Prevalence of Cardiovascular Risk Factors in Type-2 Diabetic Patients with IHD

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Abstract

Objective: Diabetes mellitus (DM) is more prevalent in Asians compared to White Caucasians. People with diabetes have a risk of IHD two to five times greater than that in non-diabetic individuals. There is limited data available in the literature about IHD and its association with known risk factors in the Yemeni diabetic population.

Methods: A comparative study was carried out in AL-Kuwait University Hospital (KUH) Sana'a City, Yemen (on 200 known type-2 diabetics with and without IHD) to establish the relative prevalence of hyperglycemia, dyslipidemia, hypertension, smoking, obesity and microalbuminuria, among type 2- diabetics with IHD compared to those who did not develop IHD. Data was collected from the patients attending KUH and detailed scrutiny of hospital records of admitted cases. The patient population was divided into two groups depending upon the presence or absence of IHD i.e., group A (n=100) and B (n=100) respectively. Both groups were studied independently for various risk factors including glycemic control, lipid profile, hypertension, smoking habits ,obesity and microalbuminuria. The results obtained in each group were compared with each other to find out the statistical significance of each risk factor.

Results: Type 2- diabetic patients with IHD group (group A) was more frequently males, had long diabetic duration (11.2±3.1 vs 8.4±3.1), and were more frequently smokers (42% vs 23%) than those without IHD group (group B). Group A (DM+IHD) patients were more frequently obese (38% vs 13%) and had high blood pressure (77% vs 35%) than group B (DM alone) p-value =0.0001. Poor glycemic control in group A (HbA1c > 7) (71% vs 34%) was positively correlated with IHD (p < 0.01). High serum triglycerides level (66% vs 27%), low serum HDL (70% vs 32%) and high serum LDL (58% vs 28%) was higher in group A (DM + IHD) than in group B (DM alone) and the results were statistically significant (p=0.0002).

The value of microalbuminuria was significantly higher in group A than in group B (60% vs 22%). Overall results have clearly shown that the prevalence of these risk factors is higher in diabetics with IHD compared to those without IHD.

Conclusion: It is concluded that the prevalence of conventional cardiovascular risk factors is quite significant in the Yemeni diabetic population.

Key words: Type 2- DM , IHD, MA

Introduction

Diabetes mellitus is the 8th health related cause of death all over the world and the fourth most common cause of death in the United States. Diabetes mellitus is one of the leading public health problems globally especially in the industrialized world, and it has a profound effect on the cardiovascular system affecting nearly 100 million cases worldwide(1). Diabetes mellitus is a chronic hereditary or acquired metabolic disorder characterized by persistent hyperglycemia due to relative or absolute deficiency of insulin. This condition is invariably associated with an altered carbohydrate metabolism leading to secondary alteration of fat, protein, water and electrolyte metabolism(1).

Ischaemic Heart Disease (IHD) is a syndrome, which remains a major cause of death worldwide. It includes Angina Pectoris, Acute Myocardial Infarction (AMI) and sudden cardiac death. As per WHO report 55/100,000 of Americans die of IHD and 45.3% of all deaths in USA are due to IHD (2).

However, in the UK 25,000 patients suffer from AMI annually (3) with an overall mortality three folds greater in diabetics. Cardiovascular disease is the main cause of death and disease in persons with diabetes mellitus (4,5). The prevalence of ischemic heart disease in patients with type 2- diabetes mellitus ranges from 10%-25% (6). Moreover, the presence of diabetes mellitus causes the protective effect of female sex to disappear in ischemic heart disease, as shown in the Rancho Bernardo study (7). Risk factors that predispose to atherosclerosis and resultant IHD have been identified by means of a number of prospective studies in well established population groups like the Framingham study and Multiple Risk Factor

Intervention Trial (8) i.e Dyslipidemia (hypercholesterolemia, high level of LDL, hypertriglyceridemia and low level of HDL)(9), Hypertension(10), Cigarette smoking (11) and Diabetes Mellitus(8). Type 2 diabetes mellitus is a complex disease, with disorders in the lipid profile, blood pressure and clotting factors. However, traditional risk factors explain just 25% of the excess cardiovascular risk in patients with diabetes (12). The presence of insulin resistance might also partly explain this excess risk.

