Section: Surgery

Original Research Article

ASSESSMENT AMONG TYPE 2 DIABETES MELLITUS RELATIONSHIP WITH ALBUMINURIA

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Abstract

Background: Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia. Factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production. The term microalbuminuria is defined by a urinary albumin excretion (UAE) rate higher than normal but lower than 200 µg/min, the lowest detection limit of proteinuria as measured by standard laboratory methods in the absence of urinary tract infection and acute illness including myocardial infarction.[9] Albumin excretion in healthy individuals ranges from 1.5–20 µg/ min. **Materials and Methods:** This is a Hospital Based, cross-sectional study was conducted in the Department of General Medicine SCB Medical College, Cuttack. Patients aged between 40 to 80 years coming to the General Medicine OPD or INDOOR Department in SCB Medical College, Cuttack were selected for study. Age, Body weight, Height, BMI, serum uric acid, urinary albumin to creatine ratio (ACR), Fasting Blood Glucose (FBG), HbA1C, lipid profile, serum creatinine. Total number of cases were 100 (hundred) including both male and female and evaluated to calculate a correlation coefficient between albuminuria as measured by urinary ACR level. **Results:** Microalbuminuria & Macroalbuminuria related positively with mean of FBG, HbA1C, serum Creatinine & serum Uric Acid and related negatively with mean eGFR. Mean urinary ACR in Normoalbuminuria, Microalbuminuria & Macroalbuminuria are 22.28±4.09, 134.79±70.65 and 469.83±120.14 respectively. In people with Hyperuricemia 50%(n=22) have microalbuminuria ; 36.4%(n=16) have macroalbuminuria & 13.6%(n=6) have normoalbuminuria. In people with Normouricemia, 17.9% (n=10) have microalbuminuria; 5.4%(n=3) have macroalbuminuria & 76.8%(n=43) have normoalbuminuria. **Conclusion:** Urinary ACR correlated positively with FBG, HbA1C, serum creatinine, LDL & Triglycerides in patients with T2DM. No significant correlation found between urinary ACR and Age, Sex, Weight, Height, BMI, Hypertension & HDL.

INTRODUCTION

Diabetes mellitus (DM) is a group of metabolic diseases characterized by hyperglycemia. Factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production.[1] DM is associated with abnormalities in carbohydrates, fats and protein metabolism. Classic symptoms of DM include polyuria, polydipsia, and weight loss.[2] The metabolic dysregulation associated with DM causes secondary pathophysiologic changes in multiple organ systems. In the United States, DM is the leading cause of end-stage renal disease (ESRD)1, nontraumatic lower extremity amputations, and adult blindness.[3]

Acute complications of diabetes are diabetic ketoacidosis (DKA) and hyperglycemic hyperosmolar state (HHS).[4] Chronic complications can be divided into vascular and nonvascular complications. The vascular complications of DM are further subdivided into microvascular (retinopathy, neuropathy and nephropathy) and macrovascular complications [coronary heart

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disease (CHD), peripheral arterial disease (PAD), cerebrovascular disease]. Nonvascular complications include problems such as gastroparesis, infections, skin changes, cataracts, glaucoma, disease and hearing loss.[5]

Classification of diabetes mellitus is done on the basis of the pathogenic process that leads to hyperglycemia. Type 1 DM and Type 2 DM are two broad categories. Both types of diabetes are preceded by a phase of abnormal glucose homeostasis as the pathogenic processes progress.[6] Type 1 DM is the result of complete or near-total insulin deficiency. Type 2 DM is a heterogeneous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion, and increased glucose production.[7] Type 2 DM is preceded by a period of abnormal glucose homeostasis classified as impaired fasting glucose (IFG) or impaired glucose tolerance (IGT).[8]

The term microalbuminuria is defined by a urinary albumin excretion (UAE) rate higher than normal but lower than 200 µg/min, the lowest detection limit of proteinuria as measured by standard laboratory methods in the absence of urinary tract infection and acute illness including myocardial infarction.[9] Albumin excretion in healthy individuals ranges from 1.5–20 µg/ min.[10] The presence of microalbuminuria precedes the development of overt diabetic nephropathy by 10–14 years. It is at this stage that one can hope to reverse diabetic nephropathy or prevent its progression.[11] Therapeutic interventions which reverse microalbuminuria include intensified glycemic control, use of ACE inhibitors, etc. A diagnosis of microalbuminuria can be made by measuring its excretion rate during 24 hours or in an overnight urine collection, or by measuring albumin/creatinine ratio or albumin concentration in the morning or a random urine sample.[12] Determination of UAE in the morning urine sample constitutes the ideal test for screening, and overnight urine collection might be the best choice for monitoring microalbuminuria.[13]

MATERIALS AND METHODS

This is a Hospital Based, cross-sectional study was conducted in the Department of General Medicine SCB Medical College, Cuttack

Case Selection

Patients aged between 40 to 80 years coming to the General Medicine OPD or INDOOR Department in SCB Medical College, Cuttack were selected for study.

