

Exercise stress test and coronary angiography in diabetic patients with occult ischaemic heart disease

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ABSTRACT

Background: Diabetes mellitus (DM) is among the most common chronic diseases in the world, affecting about 180 million people in 2008, and the number is expected to be doubled by 2030 There are as many as 12.5 million diabetic patients with silent coronary artery disease.

Aim: The aim of this study was to assess the incidence and extent of coronary artery disease among diabetic patients with occult CHD.

Methods: A comparative study of asymptomatic diabetic patients and control group for evidence of CAD was conducted over the period from May 2012 to November 2013. The studied population includes a total of 82 diabetic patients and 82 healthy persons as a control group. Both diabetic and control groups underwent exercise stress test by treadmill, and coronary angiography was done to patients with positive test.

Results: There was highly significant association ($P<0.01$) between CAD and positive exercise stress test in diabetic group but no association in control group, CAD was present in 50% (8/16) of patients with DM and positive exercise stress test whereas in control group no one of them had CAD (0/6).

Conclusions: The study show that there is highly significant association between diabetes mellitus and coronary artery disease in asymptomatic diabetic patients.

Keywords: Diabetes Mellitus, Exercise Stress Test & Coronary Angiography.

فحص اجهاد القلب وقسطرة شرايين القلب لمرضى السكري الذين لا يشتكون من امراض القلب

المقدمة: مرض السكري هو احد اكثر الامراض المزمنة شيوعا في العالم، حوالي ١٨ مليون شخص مصابين بداء السكر عام ٢٠٠٨ وهذا الرقم من المتوقع ان يتضاعف سنة ٢٠٣٠. حوالي ١٢،٥ مليون مريض مصاب بالسكري يعانون من قصور الشرايين التاجيه القلبيه الصامت .

الاهداف: هو الكشف عن وجود ومدى شدة قصور الشرايين التاجيه عند مرضى السكري.

طريقة البحث: اجريت دراسته بين ٨٢ مريض مصاب بداء السكر لا يشتكون من اعراض القلب وبين عينه مقارنه من الاشخاص الاصحاء للفترة من مارس ٢٠١٢ الى ايلول ٢٠١٣. وقد اجري فحص اجهاد القلب لجميع المرضى وعينة المقارنه بينما اجريت قسطرة القلب للاشخاص الذين كان فحص اجهاد القلب موجب عندهم.

النتائج: كانت هناك علاقه مهمه بين مرض السكري وفحص اجهاد القلب حيث كان موجب بنسبة ٢١،٩٥% (٨٢/١٨) بينما كانت نسبته ٧،٢١% (٨٢/٦) عند الاصحاء .

ثم اجريت قسطرة شرايين القلب لاصحاب فحص اجهاد القلب الموجب من كلا المجموعتين وقد بينت قسطرة الشرايين القلبيه ان هناك علاقه مهمه بين مرضى السكري و قصور الشرايين التاجيه القلبيه بنسبة ٥٠% (١٦/٨) بينما لم تظهر قسطره القلب اصابة عينة المقارنه (٦/٠).

الاستنتاجات: باختصار هذه الدراسة بينت وجود علاقه مهمه بين قصور شرايين القلب ومرضى السكري الذين لا يشتكون من اعراض امراض القلب . المفردات الاساسيه: داء السكر، فحص اجهاد القلب، قسطرة القلب.

