Orginal Article

Prevalence of Macrovascular Complications and Their Associated Risk Factors Among Type 2 Diabetic Patients Attending In A Tertiary Level Hospital

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Abstract

Background: *Macrovascular complications cause much of the serious morbidity and mortality in patients with diabetes. The aim of the study was to determine the prevalence and risk factors of different macrovascular complications among type 2 diabetic patients.*

Materials and Methods: *We studied two fifty cases of type 2 diabetic patients in this cross-sectional study which was conducted in the out-patient department of BIRDEM hospital, Bangladesh. The randomly selected patients were evaluated for the presence of coronary heart diseases (CHD), stroke and peripheral vascular diseases (PVD) through the review of their registered diabetic guide book. We included sociodemographic information, blood pressure, anthropometry (height, weight, body mass index) and lipid profile of the patients. Glycaemic status was assessed by HbA1c (HbA1c was categorized into 3 groups) and plasma glucose levels. We used logistic regression analysis to determine and quantify the association of CHD, stroke and PVD with various risk factors.*

Results: *Two hundred and fifty cases of type 2 diabetic patients (male 129 and female 121 were studied. The prevalence of macro-vascular complications was 28.8%. Among them CHD was 21.2% (95% CI: 16.13-26.27%), stroke in 8.4% (95% CI: 4.96-11.84%) and PVD in 7.2% (95% CI: 4-10.4%). Logistic regression models showed that macrovascular complications were more common in females; the risk increased significantly with age, longer duration of diabetes, lacking of physical exercise, presence of hypertension, HbA1c, Fasting Blood Glucose (FBG) and blood glucose 2 hours ABF.*

Conclusions: *CHD is the most common macrovascular complication among type 2 DM patients. Advanced age, longer duration of diabetes, hypertension, poor glycaemic control, lacking of physical exercise etc. are significant risk factors of macrovascular complications in type 2 diabetic patients.*

Key words: *Macrovascular complications, CHD, Stroke, PVD, Risk factors, Type 2 diabetes.*

Introduction

Diabetes mellitus is associated with a high risk of developing different vascular complications. Macrovascular complications in diabetes consist mainly of an accelerated form of atherosclerosis that affects the coronary, carotid and peripheral arteries, thus increasing the risk of myocardial infarction, stroke and diabetic foot diseases[1,2]. Several studies have been carried out in USA, Europe and Asian countries to determine the prevalence of macrovascular complications in their diabetic patients[3-7]. Patients with DM are two to four times more likely to develop cardiovascular disease than

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those in the general population and have a two to five time's greater risk of dying from these diseases[8]. Coronary and cerebrovascular diseases are reported to be two to three times more common in those with DM, and their associated mortality is also increased[9,10]. In the worldwide INTERHEART study of patients from 52 countries, diabetes accounted for 10% of the population attributable risk of first MI[11]. Transient ischemic attacks are two to six times more common in DM patients and the risk of vascular dementia is also augmented[8]. The risk of peripheral vascular disease (PVD) in diabetics is four times higher[12,13] and is known to increase the risk of lower limb amputation by 15-40 times compared to the general population[8]. Most investigators now agree that diabetic vascular complications result from the interaction of multiple metabolic, genetic and other factors. Several studies have observed that poor glycaemic control, obesity, hypertension, dyslipidaemia, physical inactivity, microalbuminuria, smoking etc. are contributory risk factors of macrovascular diseases[14-18]. In Bangladesh there are a few clinical studies on prevalence of macrovascular complications and their associated risk factors among type 2 diabetic patients [19,20]. Therefore, we attempted to do a clinical study in this regard. The purpose of this study was to assess the prevalence of macrovascular complications (coronary heart diseases, stroke and peripheral vascular diseases) and to identify various risk factors influencing them.

