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A study on nephropathy in type2 diabetes individuals in coastal Andhra Pradesh, India

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Introduction: Diabetes nephropathy (DN) is an important, life-threatening microvascular complication of diabetes mellitus (DM). With this, a study was conducted to find the association between type 2 DM and DN. **Materials and Methods:** The study was conducted in the department of general medicine, GSL Medical College. Type 2 diabetic subjects who attended the outpatient and inpatient wards, aged > 30 years were included in the study, known renal disease/ were not considered. Albumin creatinine ratio was measured by immune turbidometry using a microalbuminuria test kit provided by ERBA MANHEIM GERMANY. Serum creatinine was done by creatininase enzymatic method, eGFR was calculated using the CKD-EPI equation. P<0.05 was considered statistically significant. **Results:** A total of 150 DM participants were included in the study; mean serum creatinine was 1.59 + 1.25 with a range from 0.4 to 8.7 mg/dl and mean eGFR of the study participants was 73.65 + 40.428 ml/min/m^2 with a range from 7 to 162 ml/min/m^2. DN was detected in 45% (67) participants. **Conclusions:** The present study reveals that there was significant evidence to support that microalbuminuria or proteinuria in patients with diabetes is a potential risk factor not only for kidney function impairment but also as a marker for high risk of cardiovascular complications.

Keywords: Diabetes, Kidney, Microalbuminuria, Nephropathy

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Introduction

Diabetic nephropathy (DN) is the leading cause of end-stage renal disease and the care of patients with diabetes and DN contributes to significant health care costs. Of patients with type 1 diabetes, approximately 20 – 30% will eventually develop DN, whereas about 10-20% of those with type 2 diabetes will do so [1]. India is the diabetes capital with home to 69.1 million people with DM, the second-highest number of cases after China.

Patients with diabetic kidney disease have exceptionally high rates of cardiovascular morbidity and mortality. The excess mortality among patients with diabetes appears to be largely limited to the subgroup with kidney disease and is explained by their high burden of cardiovascular disease. The mechanisms underlying the strong association between diabetic kidney disease and various forms of cardiovascular disease are poorly understood [2].

More recent studies have emphasized the importance of chronic heart failure (HF) as common and deadly comorbidity, to which the patient with nephropathy, even in its earliest stages, is especially prone.

DN is an important and often life-threatening microvascular complication of diabetes mellitus (DM). It is usually first manifested as an increase in urinary albumin excretion (microalbuminuria), which progresses to overt albuminuria and then to renal failure [3,4]. With this, a study was conducted to find the association between type 2 DM and DN.

Materials and Methods

Settings: The study was conducted in the department of general medicine, GSL Medical College.

Duration and Study design: The study was conducted from November 2015 to April 2017. It was a cross-sectional study

Study subjects: Type 2 diabetic subjects who attended the outpatient and inpatient wards of the medicine department in GSL medical college were included in the study.

Sample size: Random sampling was considered in the study; as per this, 150 patients were included in this research.

Inclusion criteria: All type 2 diabetics above the age of 30 years.

Exclusion criteria: Type 2 diabetics with ischemic heart disease, hypertension, and Valvular heart disease, UTIs, poor transthoracic echo window, known renal disease/family history of renal disease were excluded from the study.

Ethical issue: The study was approved by the institutional ethics committee.

Methodology: A pre-structured questionnaire was used to collect clinical data. Baseline data including age, detailed medical history, history, family history, drug history, and personal history were recorded. Clinical examination and routine and relevant investigations were carried out for all participants.

The weight of the subjects was measured to the nearest 0.1 kg in light clothes on standing barefoot using a well-calibrated balance scale. The height of the subject was measured to the nearest 0.5 cm using a wooden scale fixed on the wall while the subject is standing relaxed with barefoot and heels together touching the wall.

Waist circumference was measured at the smallest horizontal circumference between the lower costal margin and iliac crest after a normal expiration, and the hip circumference was measured at the point of maximum extension of the buttocks. BMI was calculated as weight in kilograms divided by height in square meters.

