PREVALENCE OF DIABETES MELLITUS WITH RENAL INVOLVEMENT IN A RURAL POPULATION OF BANGLADESH

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Abstract

Background: Population based studies on the prevalence of Diabetes Mellitus (DM) with renal involvement in Bangladesh is limited. It is an obstacle both for the screening program and intervention to prevent this disease. This study was designed to estimate the prevalence of DM with renal involvement among the rural population of Bangladesh.

Materials and methods: This cross-sectional study was conducted at selected rural areas in Chattogram district of Bangladesh over the period from January 2014 to December 2014. A total of 2500 individuals age 18 years and above were selected by a multistage sampling method. Diabetic status was assessed by doing Capillary Blood Glucose (CBG) Oral Glucose Tolerance Test (OGTT) and Hemoglobin A1c. Renal function was evaluated by serum creatinine and spot urine dipstick test.

Results: Out of 2500 rural residents 557 (22.3%) were found to have DM. Overall 616 (24.6%) subjects had renal involvement and subjects with DM had significantly more renal involvement than the subjects without (36.4% versus 21.3%1). Subjects with DM and renal involvement were significantly older and had lower monthly family income than those without renal involvement. Among 557 subjects with DM, only 41.7% was known to be diabetic. Only 36.3% of the diabetic subjects were aware about their renal involvement.

Conclusion: The large proportion of undiagnosed cases of DM indicates the lack of public awareness of diabetes and the shortage of medical facilities. In view of the huge population in Bangladesh, the results of this study emphasize the need to improve the early detection and prevention of diabetes in Bangladesh as a means to prevent the emerging diabetes epidemic.

Key words
Prevalence; Diabetes mellitus; Renal involvement; Rural.

Introduction

Diabetes Mellitus (DM) is one of the major Non-Communicable Diseases (NCD) that has emerged as a major public health problem worldwide, especially in low-and-middle income countries, where more than 80% of people living with diabetes[1,2]. Estimated global prevalence of DM among adults in 2013 was 8.3%, which is 382 million people living with DM and projected to increase beyond 592 million in less than 25 years[1]. Southeast Asia accounts for close to one-fifth of all DM cases worldwide and the prevalence of DM is estimated to increase by 71% in this region by 2035[2]. The International Diabetes Federation (IDF) Diabetes Atlas 5th edition projected that DM prevalence in Bangladesh will increase to more than 50% by next 15 years, placing Bangladesh as the 8th highest diabetic populous country in the world.[3] The economic and human costs provoked by diabetes in a large population such as in Bangladesh will be substantial[4,5].

DM is the most common cause of kidney failure, accounting for approximately 44% of new cases of Chronic Kidney Disease (CKD)[6]. Like DM, CKD is a public health problem as it increases the mortality risk for any cause[7]. The costs of care for people with diabetes kidney disease are very high[8].

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Submitted on : 19.01.2020
Accepted on : 08.02.2020

Patients with DM associated with renal impairment had an increased mortality risk, especially a higher risk of cardiovascular death, when compared to other diabetic patients without renal impairment[9]. However, only limited information is available on prevalence of CKD among Bangladeshi population with DM[10].

Basic information about the prevalence of DM with renal impairment should be analyzed to provide evidence for further prevention. Although a few previous studies have focused on prevalence, awareness, treatment, control and risk-factor assessment in Bangladesh, most of them were conducted in and around the Dhaka city, the capital of Bangladesh[11]. Our study aimed to estimate the prevalence of DM with or without renal impairment, in rural areas of Chattogram District, situated in the southeast region of Bangladesh. This study would provide information on preventing renal impairment in DM to the appropriate stakeholders.

Materials nd methods

This population based cross-sectional study was conducted from January 2014 to December 2014 after obtaining approval from Ethical Review Committee of Chittagong Medical College.

A multistage sampling method was employed to select a random sample of the general population aged 18 years and above in Chattogram District. Subjects who did not provide written informed consent and women with pregnancy induced DM were excluded. There are 15 Upazilas in this district and one Upazila was selected through lottery method. From the Upazila 05 unions were again selected randomly. From the selected union, total number of wards was collected with holding numbers of all the homes. In the day of collection, a street was selected randomly from each ward and every home was visited from the beginning to the end of the road of that ward. As per age of the national ID card a subject was selected after explaining of the procedure. A written consent was taken. A total of 2569 people were invited to participate in the survey, 2041 subjects participated, with an overall response rate of 79.44%. Of these participants, there was complete information on 2500 subjects and these were included in the analysis.

