Global Risk Score to Cardiovascular Disease in Patients with type 2 Diabetes Mellitus in Egypt

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Abstract

Background: **Subjects with diabetes have increased cardiovascular disease (CVD) risk compared to those without diabetes. Addressing CVD risk in diabetes remains important due to increasing diabetes prevalence worldwide and in Egypt in particular.** ***Aim:*** **Assessment of major risk factors, and mean global risk score to CVD in type 2 diabetic patients.** ***Material and methods:*** **This is a case control study carried on type 2 diabetic patients in Suez Canal University Hospital, Ismailia, Egypt. Two-hundred and sixty-four patients with type II diabetes, and a matched group of 268 non-diabetic subjects took part in the study. Clinical examination and biochemical analysis were collected. To assess the mean global cardiovascular risk scoring in type 2 diabetic patients a Framingham heart study was used.** ***Results:*** **The mean total risk among type 2 diabetic patients was significantly higher than the matched control group. Moreover, the mean total risk among females in the diabetic patients was higher than that among male patients. Whereas in control group, the total mean risk in males was significantly higher than in females. The major risk factors in diabetic patients including body mass index, blood pressure, postprandial blood sugar and hemoglobin, total cholesterol and triglyceride were significantly higher than in the control group.** ***Conclusion:*** **The study highlighted the cardiovascular risk in type 2 diabetic patients in Egypt. These data emphasize the importance of treating cardiovascular risk factors in diabetic patients more aggressively in order to prevent CVD events. Furthermore, health care providers must increase the awareness in diabetic patients to adopt better life style.**

Keywords: *cardiovascular risk assessment, type 2 diabetes, primary prevention*

Introduction

Diabetes mellitus (DM) is a major emerging clinical and public health problem in Egypt in parallel with the worldwide diabetes. A recent meta-analysis of 26 studies reported that the prevalence of diabetes mellitus in the Middle East Region (including Egypt) was 10.5%[(1)]. Diabetes mellitus is known to be associated with a high risk of developing vascular complications which can lead to premature death and/or disability mainly by increasing the risk of myocardial infarction, stroke and peripheral vascular disease[(2)]. Previous studies suggested that patients with DM but without other conventional risk factors for atheroscler-osis are two to four times more likely to develop cardiovascular disease (CVD) than those in the general population and have a two to six times greater risk of dying from CVD[(3-6)]. Type 2 diabetes is of particular concern in this study because it is so common and usually occurs in persons of advancing age, when multiple other risk factors coexist. There is a growing consensus that most patients with diabetes melli-

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tus, especially those with type-2 diabetes, belong in a category of high short-term risk of CVD. Furthermore, when the risk factors of diabetic patients are summed, their risk often approaches that of patients with established coronary heart disease (CHD)[7]. The quantitative relationship between risk factors and CVD risk has been elucidated by the Framingham Heart Study[8]. These major risk factors [age, smoking, elevated blood pressure, elevated serum total cholesterol and low-density lipoprotein (LDL), low serum high-density lipoprotein (HDL), and diabetes mellitus] are additive in predictive power. Therefore, the total risk of a person can be estimated by a summing of the risk imparted by each of the major risk factors[8].

Cardiovascular disease is the leading cause of mortality worldwide, resulting in more than 17 million deaths in 2008. Early detection and treatment of high-risk patients such as diabetic patients has been endorsed as an important strategy to prevent cardiovascular events. Prevention of CVD development among patient possess risk factors represents a relevant impact in the population's quality of life, besides the reduction of costs in public health care, caused by complications due the evolution of the disease[1]. Preventive efforts should target each major risk factor. Any major risk factor, if left untreated for many years, has the potential to produce CVD. Nonetheless, an assessment of total (global) risk based on the summation of all major risk factors can be clinically useful for 3 purposes: (1) identification of high-risk patients who deserve immediate attention and intervention, (2) motivation of patients to adhere to risk-reduction therapies, and (3) modification of intensity of risk-reduction efforts based on the total risk estimate[9].

The present study is a case control study aiming to assess the major risk factors and global risk scoring to cardiovascular disease in type 2 diabetic patients attended family medicine clinic at the Suez Canal University Hospital, Ismailia, Egypt.

Materials and Methods

Participants

This study was conducted on two hundred sixty four (122 males and 142 females) type 2 diabetic patients**.** Patients were randomly-selected from the registry of the chronic disease clinic at the Suez Canal University Hospital, Ismailia, Egypt, and were diagnosed with type 2 diabetes according to American Diabetes Association criteria. A control group of a matched two hundred sixty eight (126 males and 142 females) normal subjects was selected. Patients with congestive heart failure, cardiomyopathy and severe co-morbids were excluded from the study. The local research ethical committee of the Faculty of Medicine Suez Canal University approved this study.

