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Microalbuminuria in Normotensive Type 2 Diabetic Patients

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Original Research Article

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Abstract: *Microalbuminuria* denotes an abnormally increased excretion rate of albumin in the urine in the range of 30–299 mg/g creatinine. Microalbuminuria is considered as a marker of diabetic nephropathy. The American Diabetes Association guidelines currently recommend that all patients with diabetes mellitus and micro or macroalbuminuria should be prescribed an ACE inhibitor or ARB to mitigate nephropathy irrespective of hypertension. The current study was conducted to analyse the prevalence of microalbuminuria in a sequential sample of normotensive type 2 diabetic patients attending hospital diabetic clinics and to determine its relationship with known risk factors. This cross-sectional analytical study was conducted at tertiary teaching hospital in Kerala. Patients having hypertension, macroalbuminuria, other causes of proteinuria were excluded. Data was analysed by SPSS software. Microalbuminuria was observed in 51.2% of the study population. There was statistically significant association of microalbuminuria with age, systolic blood pressure, diastolic blood pressure, serum triglycerides, serum cholesterol, blood urea, serum creatinine, creatinine clearance and diabetic duration ($p< 0.001$). This study concludes that 51.2% of normotensive type 2 diabetic patients will require medications with ACE inhibitor or ARB as per ADA recommendations. Early screening for these risk factors among nonalbuminuric type 2 diabetic patients may optimise the renal outcome of patients with diabetes mellitus.
Keywords: *Microalbuminuria*, type 2 diabetic, ACE inhibitor.

INTRODUCTION

Diabetic nephropathy is a major cause of morbidity and premature mortality among diabetes mellitus patients. This complication initially manifests as microalbuminuria which progresses to overt albuminuria and ultimately results in renal failure [1]. The American Diabetes Association guidelines currently recommend that all patients with diabetes mellitus and micro or macroalbuminuria should be prescribed an ACE inhibitor or ARB to mitigate nephropathy irrespective of hypertension [2,3]. This study is done to analyse the prevalence of microalbuminuria among normotensive type 2 diabetes mellitus. This study will help to identify the subset of normotensive type 2 diabetic patients who will benefit from medications with ACE inhibitor or ARB. This study also analyses the risk factors of microalbuminuria among normotensive type 2 diabetic patients.

METHODOLOGY

The objective was to analyse the correlation of serum uric acid and urinary albumin excretion rate in type 2 diabetes mellitus. The study design was cross sectional study of patients at a tertiary care hospital in Southern India between April 2015 and March 2016. The inclusion criteria were type 2 Diabetes Mellitus (according to ADA criteria) [4] and age above 13 years. The exclusion criteria were patients with hypertension, collagen vascular disease, connective tissue disease, current urinary tract infections, sepsis or malignancies, chronic kidney disease or renal calculi, on chemotherapy, thiazides, salicylates, pyrazinamide, nicotinic acids or cyclosporine. A detailed history, physical examination and biochemical test were performed. Early morning first void mid-stream urine sample was collected after overnight fasting for 12 hours, similarly venous sample for serum uric acid, blood glucose, serum cholesterol, triglycerides and serum creatinine was collected after overnight fasting for 12 hours. Creatinine clearance

(mL/min) was calculated by the Cockcroft-Gault formula [5]. Urinary albumin - to- creatinine ratio (ACR) was calculated by dividing the urinary albumin concentration in micrograms by the urinary creatinine concentration in milligrams. ACR <30.0 µg /mg was defined as normoalbuminuria, 30.0 to 299.9 µg/mg as microalbuminuria, and ≥300.0 µg /mg as macroalbuminuria [6]. Abnormal albuminuria was defined as an ACR ≥30.0 µg /mg (i.e., microalbuminuria plus macroalbuminuria). All statistical calculations were performed with the SPSS 17 software. Comparisons between the groups were made with the paired t test where appropriate. The Pearson correlation with two-tailed probability values was used to estimate the strength of association between variables. The level of statistical significance was set at p value of ≤ 0.05. All results were expressed as mean ± SD.

RESULTS

A total of 84 cases of type 2 diabetes mellitus patients were included in the study. There were 43 females and 41 males and the age range was 53 -70 years with a mean age of 60.84 ± 10.8 years. Figure 1 shows the age distribution of the study population.