Data was collected through interview, spot blood and urine examination, and laboratory investigation. A projection meeting was arranged with the researcher, project workers, local Union Porishod members and local religious leader to discuss the objective of the study and their co-operation (Organizing, motivating, and identifying the subjects and coordination with the research team). Four male and four female field volunteers were recruited from the local area. One day training for these workers was conducted prior to beginning of field survey. They were trained regarding anthropometric measurement (Height, weight, waist and hip circumference). Socioeconomic data, general information and clinical data was taken by the researcher and other fellow associates (CRRG comprising physician in Chattogram who are engaged in renal research). Every participant was asked whether or not they had previously been diagnosed with diabetes or kidney disease. If the answer was yes, the subject's medical records on the diagnosis and treatment were reviewed. For HbA1c, Hb%, serum creatinine and cholesterol 5cc blood were drawn by the trained laboratory technician. The person with CBG level ≥5.6mmol/L was suggested to do OGTT or HbA1C. A diagnosis of previously diagnosed diabetes was confirmed by Fasting Plasma Glucose (FPG) level ≥7.0 mmol/l, or taking oral hypoglycaemic agents or insulin regardless of the FPG level. Undiagnosed diabetes was defined by FPG concentration of ≥7.0 mmol/l, and/or 2-h plasma glucose concentration of ≥11.1 mmol/l after a 75-g glucose load[12]. Renal impairment was defined by serum creatinine >1.2 mg/dl and/ urinary protein 1+.

Statistical analysis was carried out using the SPSS version 15.0. The prevalence was calculated by dividing the number of subjects with DM or renal impairment by the total number of subjects. Between groups comparison for continuous data was done with independent sample t test and for categorical data with Chi-square test. $p < 0.05$ was considered to be statistically significant.

Results

The socio-demographic and anthropometric characteristics of the study population are presented in Table I. It depicts that respondent's ≤40 years and >40 years were equal. Female was higher than male with a male to female ratio of 1: 1.23. Majority (7956%) of them were not educated and had monthly family income of ≥10000 BDT (61.84%). Average BMI and waist hip ratio was higher than the normal reference level.

Table I : Demographic and anthropometrical characteristics of the study population (n=2500)

Characteristics	Frequency (Percentage)*
Age	
≤40 years	1234 (49.36)
>40 years	1266 (50.64)
Sex	
Male	1120 (44.8)
Female	1380 (55.2)
Educational status	
Illiterate or no formal education	511 (20.44)
Literate	1989 (79.56)
Monthly family income	
<10000 BDT	954 (38.16)
≥10000 BDT	1546 (61.84)
BMI (kg/m^2)	
Mean (±SD)	24.73 (4.21)
Range	12.49-46.51
Waist hip ratio	
Mean (±SD)	0.93 (0.08)
Range	0.71-1.41

*Results expressed as mean (SD) and range for BMI and Waist hip ratio, BDT: Bangladeshi taka.

Figure 1 shows the distribution of DM and renal involvement among the respondents. It shows that, 557 (22.3%) had DM and 616 (24.6%) were found to have renal involvement among 2500 study subjects. Out of 557 subjects with DM 41.7% were newly diagnosed, which means only 58.3% of the DM patients were aware about their diabetic status (not presented in the graph).

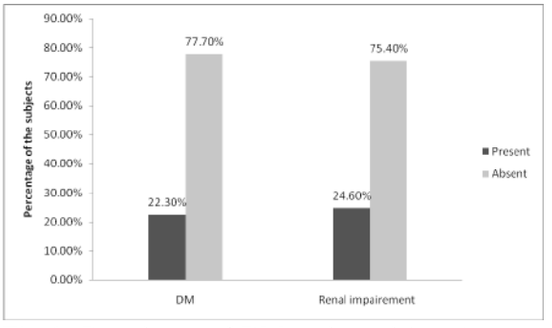

Fig 1: Prevalence of DM and renal impairement among the respondents (n=2500).

Table II shows that, significantly higher number of respondents with DM had renal impairement in comparison to their counterpart (p<0.001). However, only 36.3% of the DM patients were aware about their renal involvement (Not shown in the table).

Table II: Association between DM and renal involvement in 2500 rural resident.

Renal impairement	Diabetes Mellitus		p value
	Present (n=557)	Absent (n=1925)	
Present	203 (36.4)	413 (21.3)	<0.001
Absent	354 (63.6)	1530 (78.7)	

Data are expressed as frequency (Percentage).

Patients with DM and associated renal involvement were significantly older age and had low monthly family income in comparison to the DM patients without renal involvement (Table III).

Table III: Demographic and anthropometrical characteristics of the study population (n=2500).