Assessments

Each participant underwent a complete clinical examination including weight and length to measure body mass index (BMI), and blood pressure. Family history of diabetes mellitus and hypertension were taken. Biochemical analysis including fasted blood glucose; postprandial blood glucose, glycated hemoglobin (HbA1C) levels; serum triglycerides and total cholesterol, high-density lipoprotein (HDL) cholesterol, low density lipoprotein (LDL) cholesterol levels were collected for each participant. In order to estimate 10-year risk for "hard" coronary heart disease outcomes, global cardiovascular risk scoring was assessed according to Framingham risk assessment score.

Statistical analysis

Data were analyzed using SPSS (version 10.0; SPSS, Chicago, IL). Group comparesons were performed using Student's t-

test or Chi square test. Statistical significance was defined as P-value <0.05.

Results

The two groups were matched with P value=0.862 as shown in Table1 with no significant difference in age between the two groups. When comparing the family history of diabetes mellitus and hypertension between the diabetic group and control group, the results showed a significant difference (p =0.042 and p =0.037, respectively) between the two group, as assessed by Chi square test (Table 1).

Table 1: A comparison between diabetic group and control group for their family history of diabetes mellitus and hypertension

		Diabetics		Controls		P value
		N	%	N	%	
- Gender	Male	122	46.2	126	47	0.862
	Female	142	53.8	142	53	
- Family History of Diabetes Mellitus	Negative	88	33.3	127	47.4	0.042 *
	Positive	176	66.7	141	52.6	
- Family History of Hypertension	Negative	92	34.8	153	57.1	0.037 *
	Positive	172	65.2	115	42.9	
Total		264	100	268	100	

N = number of participants, and *= significant difference p<0.05

Major risk factors

The major risk factors including age, obesity, blood pressure, plasma glucose level, blood lipid profile in both groups were measured (Table 2). No smokers between the two groups were found. *Age:* Since the two groups were matched, there was no significant difference between the groups in the mean age. *The mean body mass index (BMI):* The BMI in diabetic group was 31.1±6.8 and in control group was 24.6±7.3. The high values of the BMI in both groups indicate that the participants in both groups are either obese (diabetic group) or high normal BMI (control group). The results from the independent sample test showed that there is a significant difference (P value =0.048) between the two groups. *Blood Pressure:* In diabetic group, 64.77 % (171 patients) found to be hypertensive. The mean systolic blood pressure was 125±11.5 mmHg and the mean diastolic blood pressure was 87.4±9 mmHg, whereas in control group was 114.1±11 and 82.2±8.8 mmHg, respectively. A significant difference was found in the systolic and diastolic blood pressure when comparing the two groups (systolic p =0.049, diastolic p =0.044). *Plasma glucose level:* in diabetic group, the fasting blood sugar was 96.5±9.3, postprandial was 130.8±25.3 mg/dl and glycated hemoglobin A_{1C} was 7.3±1.4%. Whereas in the control group, the fasting was 95.5±9 mg/dl, postprandial was 92.4±9.3 mg/dl and glycated HbA1C was 5.6±0.8%. The independent sample test revealed that there is a highly significant difference in postprandial plasma glucose and glycated HbA1C between the two groups (p < 0.05). However, there was no significant difference in the fasting plasma glucose (p=0.194). *Blood Lipid Profile:* The blood lipid profile (total cholesterol, triglyceride, LDL and HDL) was measured between the

two groups. The results show that diabetic's group total cholesterol was 259.08±18.66 mg/dl, triglyceride was 193±8.21 mg/dl, LDL was 185±9.41 mg/dl, and HDL was 48±2.81 mg/dl. Whereas in the control, the total cholesterol was 199±16.29 mg/dl, triglyceride was 138±7.3 mg/dl, LDL was 165±5.77 mg/dl, and HDL was 51.20±4.53 mg/dl. The difference between the total cholesterol and triglyceride of two groups showed a significant difference (p >0.05) as assessed by t-test. No significant difference was found for the LDL and HDL between the two groups.

Table 2: A comparison between Type 2 Diabetics and controls for major cardiovascular risk factors