Materials and Methods

This cross-sectional study was carried out in the outpatient department (OPD) of BIRDEM hospital, Dhaka, Bangladesh from June 2010 to August 2010. A total of 250 type 2 diabetic patients of both gender and age group 30-60 years were included as study participants. The duration of type 2 diabetes for the population was ranging from 2 to 10 years. Patients with other chronic illnesses like chronic hepatic diseases, chronic arthritis etc. (those may interfere with the blood glucose levels), pregnant diabetic cases or gestational diabetes, type 1 diabetics and patients of hemoglobinopathies were excluded from the study. Each subject underwent a detailed history and clinical examination. Details regarding age, sex, family history of diabetes, socioeconomic factor, educational history, occupational history, physical activity, smoking history, duration of diabetes were recorded in all patients. Blood pressure and anthropometry (height, weight, calculated BMI) of the participants were also recorded. The selected patients were evaluated for the presence of

macrovascular complications (CHD, stroke and PVD) through the review of physicians' notes in the patients' medical report which were recorded in their diabetic guide book.

Statistical analysis

The prevalence rates of macrovascular complications (coronary heart disease, stroke and peripheral vascular disease) among type 2 diabetes were determined by simple percentages. Logistic regression analysis was used to find out strength of association of risk factors with specific complication. All statistical tests were considered significant at a level of $p < 0.05$. SPSS software, version 21 was used for the statistical analysis.

Results

Sociodemographic characteristics

Total 250 cases of type 2 diabetic patients were included in this study; with 51.6% (129) male and 48.4% (121) female. The mean age of the study participants during study time was 50.17 ($\pm$7.64) years. 58.4% of the patients were 50-60 years old and 41.6% were less than fifty years. The details of the sociodemographic characteristics of the study participants are shown in table I.

Table I Characteristics of study participants (n=250)

Variables	Frequency	Percentage
Gender		
Male	129	51.6
Female	121	48.4
Age group (years)		
<50	104	41.6
50	146	58.4
Residence		
Urban	179	71.6
Suburban	44	17.6
Rural	27	10.8
Educational status		
No schooling	39	15.6
Primary	100	40.0
Secondary (SSC)	39	15.6
Higher Secondary (HSC)	20	8.0
Graduation and above	52	20.8
Occupation		
Service	57	22.8
Business	51	20.4
Housewife	115	46.0
Retired	21	8.4
Others	6	2.4
Family history of diabetes		
Yes	166	66.4
No	84	33.6
Exercise done by patients		
Yes	122	48.8
No	128	51.2
Presence of hypertension		
Yes	163	65.2
No	87	34.8
Drugs for glycaemic control		
Diet control	1	0.4
Oral antidiabetic drugs (OAD)	85	34.0
Insulin	158	63.2
Insulin and OAD	6	2.4

Clinical characteristics

The different biochemical values are presented in table II. Among the study participants the mean HbA1c was 8.07% (±1.78), fasting blood glucose 9.20 (±2.75) mmol/L and 2 hours after breakfast 13.16 (±3.95) mmol/L. These three represented the glycaemic status of the participants. The mean BMI of the study subjects was 24.69 (±3.36) kg/m^2. Mean systolic and diastolic blood pressure were 127.78 (±13.03) and 82.20 (±6.83) mm of Hg among the participants.

In this study the mean values of serum total cholesterol, triglyceride, LDL and HDL levels were 185.08 (±44.09), 206.79 (±134.92), 111.13 (±41.76) and 38.01 (±9.02) mg/dl respectively which represented normal total cholesterol and LDL levels but high triglyceride and low HDL levels. The range of duration of diabetes was 2-10 years and mean duration was 6.56 (±2.98) years. Total 163 (65.2%) participants were hypertensive. About 51.2% patients were not following any exercise regime as part of their management plan. The majority of the patients (63.2%) partially managed their DM with insulin and 34% by Oral Anti-diabetic Drug (OAD) (Table I).

