diabetes is reflected in chronic kidney disease, India becomes the major contributor in CKD patient load also and has been described as the Diabetes capital of the world.[13] It has reported that nearly one third of chronic renal failures in India are due to diabetic nephropathy that has to be controlled.

As diabetes mellitus is associated with chronic CKD as well as increased morbidity and mortality, the present study was undertaken to know the effective role of a marker in patients for early detection of Diabetes mellitus Albumin/creatinine ratio was calculated by spot urinary estimation of both in randomly selected cases.

Earlier studies have also reported that estimation of albumin creatinine in random urine samples have highly significant correlation with results using 24-hour urine collection with a sensitivity of around 80% and specificity of 81%.[14]

Effect of Type of Diabetes Mellitus on Albumin Creatinine Ratio

Interestingly, in comparison to control group, spectrum of Diabetes mellitus including type I Diabetes mellitus and type II Diabetes mellitus there is marked increase in the albumin creatinine ratio and it is significant ($P<0.001$) for type I Diabetes mellitus and for type II Diabetes mellitus also ($P<0.001$) but in comparison between type I Diabetes mellitus and type II Diabetes mellitus, difference of mean the albumin-creatinine ratio is found to be statistically insignificant ($P>0.05$) clearly indicating that albumin creatinine ratio is not affected by type of Diabetes Mellitus in spite of the fact that in both the types around 43% cases were shown to have positive reports for microalbuminuria.

Hyperglycemia is the major factor initiating the changes in the kidney. The tissue damage caused by hyperglycemia can be attributed to the hemodynamic factor due to adversely affected filtration process, high blood pressure and together this can lead to cardiovascular disease.

Hyperglycemia increases the expression of transforming growth factor beta (TGFβ) in the glomeruli and of matrix proteins. TGFβ contributes to both cellular hypertrophy and enhanced collagen synthesis is seen in diabetic nephropathy.

It can be concluded that microalbuminuria can be used as an early marker in Diabetes nephropathy and its early detection can significantly reduce the progression of renal complications associated with Diabetes mellitus

BIBLIOGRAPHY

1. Ihle BU, Becker GJ, Whitworth JA, Charlwood RA (1989); The effect of protein restriction on the progression of renal insufficiency. N Eng L J Med; 321: pp. 1773-1777.
2. Sadikot SM, Nigam A, Das S, Bajaj S, Zargar AH, Prassannakumar KM (2004); The burden of Diabetes and impaired glucose in India using the WHO 1999 criteria: prevalence of Diabetes in India study (PODIS). Diabetes Res Clin Pract; 66; pp. 301-7.
3. Watts GF, Shaw KM, Polak A (1986). The use of random urine samples to screen for microalbuminuria in the diabetic clinic. Practical DM; 3: pp. 86-88.
4. Hamid Nasri and Mahmoud Rafieian-Kopaei (2015); Diabetes mellitus and renal failure: Prevention and management, J Res Med Sci.; 20(11): pp. 1112–1120.
5. Agarwal SK, Dash SC (2000); Spectrum of Renal Disease in Indian Adults, JAPI; 48, pp. 594-600.
6. EL Nahas AM, Masters (1984); Thomas A, Brady SA; The effect of low protein diets in chronic renal diseases. Br Med J; 289: pp. 1337-134.
7. Fabre J, Balant LP, Dayer PG, Fox HM, Vernet AT (1982); The kidney in maturity onset Diabetes mellitus: a clinical study of 510 patients. Kidney Int; 21(5): pp. 730-8.
8. Mogensen CE (1984). Microalbuminuria predicts clinical proteinuria and early mortality in maturity-onset diabetes. N. Engl. J. Med.; 310: pp. 356–360pmid:6690964
9. White KE, Bilous RW, Marshall SM (2002); Podocyte number in normotensive type 1 diabetic patients with albuminuria. Diabetes; 51: pp. 3083-9.
10. Williamison JR, Rowold E, Chang K, Marvel J, Tomlinson M, Sherman WR

(1986). Sex stereid dependency of Diabetes-induced changes in polyol metabolism, vascular permeability and collagen cross-linking. Diabetes; 35: pp. 20-7.

11. Joshi SR (2003). Metabolic syndrome-emerging clusters of the Indian Phenotype, Assoc Physicians India; 51: pp. 445-6.

12. Vijay V, Snehalatha C, Shina K, Lalitha S, Ramachandran A (1999); Familiar aggregration of diabetic kidney disease in type 2 Diabetes in South India. Diabetes Research and Clinical Practice; 43: pp. 167-171.

13. Vijay Viswanthan, Yanqing Zhu, Karthik Bala, Stephen Dunn, Chamukutan Snehlatha, Ambady Ramachandran, Muthu Jayaraman, Kumar Sharma (2001); Association between ACE gene polymorphism and diabetic nephropathy in South Indian Patients. JOP. J Pancreas (online);2(2): pp. 83-87.

14. Gatling W, Knight C; Mullee MA, Hill RD (1988); Microalbuminuria in Diabetes: a population study of the prevalence and an assessment of three screening tests. Diabete Med; 5: pp. 343-347.

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