Diagnosis of diabetes was made according to WHO criteria or if the subjects were already taking insulin or oral antidiabetic drugs. Criteria for diagnosis of Diabetes mellitus. Subjects with systolic pressure more than 130mm Hg and diastolic pressure more than 90 mmHg or those on antihypertensive drugs were considered hypertensive. Triglycerides >150mg/dl and HDL<40mg/dl for males and <50mg/dl for females and on specific treatment was taken as dyslipidemia.

Venous blood samples were taken after an overnight fast for fasting blood glucose and 2-hour post glucose blood sugar, glycosylated hemoglobin, and lipid profile. Plasma glucose concentration was estimated using the glucose oxidase method.

Serum lipids (total cholesterol, triglycerides, LDL cholesterol, and HDL plasma cholesterol concentrations) were measured. Cholesterol and triglyceride levels were determined in the serum by commercially available kits on an Erbamannheim -360 analyzer. High –density lipoprotein was measured by using the direct high-density lipoprotein method.

Low-density lipoprotein and very-low-density lipoprotein cholesterol were calculated according to the formula of Friedewald et al. LDL cholesterol =cholesterol-[HDL cholesterol+ (o.46xtriglycerides)]

Glycosylated hemoglobin (HbA1c) was estimated by the ion exchange resin method using colorimetry. Albumin creatinine ratio (ACR) was measured by immunoturbidometry using the Microalbuminuria test kit provided by Erba manheim, Germany. Serum creatinine was done by creatininase enzymatic method, eGFR was calculated using the CKD-EPI equation.

ECG recording was obtained for every subject to rule out ischemic heart disease. ECG finding of left ventricular hypertrophy was done by using the Sokolow-Lyon index where the sum of S wave in V1 and R wave in V5 or V6 >35mm, R wave in aVL >11mm.

Statistical analysis: Statistical analysis was done by using SPSS version 21.0. A Chi-square test was used to assess the association among different categorical variables; *P*<0.05 was considered statistically significant.

Results

A total of 150 DM participants was included in the study; 79 were male participants and 79 were females (Table 1). Gender-wise, nephropathy was diagnosed in 35 (44.3%) and 32 (45.1%) male and female participants respectively. And nephropathy was not identified in 55.7% (44) male and 54.9% (39) female participants. Statistically, there was no significant difference (Table 2).

The mean age of study participants was 56.98 + 10.27 years and ranged between 30 to 88 years. The mean serum creatinine was 1.59 + 1.25 with a range from 0.4 to 8.7 mg/dl and mean eGFR of the study participants was 73.65 + 40.428 ml/min/m2 with a range from 7 to 162 ml/min/m2.

Out of the 150 (100%) study participants, USG findings were normal in 60% (90) and abnormal findings in the remaining 40% (60). Among these, 20% (30) were diagnosed to be grade 1-2, 19.3% (29) as grade 2-3 and 0.7% (1) were diagnosed to be grade 3-3.

Table-1: Gender wise distribution of the study participants

Gender	Frequency	Percent
Female	71	47.3
Male	79	52.7
Total	150	100.0

Table-2: Correlation between gender and nephropathy status in the study population

Gender	Nephropathy		Total
	Present	Absent	
Female	32 (45.1%)	39 (54.9%)	71 (100%)
Male	35 (44.3%)	44 (55.7%)	79 (100%)
Total	67 (44.7%)	83 (55.3%)	150 (100%)
Chi square = 0.009; P = 0.925 (Non-significant)			

Discussion

The prevalence of DN in this study was 44.7%. This was comparable with other studies, the DN prevalence was reported between 29.1% to 38%. Studies wise, the prevalence were reported to be 29.1% by Unnikrishnan et al., 39% in Pataap K Chandie Shaw et al., report, 29% by Retnakaran et al. report, 33% by Wirta et al study, 25.95% in Collins et al. [5-9].

In another study by Krairittichai U et al., 37.2% prevalence was reported [10]. From the above data, it was clear that there was a high prevalence of DN in the present study group compared to other studies, which may signify that rise in the diabetic population and early identification of nephropathy through microalbuminuria was needed.