The study was designed to investigate the correlation of the most prevalent conventional risk factors in the diabetic population of Yemen .i.e. poor glycemic control, dyslipidemia, hypertension, smoking and microalbuminuria and to support the theory that DM is a major independent risk factor in the development of IHD among diabetics in terms of hyperglycemia and other risk factors.

Materials and Methods

Data Collection

A case control study was carried out at Al-Kuwait University Hospital (KUH), in Sana'a City, Yemen, from September2010 to March 2011. Data was collected from outpatient departments as well as hospital records. The study was approved by the Joint Ethics Committee of the Faculty of Medicine and Health Sciences (Sana'a University).

Case Selection

Patients with age ranging between 40 to 55 years and diagnosed to have Type 2- DM with and without IHD, were selected for this study. Those diabetics were preferably selected who had the duration of DM 15 years or less because the longer the duration of the disease, the greater is the incidence of the associated risks and complications.

A total of 200 subjects who met the following inclusion/exclusion criteria were selected for further study.

Inclusion Criteria

§ Biochemically proved diabetics with or without history of IHD
§ Age > 40 years < 55 years
§ Patients on oral Hypoglycemic agents and or insulin

Exclusion Criteria

§ Age < 40 and > 55 years
§ Type- I DM
§ History of Diabetic Ketoacidosis
§ Known cases of Hyperlipidemia
§ Patients with advanced liver or renal disease or malignancy were excluded from the study.

The selected patients were divided into two age and sex matched groups depending upon the presence or absence of IHD.

Group A (number =100)

Patients having Type-2-DM and IHD

Group B (number = 100)

Patients having Type 2- DM but no evidence of IHD.

Study Protocol

The patients were studied through a structured questionnaire proforma and the following parameters were recorded for each subject.

Age (years), sex of the patient, weight in kilograms (indoor clothes), height in centimeters without shoes, occupation of the patient, duration of DM in years, duration of IHD, history of Hypertension, smoking habits, family history of DM, treatment history, socio economic class, body mass index (weight in kgs / height in m2), blood pressure in mmHg.

Type 2- diabetes mellitus was defined according to ADA 2004 (13), fasting blood sugar of 126 mg/dl on more than one occasion, random blood sugar of 200 mg/dl in the presence of polyuria and polydipsia, taking hypoglycemic drugs or insulin, or physical exercise therapy for diabetes and not having any episodes of ketosis.

Blood pressure (BP) was measured early in the morning and prior to drawing of blood samples using a suitable mercury sphygmomanometer after a 10 minute rest with the patient in the sitting position. BP was measured twice at 5 minute interval. The first and the fifth Korotkoffs sound were used to determine the systolic and diastolic blood pressure measurement respectively. The second blood pressure measurement was used as the blood pressure for the individual. The WHO definition of hypertension was used in this study: systolic blood pressure 160 mmHg or more and/or a diastolic blood pressure 95 mmHg or more (14), or if the patient is on treatment with antihypertensive drugs.

Height was measured without shoes, and weight was recorded while wearing indoor clothing. Body mass index (BMI) (weight in kg, divided by height in meters squared) was calculated. The WHO (1995, 2002) classification for BMI was used to estimate the degree of obesity (15). Fasting blood samples were taken to assess lipid profile, blood sugar and glycated hemoglobin (HbA1C) levels. Total lipid profile (high density lipoprotein (HDL) , low density lipoprotein (LDL) and triglycerides) was measured by a capillary tube whole blood method using the Cholesterol LDX lipid analyzer.

Dyslipidaemia was taken to be present when the total cholesterol was >5.60 mmol/L and/or triglycerides >2.10 mmol/L, LDL >3.4 mmol/L, and/or HDL <0.91 mmol/L. Fasting blood glucose was measured by glucose oxidase method; Clinical Chemistry Analyzer. Glycated haemoglobin (HbA1C) was measured using the Bayer DCA 2000+ analyzer and a value of less than 7% was taken to indicate good glycemic control.

