Research Article

Screening for microalbuminuria as an early marker of diabetic nephropathy in type 2 diabetic patients

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Abstract

Background: One of the early complications of type 2 diabetes mellitus is diabetic nephropathy which is reported as the leading cause of premature deaths due to renal failure. This study was conducted to see the prevalence of microalbuminuria in type 2 diabetic patients. **Materials and Methods**: This cross sectional study was carried out in the Diabetic Clinic of Sri Ramachandra Medical Centre, Chennai, India. Subjects were selected based on a detailed questionnaire. Blood and urine sample of 95 type 2 diabetic patients and 30 normal subjects between the ages of 45-63 years were collected to analyze fasting plasma glucose, post prandial glucose, Glycated hemoglobin, Blood urea nitrogen, creatinine and microalbuminuria. **Results**: There were 38 microalbuminuria positive cases out of 95 diabetic patients ($p<0.001$). The prevalence of microalbuminuria was higher in older patients and increased with increase in duration of diabetes. **Conclusion**: There is significant association between the duration of diabetes and microalbuminuria in type 2 diabetic patients.

Keywords: Type 2 Diabetes mellitus, Microalbuminuria, renal disease.

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INTRODUCTION

The prevalence of diabetes mellitus and its complications are on the rise in developing countries[1,2]. Increased urinary albumin excretion (UAE) is an indicator and a marker of emergent diabetes complications[3]. Current statistics from the World Health Organization (WHO) project an increase in the prevalence of diabetes worldwide mainly in developing countries. At present, India is leading the world with the largest number of diabetic subjects and this is expected to further increase in the coming years[4,5] Microalbuminuria, usually defined as a urinary albumin excretion rate of 30–300 mg per 24 hours, is known to be an independent predictor of an increased risk for cardiovascular and renal disease in diabetic subjects[6,7]. Microalbuminuria is highly prevalent; in diabetic and hypertensive populations, its prevalence varies from 10 to 40%. The higher incidence of kidney failure due to diabetes mellitus and the increased cardiovascular morbidity and mortality of diabetic patients emphasizes the need for acquiring more information concerning microalbuminuria as an early marker of diabetic nephropathy[8]. Improved glycemic control seems to delay or prevent the onset of microalbuminuria. Hence studies on diabetes mellitus related complications are essential to assess the burden of diabetes mellitus. The purpose of our study was to establish the prevalence of microalbuminuria and to evaluate risk factors for the development of microalbuminuria in patients with diabetes mellitus.

MATERIALS AND METHODS

The study group comprised of a total of 125 diabetic patients who visited the Diabetic Clinic of Sri Ramachandra Medical Centre during February 2008 to April 2008 was included in the study. Out of these 125 participants, 54 were male and 71 were females. The type 2 diabetic patients were selected based on the American Diabetic Association criteria (ADA, 2005). Individuals with normal plasma glucose (FBS and PPBS) and HbA1c (< 7 %) and normal blood pressure and no history of any disease or infection were considered to be healthy and taken as control samples. Blood samples were drawn after an overnight fast of 10 hours for the analysis plasma

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glucose, Glycated hemoglobin (HBA1c), Blood urea nitrogen (BUN), Creatinine and mid stream urine samples were collected for estimation of microalbumin and microalbumin/creatinine ratio. Biochemical analysis was done using Dade Behring – RXL dimension using the reagent kits supplied by Siemens diagnostics, USA. Fasting and post prandial plasma glucose was estimated by Hexokinase method, BUN was estimated by (urease/glutamate dehydrogenase method), creatinine was estimated by modified kinetic method of Jaffe, HBA1c was estimated using high pressure liquid chromatography (HPLC) using the Bio-Rad D10 Variant CA, USA. Urine microalbumin were analysed using the immunoturbidometric assay kit from by Randox diagnostics, UK on Konelab 60i fully automated random access analyzer and Urine creatinine was estimated using kinetic method of Jaffe. Two level of assayed QC Sample were run daily before processing the patient samples and ensured that the QC values were within the reference range and close to the mean mentioned in the product insert.

STATISTICAL ANALYSIS

Statistical analysis was performed using the SPSS version 16 software. Data are presented as mean and standard deviation. Chi-square-test was applied to see the association between the different variables responsible for the progress of renal disease. Stepwise multiple regression analysis of data was carried out to predict most relevant variable affecting the development of renal disease. A p value of ≤ 0.05 was considered significant.