	Group	Mean± SD	T	P value	95% confidence lower	upper
Age (years)	Diabetics Controls	53.4±8.2 51.7±5.7	-31.9	0.435	-20.92	-18.49
Body Mass Index	Diabetics Control	31.1±6.8 24.6 ±7.3	0.3	0.048 *	-1.04	1.36
Systolic Blood Pressure (mmHg)	Diabetics Control	125.0±11.5 114.1± 11	0.9	0.049 *	-1.04	2.8
Diastolic Blood Pressure (mmHg)	Diabetics Control	87.4±9 82.2±8.8	1.5	0.044 *	-0.38	2.66
FBS (mg/dL)	Diabetics Control	96.5±9.3 95.5±9	1.3	0.89	-0.53	2.6
PPBS (mg/dL)	Diabetics Control	130.8±25.3 92.4±9.3	19.6	0.000 *	29.17	35.66
Glucosated Hemoglobin (%)	Diabetics Control	7.3±1.4 5.6±0.8	17.3	0.011 *	1.48	1.86
Total Cholesterol (mg/dl)	Diabetics Control	259±38.66 224±38.66	1.6	0.040 *	-0.03	0.31
Triglyceride (mg/dl)	Diabetics Control	193±8.21 138±7.30	0.5	0.043 *	-0.15	0.25
LDL (mg/dl)	Diabetics Control	185±9.41 165±5.77	0.5	0.95	-0.07	0.12
HDL (mg/dl)	Diabetics Control	48±2.81 51±4.53	0.5	0.9	-0.01	0.28

LDL= Low Density Lipoprotein; HDL= High Density Lipoprotein; FBS= Fasting Blood Sugar; PPBS= ostprandial Blood Sugar; *= significance difference p<0.05

Global risk score to cardiovascular disease

The mean global risk score to cardiovascular disease in the next 10 years was 2.57±4.12 in diabetic group, compared to -6.81±4.97 in control group (p = 0.000) (Figure 1). The mean total risk among females (5.195±3.671) in the diabetic patients group was higher than the mean total risk of the male patients (-0.60 ± 1.680). Whereas in control group, the total mean global risk in males (-4.79 ± 4.753) was higher than the mean of the global total risk in females (-8.54 ± 4.482). In comparing the mean total risk in males and females in each group, there was a significant difference with p =0.001, and 0.003 respectively (Figure 2).

Figure 1:

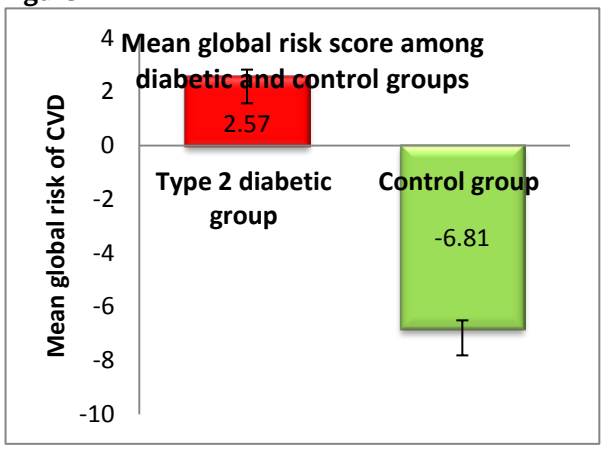
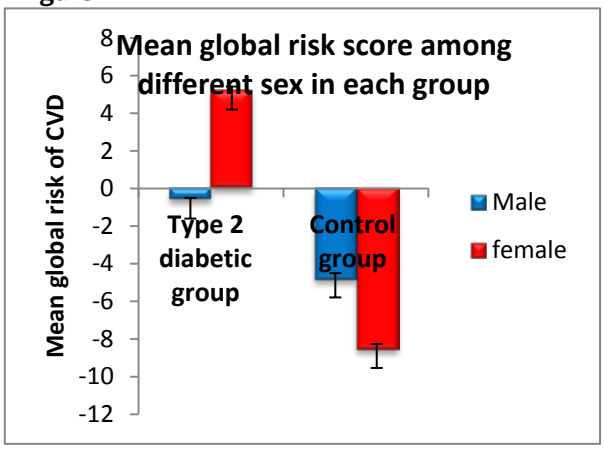


Figure 2:



Discussion

Subjects with diabetes have increased cardiovascular disease risk compared to those without diabetes. Addressing cardiovascular disease risk in diabetes is important as the prevalence of diabetes increases worldwide. Cardiovascular risk scores are useful tools in the management of individuals with diabetes. It is appropriate for identifying those at highest risk, to whom therapy can be targeted. This study assessed the major risk factors and global risk scoring to cardiovascular disease in type 2 diabetic patients attended the family medicine clinic at University Hospital of Suez Canal University, Ismailia, Egypt.

The results of this study highlight several major findings with respect to a population that has not received much research related diabetes prevention attention. A significant difference between the diabetic and control groups in the major risk factors was found including BMI, blood pressure, postprandial blood sugar and glycated hemoglobin, total cholesterol and triglyceride. A highly significant difference was found in comparing the family history of diabetes and hypertension in diabetic patients and control group. No significant difference was found for age, fasting blood sugar, LDL and HDL cholesterol levels. The main finding of this study was that the mean global risk score to cardiovascular disease in the next 10 years in diabetic patients was significantly higher than the control group (p= 0.000). Moreover, the mean total risk in female diabetic patients was higher than diabetic male patients, whereas non-diabetic women showed lower relative CHD risk compared to non-diabetic men. The results agrees with previous work[10, 11], based on Framingham study. The authors demonstrated that the relative impact of diabetes is substantially greater for women than for men, and the cardiovascular mortality and morbidity was actually about as great for diabetic women as for diabetic men.