The population with a longer duration of DM was increased prevalence of nephropathy in type 2 diabetes patients. Increased risk of microvascular complications was associated with a longer duration of diabetes.

DN has a greater degree of impairment than is present in nondiabetic kidney disease [11]. A GFR less than 60mL/min/1.73m2is consistent with the diagnosis of chronic kidney disease, underlying causes other than DN might be involved in patients with a GFR below 60mL/min/1.73m2, thus calling for the differential diagnosis between DN and any other potential non-diabetic kidney diseases.

J. Miyazato et al. reported a study on left ventricular diastolic dysfunction in patients with chronic renal failure [12]. In this study 67 patients with non-dialysis CRF as a result of chronic glomerulonephritis (*n*= 33) or DN (*n*= 34), and 134 hypertensive patients with normal renal function. The diastolic dysfunction was diagnosed in 41 participants; statistically significant.

In type 1 diabetes, microalbuminuria is rarely present at diagnosis, but persistent and untreated microalbuminuria will progress to albuminuria in 30%-80% of individuals over 10-15 years., and of those, 50% - 78% will progress to DN over the next 10-18 years [13]. In type 2 diabetes, microalbuminuria and even albuminuria may be present at or soon after diagnosis, in part because diabetes has often already been present for years. In the present study group mean urine albumin creatinine ratio (UACR) was 84.6+70.8 mg/g (p=0.0001), and the mean serum creatinine was 2.51+1.37 mg/dl (p=0.003), and the mean eGFR was 37.54+24.9 ml/min/m2 (p=0.001), which shows that the renal parameters which were mentioned shows statistically significant association with the nephropathy. The above data were compared with other studies like DCCT where gender-specific equations of ACR shows a cut off of microalbuminuria and macroalbuminuria in males was 19.1 mg/g and 143.5 mg/g, in females was 29.0 mg/g and 217.4 mg/g, and eGFR mean was 84.5+17.1 ml/min/m2 (p<0.001), and serum creatinine mean was 0.95+0.3 mg/dl (p<0.001), and these values are found to be significantly associated [14].

In a study by Fisher et al., the mean eGFR was 43+13 ml/min/m2 and the median ACR was 46 mg/g [15]. In a Japanese study by Yuko Watanabe et al., the mean ACR concerning albuminuria was 261.5 mg/g (p<0.001), and for eGFR strata, it was not significantly associated, and in that study mean eGFR and mean serum creatinine when compared to eGFR strata they were significantly associated but concerning albuminuria they were not significantly associated [16], in various other studies like Sanjeev Kumar et al. mean serum creatinine was 1.76+0.59 mg/dl (p<0.0001) and was significantly associated with nephropathy [17]. Debbarma et al. reported mean serum creatinine was 1.08+0.18 mg/dl (p=0.01) and shows a significant association with nephropathy [18]. In Prataap K et al., study, the mean serum creatinine was 0.86 mg/dl and shows significant association with macroalbuminuria (p=0.00093) and not significantly associated with microalbuminuria (p=0.20), in Prataap K et al south Asians showed an eGFR of 100ml/min and Europeans showed an eGFR of 90ml/min/m [6]. Levey et al. studied the role of eGFR in chronic kidney disease in predicting prognosis, eGFR was one of the important indicators of reserved renal function and indicator of prognosis [19].

Conclusions

The present study reveals that there was significant evidence to support that microalbuminuria or proteinuria in patients with diabetes is a potential risk factor not only for kidney function impairment but also as a marker for high risk of cardiovascular complications.

Limitation

Small sample size, short duration are the limitations of the study.

What does the study add to the existing knowledge

Diabetes is an important risk factor for kidney function impairment, and the observations from the present study do provide significant evidence that suggests microalbuminuria or proteinuria in patients with diabetes is a potential risk factor for kidney impairment and cardiovascular complications.

Author's Contribution

Dr. Avapati Raja Sekhar: Study design, Literature survey, data analysis, paper writing.
Dr. Nallamothu Murali Krishna: Study design, paper writing.
Dr. Bhaskar Dorapudi: Main work, Literature survey, data analysis
Dr. T Jaya Chandra: Data analysis, paper writing, statistical part.

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