Study Variable

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

Inclusion Criteria

Patient who provided the consent
Type 2 Diabetics 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 influnces 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

Sample Size

Total number of cases were 100 (hundred) including both male and female and evaluated to calculate a correlation coefficient between albuminuria as measured by urinary ACR & serum uric acid level.

Control

Not required

Method of Data Collection

Interview / history taking Physical examination, Laboratory examination, Record analysis.

Laboratory Investigations

Complete blood count, Serum uric acid, Urine RE/ ME & C/S,
Urinary Albumin to Creatinine Ratio (ACR), Fasting Blood Glucose (FBG),
HbA1C,
Lipid profile,
Serum Urea & Creatinine, USG whole abdomen,
ECG in all leads

Statistical Analysis

Statistical analysis was done by standard methodology & appropriate statistical tests.

Categorical variables were expressed as Number of patients and percentage of patients and compared across the groups using Pearson's Chi Square test for Independence of Attributes. Continuous variables were expressed as Mean ± Standard Deviation and compared across the groups using one Way ANOVA test.

Correlation coefficient has been calculated to understand the degree of linear dependency among the continuous variables and test for significance have been performed.

Regression analysis was performed with Urinary ACR as the dependent variable and Serum Uric acid as the independent variable. ROC Curve was generated for different levels Serum Uric Acid in calculating Sensitivity and Specificity for Albuminuria for all patients as well as separately for Male and Female.

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RESULTS

Table 1: Sex distribution of study population in different albuminuria groups

	Albuminuria				
Sex	Normo Albuminuria	Micro + Macro Albuminuria	Total	P Value	Significance
FEMALE	24(49)	29(56.9)	53(53)	0.430	Not Significant
MALE	25(51)	22(43.1)	47(47)		
	49(100)	51(100)	100(100)		

In patients with normoalbuminuria 49%(n=24) are female & 51%(n=25) are male.
In patients with albuminuria (micro + macro) 56.9%(n=29) are female & 43.1% are male.

Table 2: Distribution of mean Age, Weight, Height & BMI among different Albuminuria groups in study population

	Albuminuria			
	Normo Albuminuria	Micro + MacroAlbuminuria		
	Mean ± Std. Deviation	Mean ± Std. Deviation	P Value	Significance
Age	56.35 ± 8.65	56.8 ± 10.94	0.818	Not Significant
Weight	62.96 ± 7.17	64.2 ± 7.45	0.400	Not Significant
Height	157.61 ± 7.25	159.43 ± 7.2	0.211	Not Significant
BMI	25.33 ± 2.16	25.23 ± 2.16	0.820	Not Significant

significant relationship found between Albuminuria with mean age, weight, height & BMI in study population.

Table 3: The BMI of study population is divided into three group(<25, >25to<30, >30)

	Albuminuria					
BMI	Normo Albuminuria	Micro Albuminuria	Macro Albuminuria	Total	P Value	Significance
<25	21(42.9)	17(53.1)	7(36.8)	45(45)	0.372	Not Significant
>25 to <30	26(53.1)	15(46.9)	10(52.6)	51(51)		
>30	2(4.1)	0(0)	2(10.5)	4(4)		
Total	49(100)	32(100)	19(100)	100(100)		

There is no significant relation found between Albuminuria and different BMI groups in study population.

Table 4: Relation of Hypertension with different albuminuria groups in study population: Not significant

	Albuminuria					
	Normo Albuminuria	Micro Albuminuria	Macro Albuminuria	Total	P Value	Significance
ypertensive	20(40.8)	14(43.8)	12(63.2)	46(46)	0.241	Not Significant
rmotensive	29(59.2)	18(56.2)	7(36.8)	54(54)		
Total	49(100)	32(100)	19(100)	100(100)		

Table 5: Relation of HbA1C with Albuminuria in study population

	Albuminuria				
HbA1C	Normo Albuminuria	Micro + Macro Albuminuria	Total	P Value	Significance
<7%	48(98)	10(19.6)	58(58)	<0.001	Significant
≥7%	1(2)	41(80.4)	42(42)		
Total	49(100)	51(100)	100(100)		

People with Normo albuminuria have higher proportion of patients with HbA1C < 7%. People with Albuminuria (Micro+Macro) have higher proportion of patients with HbA1C>=7%.

Table 6: Distribution of mean Triglycerides (TG), LDL & HDL in relation to different groups of Albuminuria in study population

	Albuminuria				
	Normo Albuminuria	Micro Albuminuria	Macro Albuminuria		

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	Mean ± Std. Deviation	Mean ± Std.Deviation	Mean ± Std.Deviation	P Value	Significance
TG	119.57 ± 25.33	127.62 ± 24.49	154.68 ± 24.69	<0.001	Significant
LDL	121.8 ± 22.45	127.97 ± 22.37	151.05 ± 13.58	<0.001	Significant
HDL	47.43 ± 5.88	48.22 ± 5.39	45 ± 6.51	0.160	Not Significant

Albuminuria correlated positively with increased level of TG & LDL but no such relation seen with HDL.