**Table II** Mean and Standard deviation (Mean ± SD) of different covariates of study subjects

Variables	N	Mean ± SD
Age (years)	250	50.17 ± 7.640
Duration of diabetes (years)	250	6.56 ± 2.988
BMI (kg/m^2)	250	24.69 ± 3.36
Systolic blood pressure (mmHg)	250	127.78 ± 13.033
Diastolic blood pressure (mmHg)	250	82.20 ± 6.837
HbA$_{1c}$(%)	250	8.073 ± 1.782
Fasting blood glucose (mmol/L)	250	9.204 ± 2.758
2 hours ABF* (mmol/L)	250	13.165 ± 3.95
Total cholesterol (mg/dl)	250	185.08 ± 44.09
Triglyceride (mg/dl)	250	206.79 ± 134.92
LDL (mg/dl)	250	111.13 ± 41.76
HDL (mg/dl)	250	38.01 ± 9.02

* 2 hours ABF means blood glucose 2 hours after breakfast.

Prevalence of macro-vascular complications

The prevalence of macro-vascular complications was 28.8%. Among them CHD was present in 21.2%, stroke in 8.4%, PVD in 7.2% type 2 diabetic patients (Figure 1).
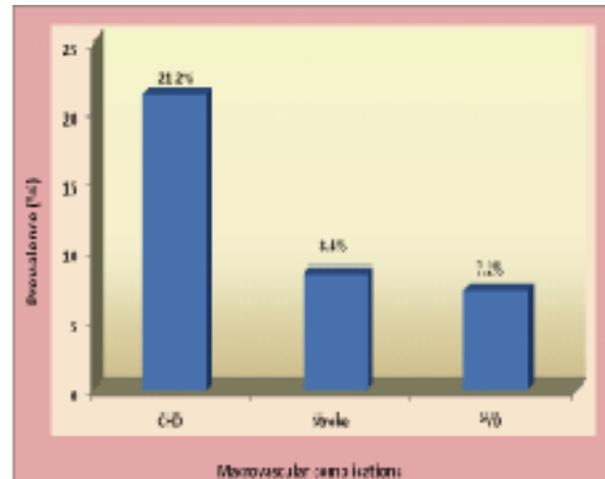
Figure 1 Prevalence of different macrovascular complications of the study participants

On logistic regression analysis we observed that the risk of CHD was more among females (OR = 3.48; 95% CI: 1.796-6.740) and steadily increased with advanced age (OR = 3.924; 95% CI: 1.867-8.247). Lacking of physical exercise (OR = 4.928; 95% CI: 3.396-10.135), presence of hypertension (OR = 6.845; 95% CI: 2.612-17.943), blood glucose 2 hours ABF (OR = 1.09; 95% CI: 1.012-1.177), SBP (OR = 1.062; 95% CI: 1.036-1.088) and DBP (OR = 1.096; 95% CI: 1.049-1.145) were significant risk factors of CHD (Table IV). In case of stroke we observed that advanced age (OR = 3.29; 95% CI: 1.075-10.098), HbA1c (OR = 1.464; 95% CI: 1.180-1.816), blood glucose 2 hours ABF (OR = 1.117; 95% CI: 1.024-1.218), SBP (OR = 1.040; 95% CI: 1.008-1.073) and DBP (OR = 1.079; 95% CI: 1.018-1.143) were significant risk factors of stroke. When we compared male and female with stroke we did not find any significant difference. Longer duration of diabetes, presence of hypertension, lacking of physical exercise and FBG also did not show any significant association with stroke (Table IV). Advanced age (OR = 3.855; 95% CI: 1.086-13.679), female patients (OR = 2.985; 95% CI: 1.031-8.644), SBP (OR = 1.054; 95% CI: 1.019-1.090) and DBP (OR = 1.124; 95% CI: 1.056-1.195) had shown significant association with PVD. Gender variation, longer duration of diabetes, presence of hypertension, exercise, FBG and blood glucose 2 hours ABF did not show any significant association with PVD (Table IV).