When assessing the major risk factors of cardiovascular disease in diabetic patients, we found that most of the factors are highly significant when compared with the control group, increasing the risk for cardiovascular diseases. The BMI values obtained, as observed in Table 2, appoint excessive weight in most patients where BMI of diabetic patients was 31.1 ±6.8. These results are similar to those found in a multi-centric study carried out with more than 2,500 DM2 patients in 12 cities of different Brazilian regions[12]. The

prevalence of obesity in diabetic patients is three times higher than in the population in general. Sartorelli et al[13] estimated that high prevalence of overweight among type 2 diabetic patients ranges between 80-90%.

Despite awareness about the importance of excessive body weight for morbidity and mortality of patients with DM2, the control of this variable in diabetic populations has been rarely emphasized in most studies. In addition, the approach to this problem in basic health care has been neglected, since recommendations on the control of this variable exist in most services, but is not accompanied by resources that can adequately support individuals in an effective change that results in weight loss. Here we highlight that a high prevalence of obesity is observed in DM2 patients. In addition to the strong association of obesity with cardiovascular disease, particularly in the developed world, Type 2 diabetes and high blood pressure (hypertension) are strongly linked with each other. Research has shown that at least 40% of people suffering from diabetes in its various forms have high blood pressure[14]. Moreover, high blood pressure can increase the chance of cardiovascular disease, leading to a heart attack or stroke. Taken together these findings suggest that an increase in systolic BP is associated with increased cardiovascular events. This is supported by an epidemiologic analysis of United Kingdom Prospective Diabetes Study (UKPDS) data in which each 10 mmHg increase in systolic blood pressure increased the risk of myocardial infarction by 11%. In the present study, the blood pressure of diabetic patients was significantly higher than control group with mean systolic pressure of 125±11.5 and mean diastolic pressure of 87.4±9. It is important to note that among the diabetic patients in this study, hypertension treatments were taken. The results from this study highlight that, among diabetic individuals, hypertension is twice more frequent when compared to the population in general. This agrees with Carolino et al[15] who showed in their study that about 67% of diabetic patients were classified as hypersensitive.

The results here showed (Table 2) that fasting blood sugar in diabetic group was almost normal and no significant difference was found with the control group, whereas the postprandial blood sugar and HbA1C was significantly higher in diabetic group compared to the control group. In 2005, Cavalot and his colleges[16] proved that postprandial, but not fasting, blood glucose is an independent risk factor for cardiovascular events in type 2 diabetes, with a stronger predictive power in women than in men, suggesting that more attention should be paid to postprandial hyperglycemia, particularly in women. In the same stream, Bell[17] showed in his study a strong correlation between high postprandial glycemic levels and the development of vascular complications. Also, Lin and his colleges[18] proved that 2 hours postprandial glucose improves the predictive ability to identify non-diabetic individuals at increased risk of cardiovascular death.

The poor blood glucose control as indicated by high HbA_{1c} (7.3±1.4) for diabetic patients in this study could elevate cardiovascular risk. These findings agree with Singer et al[19] study, who demonstrated that HbA1c was significantly related to prevalent CVD, especially among women but not men. In a more recently study, Cavalot et al[20] showed that both postprandial and HbA1C blood glucose predict cardiovascular events in a long-term follow-up (14 years). The biochemical data (Table 2) indicated the high prevalence of dyslipidemias in diabetic patients, especially in total cholesterol and triglycerdes. Alteration

in lipid profile is a frequent association with diabetes, and a significant increase occurs in morbidity of individuals with types 1 and 2 diabetes mellitus in the presence of dyslipidemia. Moreover, the unfavorable impact of dyslipidemia on cardiovascular morbidity and mortality are largely acknowledged. On the other hand, there is plenty of evidence that the treatment of dyslipidemia has a favorable effect on the control of macro vascular disease in diabetic individuals[21].

It is known that the two main components of diabetic dyslipidemia are the elevated levels of triglycerides and the low levels of HDL-cholesterol, both considered the main predictors of cardiovascular diseases. The results in this study are similar to that found in a survey with DM2 patients[12]. However, we did not find a significant decrease in HDL.

Conclusion: our data suggest that diabetic patients without previous CVD have significantly higher risk of CVD than a non-diabetic group with a higher risk in female diabetic patients. These data emphasize the importance of treating cardiovascular risk factors in diabetic patients more aggressively in order to prevent CVD events. Furthermore, health care providers must increase the awareness in diabetic patients to adopt better life style.

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