Table 7: Distribution of mean FBG, HbA1C, serum Creatinine, GFR, Urinary ACR & serum Uric Acid among different Albuminuria groups in study population

	Albuminuria				
	Normo Albuminuria	Micro Albuminuria	Macro Albuminuria		
	Mean ± Std. Deviation	Mean ± Std. Deviation	Mean ± Std. Deviation	P Value	Significance
FBG	115.43 ± 19.43	184.47 ± 33.56	233.11 ± 53.95	<0.001	Significant
HbA1C	6.03 ± 0.48	7.47 ± 0.72	8.53 ± 1.3	<0.001	Significant
Serum Creatinine	0.79 ± 0.15	0.92 ± 0.23	1.04 ± 0.2	<0.001	Significant
GFR	86.2 ± 11.11	75.04 ± 8.85	64.91 ± 5.43	<0.001	Significant
UrinaryACR	22.28 ± 4.09	134.79 ± 70.65	469.83 ± 120.14	<0.001	Significant
Serum Uric Acid	4.64 ± 1.07	6.38 ± 1.3	7.68 ± 1	<0.001	Significant

There is statistically significant relation between mean of FBG, HbA1C, serum Creatinine, GFR & serum Uric Acid with different Albuminuria groups in study population. Microalbuminuria & Macroalbuminuria related positively with mean of FBG, HbA1C, serum Creatinine & serum Uric Acid and related negatively with mean eGFR. Mean urinary ACR in Normoalbuminuria, Microalbuminuria & Macroalbuminuria are 22.28±4.09, 134.79±70.65 and 469.83±120.14 respectively.

Table 8: Association of Albuminuria with serum Uric Acid

	Serum uric acid				
Albuminuria	Normo Uricemia	Hyper Uricemia	Total	P Value	Significance
Normo Albuminuria	43(76.8)	6(13.6)	49(49)		
Micro Albuminuria	10(17.9)	22(50)	32(32)		
Macro Albuminuria	3(5.4)	16(36.4)	19(19)	<0.001	Significant
Total	56(100)	44(100)	100(100)		

In people with Hyperuricemia 50%(n=22) have microalbuminuria ; 36.4%(n=16) have macroalbuminuria & 13.6%(n=6) have normoalbuminuria.
In people with Normouricemia, 17.9% (n=10) have microalbuminuria; 5.4%(n=3) have macroalbuminuria & 76.8%(n=43) have normoalbuminuria.

DISCUSSION

Present study has shown statically significant linear relationship of degree of albuminuria with age. Earlier studies have also shown positive correlation of microalbuminuria with age of the patients.[14] Our study has not shown gender-wise correlation of microalbuminuria, which is in contrast to the previous studies that have reported male dominance in the prevalence of microalbuminuria. As reported in many studies, our study failed to show any correlation between BMI and microalbuminuria.[15] This may be due to the confounding variables like duration of diabetes and glycemic control that would have played a major role in the occurrence of microalbuminuria.[16]

Diabetic nephropathy can conveniently be categorized into different stages with respect to renal hemodynamics, systemic blood pressure, urinary findings, and susceptibility to therapeutic interventions. In the initial renal hyperperfusion stage, glomerular filtration is elevated with absent albuminuria. In the second stage (clinical latency) glomerular filtration will be high normal with absent albuminuria. Next stage is incipient nephropathy, wherein glomerular filtration will be normal with presence of microalbuminuria.[17]

It usually appears 5–15 years after the diagnosis of diabetes mellitus. In the subsequent stage, glomerular filtration decreases with appearance of macroproteinuria and clinical manifestations of nephropathy. Finally ends up in endstage renal disease with massive albuminuria and diminished glomerular filtration.[18] Hence microalbuminuria may not be associated with abnormal serum creatinine or creatinine clearance, but can be an important warning signal which if ignored can result in irreversible renal damage.[19]

Present study has shown positive correlation of microalbuminuria with duration of diabetes mellitus

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which is in accordance with many previous reports. Duration of diabetes has significant contribution for the development microalbuminuria by prolonged exposure to hyperglycemia-induced advanced glycosylation end products accumulations. Control of diabetes with regular treatment also plays a significant role in the development of diabetic nephropathy.[20]

CONCLUSION

Hyperuricemia correlated positively with FBG, HbA1C, serum creatinine, LDL & Triglycerides in patients with T2DM. No significant correlation found between Hyperuricemia and Age, Sex, Weight, Height, BMI, Hypertension & HDL. Urinary ACR correlated positively with FBG, HbA1C, serum creatinine, LDL & Triglycerides in patients with T2DM. No significant correlation found between urinary ACR and Age, Sex, Weight, Height, BMI, Hypertension & HDL. Serum uric acid is an independent correlate of urinary ACR in patients with type 2 diabetes mellitus.

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