RESULTS

Out of 125 (54 males and 71 females) subjects, 38 individuals had microalbuminuria (30.4%). The characteristics of the normoalbuminuric and microalbuminuric patients were shown in Table1.

Table 1: The characteristics of the normoalbuminuric and microalbuminuric patients

Characteristics	Normo albuminuria (< 30 mg)	Micro albuminuria (30 - 300 mg)
No. of participants	30	95
Age, Mean ± SD, y	39+11	54+9
Sex (M / F ratio)	14/16	51/44

Data are Mean±SD.

The prevalence of microalbuminuria in the diabetes patients was found to be 40% (38 out of 95). The prevalence of microalbuminuria was higher in older patients and increased with increase in duration of diabetes compared with the normoalbuminuric group ($p<0.001$). In the present study we did not find any statistical difference in the prevalence of microalbuminuria across the genders. The association between microalbuminuria, HbA1c and MPG were highly significant ($p<0.0001$). Table 2. The present study did not find any correlation between microalbuminuria and the independent variables FPG and PPBS Table 3.

Table 2: The Biochemical characteristics of the normoalbuminuric and microalbuminuric patients

Parameters	Control (n=30)	Type 2 diabetes (n=95)	*p* Value
FBS (mg/dl)	92.5+6.13	184.82+66.80	NS
PPBS (mg/dl)	107.8+26.2	286.87+85.6	NS
HbA1c (%)	5.54±0.28	8.99±2.23	<0.001
MPG (mg/dl)	120.53±9.92	242.74±79.6	<0.001
BUN (mg/dl)	8.4±3.37	12.89±3.38	0.015
S.Creatinine (mg/dl)	0.72±0.09	0.74±0.25	0.031
Urine Microalbumin (mg/L)	6.5±4.69	55.09±29.47	<0.001
Albumin/creatinine ratio	8.22 ±3.41	33.64±5.92	<0.001

Data are Mean±SD; HbA1c = glycated haemoglobin

Table 3: Microalbuminuria as a independent variable using logistic regression analysis

Independent variable	B	96% CI	*p*-value	OR (ODDS RATIO)
FBS	0.003	0.991, 1.015	0.624	1.003
PPBS	0.005	0.997, 1.013	0.229	1.005

DISCUSSION

Diabetes is the most common cause of end stage renal disease (ESRD) which accounts for 40□50% of all new cases of ESRD and is a major risk factor for cardiovascular disease[9,10,11]. Appearance of albumin in urine is one of the early sign of diabetic nephropathy which could be treated to prevent early renal disease before the predicted progression to proteinuria and chronic kidney disease. In the present study, we found that 40 % of the diabetic patients had microalbuminuria, an early marker of the onset of diabetic nephropathy, previous studies have reported marked variation in the prevalence of microalbuminuria[12,13]. Studies done in India have also reported high prevalence of microalbuminuria 26.6% in 65 type 2 diabetes mellitus north Indian patients, while a study from Christian medical college vellore reported a prevalence of 19.7 % and a Chennai

based study reported 15.7 % in 600 type 2 diabetic patients and a clinic based south Indian type 2 diabetes study from Chennai reported 36.7 % [15,16]. This variation in prevalence can be attributed to factors such as differences in populations, in the definitions of microalbuminuria, method of urine collection, etc. However this could also reflect true differences in the ethnic susceptibility to nephropathy. One of the risk factors for microalbuminuria is poor glycemic control. HbA1c is the best criteria in preventing diabetes complications, reducing every 1% of HbA1c could prevent 30-35% of microvascular and 14-16% of macrovascular complications. Studies have demonstrated that HbA1c has more relation to postprandial plasma glucose level than fasting plasma glucose but some studies have observed that HbA1c has close relation to fasting plasma glucose level than postprandial plasma glucose level. In the present study HbA1c was high in post prandial plasma glucose compared with fasting plasma glucose level[17,18]. The present study also reveals the duration of diabetes and age as risk factors. Recent studies have suggested that postprandial plasma glucose rise could have severe morbidity effects on cardiovascular system. In UKPDS study, with focus on fasting plasma glucose it was shown that there was no significant reduction in macrovascular complications. However, in those and in whom focus was on serious postprandial plasma glucose monitoring had observed better effects, reducing macrovascular complications[19.20]. In conclusion the prevalence of microalbuminuria in this study is 40% and risk factors are similar with other studies. As diabetes mellitus is becoming increasingly common in India and is expected to double by 2025. Therefore early detection and good control of diabetes will reduce the burden of renal and cardiovascular disease.

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