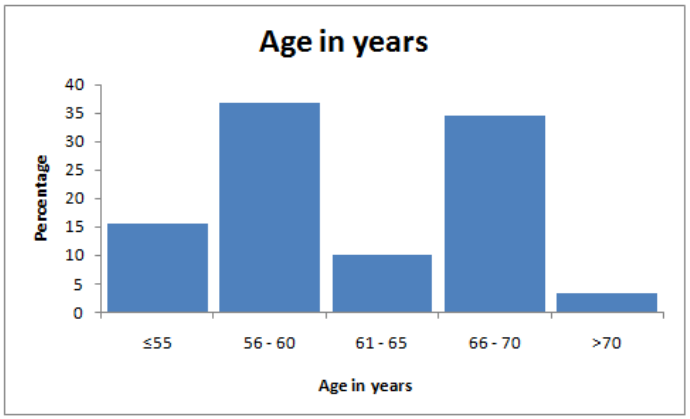

Fig-1: Age distribution of the study population

81 (96.4%) subjects were normal weights and only 3.6% were overweight. Almost 70.23% had blood sugar < 140 mg/dl and only 29.77% had >140 mg/dl fasting blood sugar. Majority of the patients (62%) were on oral hypoglycaemic agents only. 34 (37.8%) and 38 (42.2%) patients had high blood triglyceride levels (>150 mg/ dl) and cholesterol levels (>250 mg/dl) respectively. The medication used by the study population is depicted in the figure-2.

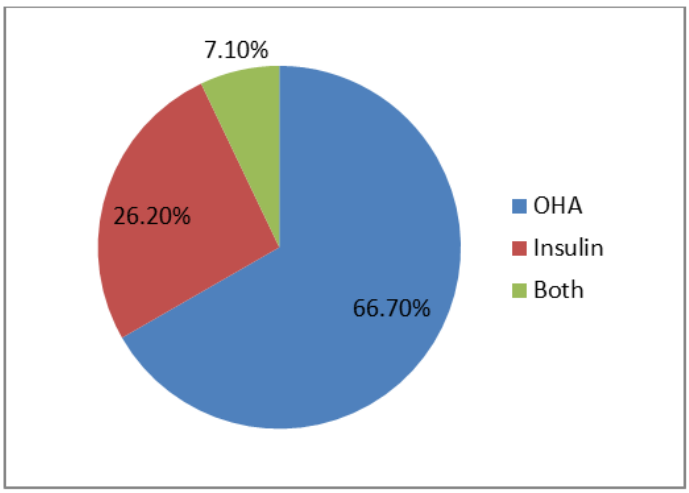

Fig-2: Medication use of the study population.

Majority (53.3%) of patients had calculated creatinine clearance of <60mL/min. Creatinine clearance of the study population is shown in figure 3.

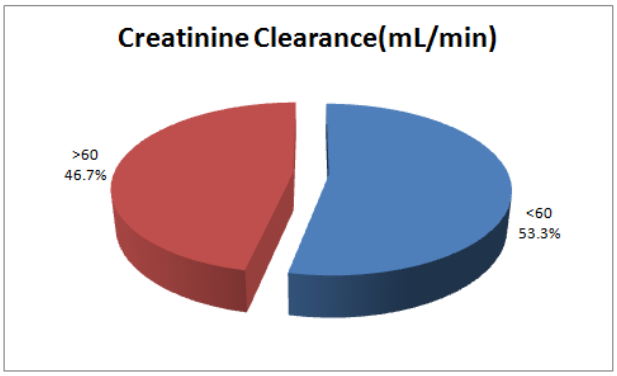

Fig-3: Creatinine clearance of the study population

51.2% of the study population had microalbuminuria (Figure 4). Table 1 shows the baseline characteristics of the study population. There was statistically significant association of microalbuminuria with age, systolic blood pressure, diastolic blood pressure, serum triglycerides, serum cholesterol, blood urea, serum creatinine, creatinine clearance and diabetic duration (p< 0.001). The distribution and association of different variables in relation to albuminuric status of the patient is depicted in table-2.