Characteristics	Diabetes mellitus		p value
	With renal involvement (n=203)	Without renal involvement (n=354)	
Age			
≤40 years	44 (21.67)	120 (38.83)	0.003
>40 years	159 (78.33)	234 (66.11)	
Sex			
Male	85 (41.87)	160 (45.19)	0.501
Female	118 (58.13)	194 (54.81)	
Educational status			
Illiterate	46 (22.66)	68 (19.21)	0.388
Literate	157 (77.34)	286 (80.79)	
Monthly family income			
<10000 BDT	135 (66.50)	77 (21.75)	<0.001
≥10000 BDT	68 (33.50)	277 (78.25)	
BMI (kg/m^2)			
Mean (±SD)	24.70 (4.25)	24.74 (4.18)	0.812
Waist hip ratio			
Mean (±SD)	0.94 (0.06)	0.92 (0.09)	0.064

*Results expressed as mean (SD) and range for BMI and Waist hip ratio, BDT: Bangladeshi taka. Significant values are in bold face.

Discussion

The rural community is different from the urban community in Bangladesh in terms of income, educational level and receiving health care facility[13]. The present study was conducted among rural population of Chattogram district of Bangladesh. A total of 2500 subjects were recruited in the study to examine the prevalence of DM and renal involvement and to find the association of renal involvement with DM.

The present study demonstrated that, 22.3% of the rural participants had DM. Another study conducted in the last century reported the crude prevalence of type 2 DM was 4.3% in Bangladesh[14].

These indicate a rising trends of DM in Bangladesh. A recent paper published in 2014 using data from the Bangladesh Demographic and Health Survey 2011, reported the overall age-adjusted prevalence of diabetes: 15.2% in urban areas compared with 8.3% in rural areas in Bangladesh[11]. Study conducted in our neighboring country, India among 4535 individuals aged >30 years from 20 villages representative of Godavari, a developing rural area of Andhra Pradesh, showed the prevalence of diabetes was 13.2%[15]. Wide variation of the prevalence was observed in different studies conducted in our country and this prevalence of DM in a rural area was 2.1% in 1995 and increased to more than three times in 2012 to 7.9%[16]. In our study, 41.7% of diabetics were not aware they had the disease. Similarly, the IDF reported recently that over 50% of people with diabetes in south Asia were unaware of their condition[1].

Out of the 2500 included rural resident one in every four of them had renal involvement, and among the subjects with DM 36.4% had renal involvement. It was found that more than one-quarter of diabetic patients, aged ≥25, had CKD in Dutch primary health care[17]. In another study high prevalence of CKD (24.7%) among adult diabetic was found in Tanzania and they were usually undiagnosed[18]. High prevalence was attributable to the case definition of CKD. CKD was determined including those with normal glomerular filtration rate as long as there was microalbuminuria. In the present study patients were labeled as having renal involvement if they had serum creatinine level >1.2 mg/dl or urinary protein 1+ or more. This might explain the comparatively higher prevalence of renal involvement in the present study.

The prevalence of renal involvement in DM was higher in association with factors such as older age, female sex, and illiteracy and low income group. However, it was statistically significant only in the older age and low income group. It was also in concordance with other study which found increased age had the strongest association with decreased eGFR[17]. A nationwide cross-sectional study from Spain found age, sex (Women), systolic arterial blood pressure, and previous history of cardiovascular disease were significantly associated with renal involvement in DM[18]. BMI in this study showed no association with renal involvement. Lu JL, et al found BMI of 30 kg/m^2 or more to be associated with rapid loss of kidney functions, but this association was accentuated in older patients (Not young patients like in this study) and BMI 25- < 30 was associated with the best clinical outcomes[20].

Limitations

The limitation of this study was due to a cross sectional design that could not explain about causal relationships. A cohort study is needed for further study. Sample size was not as large as to provide the real picture of the country burden of DM. The failure to collect a representative sample from all the segment of southern part of Chattogram was another limitation. The other limitation was, the renal involvement being defined by only serum creatinine and proteinuria in a spot urine test.

Conclusions

Despite these limitations, our study reveals that the prevalence of DM as well as renal involvement in the rural population of Chattogram district was high. The high proportion of previously undiagnosed DM and renal involvement in rural areas indicates the lack of public awareness of the disease and the lack of a case-finding strategy for asymptomatic cases by medical facilities.

Recommendations

A nationwide educational program on prevention of DM is required urgently. Further effort is also necessary to improve medical facilities in rural areas.

Acknowledgments

It was a self funded study. The authors would like to thank all survey participants for their involvement, as well as the Physicians of the respective areas for their collaboration and cooperation.

Contribution of authors

RKS-Conception, designing, data collection, drafting and final approval.
SR-Acquisition of data, drafting and final approval.
FUA-Data analysis, manuscript drafting and final approval.
BRC-Data analysis, drafting and final approval.
SS-Acquisition of data, drafting and final approval.
SW-Interpritation of data, critical revision and final approval.
PKD-Interpritation of data, critical revision and final approval.

Disclosure

All the authors declared no competing interest.

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