Urine samples were collected in the early morning after overnight fast. Urine creatinine was measured using Jaffes method. Urine microalbumin concentration was measured using commercially available immuno-turbidometric assay kits from Randox, on Opera Technicon Auto Analyser). The urine sample was added to a buffer containing antibody specific for human serum albumin. The absorbance of the resulting turbid solution is proportional to the concentration of the albumin in sample solution. By constructing a

standard curve from the absorbance of the standards, the albumin concentration in the sample can be determined. According to the American Diabetes Association (ADA), when using the random collection technique, normal albumin excretion should be defined as <30 mcg/mg of creatinine; microalbuminuria 30 to 299 mcg/mg of creatinine, and macroalbuminuria is 300> mcg/mg of creatinine (16).

IHD is evidenced by documented clinical history of angina pectoris or myocardial infarction, or diagnosed on resting ECG with the following criteria:

a. Significant Q waves (> 40 ms) consistent with a prior MI
b. Resting ST segment depression (> 1 mm in limb leads and 2 mm in chest leads),or
c. T wave inversion suggestive of myocardial ischaemia.

The diagnosis of IHD was also supported by positive Exercise Tolerance Test (Bruce Protocol).

Statistical Analysis

The data was computerized and analyzed using SPSS version 7.5. The results are expressed as mean + SD. The difference between the groups was assessed by chi-square test and student's two tailed test for independent samples.

Results

A total of 200 diabetic patients comprising 100 males (50%) and 100 females (50%) with the age ranging from 40 to 55 years were studied. Depending upon the presence or absence of IHD, the selected subjects were divided into two groups i.e.,

Group A (n= 100) Diabetics with IHD
Group B (n=100) Diabetics without IHD

Both groups were studied independently for various risk factors including BMI, HbA1c, serum triglycerides, HDLs, serum LDL, hypertension, smoking and microalbuminuria. The mean values thus obtained were compared with each other in two groups to analyze the statistical significance of each parameter studied.

Significant results were obtained. Mean values of clinical parameters are shown in Table (1). Type 2- diabetic patients with IHD (group A) had longer duration of DM(11.2±3.1 VS8.4±3.1), were more frequently smoker s(42% VS 23%) and had high BMI > 30kg|m2 (38% VS 13%) P-value =0.0001, than type 2- diabetic patients without IHD (group B).

The presence of hypertension (77% in group A VS 35% in group B) was positively correlated with IHD in our study (p=0.0001) Table (1).

The levels of HbA1c > 7 (71% VS 34%), high serum triglycerides (66% VS 27%) and high serum LDL (58% VS 28%) were significantly higher in group A (DM+IHD) compared to those in group B (DM alone) i.e., p: 0.0001, 0.002and 0.001 respectively. The level of low serum HDL (70% VS 32%) was significantly lower in group A than in group B (p: 0.001).

Microalbuminuria was higher in group A (60%) than in group B (23%), and the difference was statistically significant (p =0.005). (Table 2).

Discussion

The most common cause of death in European adults with diabetes is coronary artery disease (CAD). Several studies have demonstrated they have a risk that is two to three times higher than that among people without diabetes (8). Multiple risk factors are associated with cardiovascular disease in subject with diabetes, including hypertension, hyperlipidemia, obesity and microalbuminuria (12).

Hypertension was the most frequent risk factor of IHD in type 2- diabetic patients in this study (17,18), followed by poor glycemic control (18), dyslipidemia (18,19) and microalbuminuria (20). The prevalence of hypertension in our patients with IHD is 77%. It is the most common prevalent

Factors	Total (200)	With IHD(100)	Without IHD (100)	P-VALUE
Age in year	51.3±2.3	50.3±32	49.1±21	0.2
Male sex %	100(50%)	58(58%)	42(42%)	0.05
Smoking %	65(32.5%)	42(42%)	23(23%)	0.001
Duration of DM in years	9.8±4.1	11.2±3.1	8.4±3.1	0.001
BMI kg/m2	51(25.5%)	38(38%)	13(13%)	0.0001
High BP mmHg	112(56%)	77(77%)	35(35%)	0.0001

Table 1: Clinical characteristics of type 2 diabetic patients with or without IHD