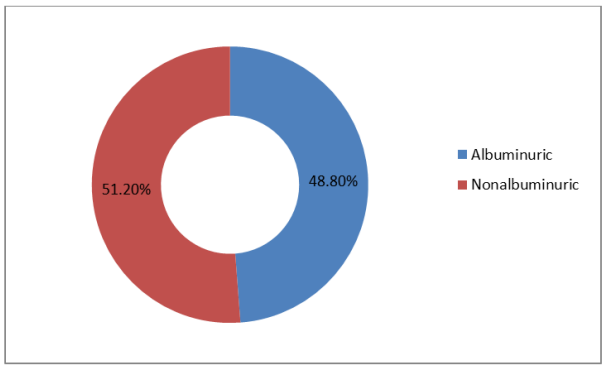

Fig-4: Proportion of subjects with albuminuria

Table-1: Baseline characteristics of the subjects

	Mean	SD	Min	Max	25th percentile	50th percentile	75th percentile
Age (years)	61.49	5.78	53	72	56	60	67
BMI (kg/m^2)	22.71	1.48	19.0	26	22	23	24
Diabetic duration (years)	4.96	4.14	1	15	1	4	7
SBP (mm hg)	123.62	9.72	100	138	119	126	130
DBP (mm hg)	78.02	7.18	68	90	70	79	86
Fasting plasma glucose	128.80	29	89	227	103.75	125.50	147
Serum cholesterol (mg/dl)	228.89	44.64	167	318	186.75	230	267
Triglycerides (mg/dl)	128.66	24.63	94	168	105	126.50	152.25
Uric acid (mg/dl)	6.1	1.26	3.7	8.8	5.05	6.10	7.05
Creatinine clearance	51.26	13.03	27	77.38	39.45	49.50	62
Serum creatinine (mg/dl)	1.31	0.27	0.7	1.9	1.1	1.300	1.5
Serum urea (mg/dl)	39.08	8.04	21	57	33	37.50	46
12 hour urine protein	120.91	101.21	26.5	315	29.5	40.250	210
Urine creatinine (mg/dl)	54.68	20.75	32	97	36	39.00	73.25
Albumin-creatinine ratio	125.70	107.40	26.50	317	30	40	218.5

Table-2: Association of albuminuria with different characteristics

Characteristic	Normoalbuminuric (n=41)		Microalbuminuric (n=43)		P Value
	Mean	Std. Deviation	Mean	Std. Deviation	
Age (years)	56.04	1.51	65.41	3.49	< 0.01
Diabetic duration (years)	1.37	0.53	7.16	2.76	< 0.01
SBP (mmHg)	115.02	6.97	130.14	4.19	< 0.01
DBP (mmHg)	71.9	3.76	82.51	4.97	< 0.01
Fasting plasma glucose (mg/dl)	104.92	7.05	142.34	16.25	< 0.01
Serum cholesterol (mg/dl)	190.12	19.27	257.07	30.88	< 0.01
Serum triglycerides (mg/dl)	105.82	10.17	145.69	14.63	< 0.01
Serum uric acid (mg/dl)	5.01	0.73	6.79	0.577	< 0.01
Creatinine clearance	63.64	3.80	42.58	6.92	< 0.01
Serum urea (mg/dl)	32.75	5.46	43.25	4.76	< 0.01
Serum creatinine (mg/dl)	1.08	0.13	1.46	0.15	< 0.01

DISCUSSION

Several studies have reported markedly varied prevalence of microalbuminuria in type 2 diabetic patients. According to a cross-sectional study of 180 type 2 diabetic patients from Gujarat, Microalbuminuria was observed in 34.48% [7]. Another cross sectional study of 222 type 2 diabetic patients, from Albania documented the prevalence of microalbuminuria as 38.6% [8]. This variation in prevalence can be attributed to factor such as difference in study population, the cut-off value of microalbuminuria, and method of urine collection. However this may also represent the real differences in the natural ethnic propensity to develop nephropathy. In the present study the prevalence of microalbuminuria across the genders were not statistically different. The prevalence of microalbuminuria in the current study was 51.2%.

The well described risk factors for microalbuminuria include hypertension, uncontrolled blood sugars, elderly, duration of diabetes [9], male gender and pre-existing retinopathy. In our study, we observed that the microalbuminuria had a significant association with age, duration of diabetes, systolic and diastolic blood pressure, fasting plasma glucose, blood urea, serum cholesterol, triglyceride, uric acid, creatinine and creatinine clearance. Similar to the current study, as hypercholesterolemia increases, the percentage of patients having microalbuminuria also increases [10]. In the study by Farkas et al. and Dadhaniya et al., patients having increased serum creatinine had significant association with microalbuminuria [10,11]. Significant correlation was found between microalbuminuria and serum creatinine in our study also. In conclusion, microalbuminuria in diabetes represents an earlier phase in the development of clinical nephropathy is associated with many potentially modifiable risk factors. Early screening for these risk factors among nonalbuminuric type 2 diabetic patients may optimise the renal outcome of patients with diabetes mellitus.

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