Table IV Univariate logistic regression analysis showing different variables associated with CHD, stroke and PVD

Independent variable	CHD Odds Ratio (95% CI)	Stroke Odds Ratio (95% CI)	PVD Odds Ratio (95% CI)
Age (years)			
<50	1.0	1.0	1.0
50	3.924***	3.29***	3.855*
	(1.867-8.247)	(1.075-10.098)	(1.086-13.679)
Gender			
Male	1.0	1.0	1.0
Female	3.480***	1.468	2.985*
	(1.796-6.740)	(.595-3.619)	(1.031-8.644)
Duration of diabetes (years)			
5	1.0	1.0	1.0
>5	1.945	2.803	.589
	(.992-3.814)	(.914-8.597)	(.225-1.541)
Exercise done by patients			
Yes	1.0	1.0	1.0
No	4.928***	2.566	.950
	(3.396-10.135)	(.962-6.849)	(.364-2.478)
Presence of hypertension			
No	1.0	1.0	1.0
Yes	6.845***	1.074	1.421
	(2.612-17.943)	(.417-2.769)	(.490-4.127)
HbA $1c$ (%)	1.092	1.464**	1.059
	(1.012 -1.177)	(1.180-1.816)	(0.819-1.369)
Fasting blood glucose	1.097	1.103	1.072
	(.988 -1.218)	(.982 -1.240)	(.913 -1.259)
Blood glucose 2 hours ABF	1.092*	1.117*	1.055
	(1.012 -1.177)	(1.024 -1.218)	(.939 -1.186)
Systolic blood pressure	1.062***	1.040**	1.054*
	(1.036 -1.088)	(1.008 -1.073)	(1.019 -1.090)
Diastolic blood pressure	1.096***	1.079**	1.124**
	(1.049 -1.145)	(1.018 -1.143)	(1.056 -1.195)

* P<0.05, ** p<0.01, *** p<0.001

Discussion

This study investigated the prevalence and risk factors of macrovascular complications in a sample of Bangladeshi type 2 diabetic patients. In our study we found that the prevalence of macrovascular complications was 28.8%. Among them CHD was most frequent 21.2%, stroke 8.4% and PVD 7.2%. A study conducted in our country[19] showed that the prevalence of IHD was 26.5%, CVD 5.3% and foot complications 2.0%. Another studies of different countries also showed similar results like us[14-16]. In this study we observed that advanced age and longer duration of diabetes were important risk factors for CHD. Our results were similar with findings of other studies[17,20]. Female were significantly associated with CHD in our study which was contrast to some studies[16]. Our study also revealed that lack of physical exercise had significantly greater risk of CHD, which was found in other published studies[21,22]. We found that hypertension is a significant

risk factor for CHD in type 2 DM. Both systolic and diastolic blood pressures were significantly associated with CHD. Many other studies suggested that blood pressure control in type 2 diabetes can result in reduction of CHD[23-26]. Poor glycaemic control indicated by raised glucose level 2 hours after breakfast were significantly associated with increased prevalence of CHD in this study. Some studies were similar with our results[14,27].

Our study reported that advanced age is important risk factors for stroke. Similar findings were noted in some other studies[14]. We could not find any significant relation between stroke and duration of diabetes. These findings were consistent with a study[16] which reported that age and duration of diabetes were not significantly associated with CVD. We found that increased systolic and diastolic blood pressures both were significantly associated with stroke and similar results were observed also by others[16,28]. Our study observed that an increased HbA1c% and 2 hours after breakfast blood glucose level both were found to be strong predictors for stroke. These findings were resembled with other studies[27,28].

Similar to other vascular complications PVD was also significantly related to advanced age and female patients. These findings are consistent with result of other studies[16]. This study revealed that systolic and diastolic blood pressures both were significant risk factors of PVD but this result was contrast with some studies[16,17]. We were not able to detect any association between PVD and glycaemic control as determined by HbA1c level, fasting and 2 hours after breakfast blood glucose levels. These results were not unique. Indeed, many longitudinal studies were unable to establish such a link[24,29]. The reason may be because of the relatively small sample size studied and the small number of patients with PVD, or it may be related to the multi-factorial nature of PVD.

Conclusion

Our data suggest that CHD is the most common macrovascular complication among type 2 DM patients. The risk of macrovascular complications increase with various risk factors like advanced age, longer duration of diabetes, hypertension, poor glycaemic control, lacking of physical exercise etc. These findings highlight the need of frequent screening of patients with type 2 DM to identify patients at high risk of health complications and to prevent further disability.

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