Factors	Total=200	With IHD=100	Without IHD=100	P-value
Serum TG mg/dl	93(46.5%)	66(66%)	27(27%)	0.002
Serum HDL mg/dl	102(51%)	70(70%)	32(32%)	0.001
Serum LDL mg/dl	86(43%)	58(58%)	28(28%)	0.001
HbA1c≥7	105(58.8%)	71(71%)	34(34%)	0.0001
MA	82(41%)	60(60%)	22(22%)	0.005

Table 2: Laboratory characteristics of type 2- diabetic patients with or without IHD

factor in our patients with IHD. Hypertensive diabetic patients have a greater risk of micro vascular and macro vascular complications than normotensive patients (21). People with both diabetes and hypertension have approximately twice the risk of cardiovascular diseases as non diabetic people with hypertension(22).

Poor glycemic control and metabolic derangements is another important issue to mention in this present registry. We found that 71% of type 2- diabetic patients with IHD had poor glycemic control (HbA1c > 7). A cohort study from the Asia Pacific Region clearly indicated a positive continuous association between usual blood glucose and cardiovascular disease risk (23). Autonomic function is influenced by glycemia and exerts a crucial role in the control of blood pressure and cardiac function. The disruption of this physical mechanism impacts deeply on cardiovascular mortality in diabetes (24).

The significance of increased plasma TG and LDL levels and decreased HDL level as a risk factor for IHD has been controversial. Some studies show direct association of high lipid levels with atherogenecity(25). But other studies show the association of atherogenecity of triglycerides via decreased HDL levels. In our study population Type-II DM patients with IHD had higher levels of total triglycerides (p: 0.002), high LDL and lower levels of HDL (p: 0.001) than patients without IHD. This is in accordance with other international studies (25-27).

The most recent positional statements of the American Diabetic Association (ADA) regarding the managements of cardiovascular risk factors in adults with diabetes recommends maintaining tight control of glycemia (HbA1c 7%) ,serum lipid (LDL 100mg \dl , HDL 45mg/\dl , and TG 200mg/dl) and blood pressure (< 129mmg systolic and < 84 mmg diastolic) in persons with type 2-diabetes as a means of reducing the potential burden of cardiovascular morbidity and mortality on this population (28,29).

Cigarette smoking has been proven as an independent modifiable risk factor for IHD (26). Cigarette smoking appears to be the most important risk factor for IHD in countries where the incidence of IHD is higher (27) even passive smokers may also be at risk. Our study showed smoking to be positively co-related with IHD, p: 0.001.

Microalbuminuria is usually the first sign of renal complications in a diabetic person. Increasing albuminuria is predictive of both the incidence of CAD and of mortality. (30) The level of microalbuminuria is therefore a good marker of subsequent heart disease, as well as renal disease.

The Strong Heart Study demonstrated a significant association between microalbuminuria and echocardiographic parameters of LV systolic and diastolic function in a cohort of 1576 Native Americans with diabetes (28). Furthermore, a correlation has been noted between urinary albumin excretion (UAE) and echocardiographic measures of LV mass index, LV hypertrophy, and concentric hypertrophy in untreated hypertensive patients (31). The larger Losartan Intervention For Endpoint reduction in hypertension (LIFE) study confirmed this finding (27).

Obesity and type 2 diabetes mellitus frequently occur together. They are closely linked by commonality of aetiology and pathogenesis (genetics, insulin resistance and lifestyle).

Both of these chronic diseases are major causes of morbidity and mortality from atherogenic coronary heart disease, resulting also in increased economic costs(32). Our study showed significant association between obesity and IHD.

Epidemiological studies have reported that patients with type 2 diabetes mellitus (DM) have increased mortality and morbidity from cardiovascular diseases, independent of other risk factors(32). Almand T et al (2004)(17) showed that type 2- Diabetic patients had a 2-3 fold risk of having incident myocardial infarction. Moreover the above study confirmed that patients with type 2- DM have a 2-fold increased risk of death independent of other known risk factors for cardiovascular disease.

Conclusion

Diabetes Mellitus is emerging in our country as a non-infectious epidemic disease. The prevalence of IHD in type 2- diabetes in this study was high, as well as its associated risk factors so we recommend that any patients with type 2- diabetes should have proper control of these risk factors especially poor glycemic control and high blood pressure.

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