INTRODUCTION

Diabetes Mellitus

Diabetes mellitus (DM) is among the most common chronic diseases in the world, affecting about 180 million people in 2008, and the number is expected to be doubled by 2030,^[1] About 1.1 million people

died of diabetes in 2005, and that number is estimated to increase by 50% in 10 years. The cardiovascular disease (CVD) remains the principle cause of morbidity and mortality in setting of diabetes-most commonly in the form of coronary heart disease (CHD).^[2] Diabetes is

typically classified as type 1 diabetes, characterized by absolute insulin deficiency representing about 10% and type 2 diabetes, characterized by relative insulin deficiency associated with insulin resistance and representing > 90% of all diabetes cases.^[3]

Atherosclerosis

There are as many as 12.5 million diabetic patients with silent Coronary Artery Disease (CAD)^[4]. Patients with diabetes as compared with non diabetic individuals have a twofold to fourfold increased risk of development and dying of CHD.^[5] Diabetes is associated with an increased risk for development of acute coronary syndrome (ACS) events.^[6] Patients with diabetes have worse CVD outcomes after ACS events. Despite overall improvements in outcomes during the past several decades for patients with and without diabetes, the gradient of CVD associated with diabetes persist.^[7]

Exercise Stress Testing

Exercise is a common physiologic stress used to elicit cardiovascular abnormalities not present at rest and to estimate the adequacy of cardiac function. Exercise stress test is one of the most frequent noninvasive modalities used to assess patients with suspected or proven CVD.^[8] The indications for exercise testing continue to evolve, and the most frequent indications are to help in diagnosis of CAD, assessment of functional capacity and estimating prognosis.^[9]

Cardiac Catheterization

Cardiac catheterization should be considered a diagnostic test used in combination with complementary noninvasive tests. Identification of CAD and assessment of its extent and severity are the most common indications for cardiac catheterization in adults, coronary arteriography provides the most reliable anatomic information for determining the appropriateness of medical therapy, percutaneous coronary intervention (PCI), or coronary artery bypass surgery (CABG) and

subsequently become one of the most widely used invasive procedures in cardiovascular medicine.^[10]

The aim of study

The aim of this study was to assess the incidence and extent of coronary artery disease among diabetic patients occult CHD.

PATIENTS AND METHODS

A study of asymptomatic diabetic patients and control group for evidence of CAD was conducted over the period from May 2012 to November 2013. The studied population includes a total of 82 diabetic patients referred to Basrah Teaching Hospital for control of diabetes. Forty (40) of them with type I diabetes mellitus and the remaining 42 patients with type II. A patient was considered diabetic if he/she taking insulin or oral hypoglycemic agents, or met the criteria of the National Diabetes Data Group and WHO criteria for diagnosing DM. These criteria involve the followings (inclusion criteria):

- 1. Symptoms of DM plus Random Blood Sugar (RBS) > 11.1 m mol/L (200 mg / dL)**
- 2. Fasting blood glucose (FBS) > 7.0 m mol/L (126 mg /d L)**
- 3. Two hour plasma glucose > 11.1 m mol/ L (> 200 mg /dL) during an Oral Glucose Tolerance Test (OGGT) (11).**

An 82 healthy subjects were also studied and considered as control group. The studied population (both diabetic and control groups) has no clinical evidence of ischaemic heart disease (IHD), with normal resting electrocardiography (ECG) and resting echocardiography. Patients with other cardiac risk factors like hypertension, smoking and obesity were excluded from this study. The studied population underwent exercise stress by treadmill test for detection of silent ischaemia

and the test was considered positive if patient has ^[12]:

1. Downsloping or horizontal ST segment depression.
2. Reproducible sustained or symptomatic ventricular tachycardia.
3. Exercise- induced ST segment elevation.
4. Angina pectoris at low exercise workload.
5. Failure to increase systolic blood pressure > 120 mm Hg or sustained decrease > 10 mm Hg below rest level.

Patients with positive exercise stress test were subjected to cardiac catheterization to confirm the presence of CHD. Cardiac catheterization were performed by Judkins technique after local anasthaesia with 1% lidocaine, percutaneous entry of femoral artery was achieved by puncturing the vessel 1-3 cm below inguinal ligament. An 18 gauge thin needle was inserted at 30-45 degree angle into femoral artery and J tip guide wire was advanced through the needle into the artery then a sheath was inserted into the femoral artery. Selective coronary angiography was performed in multiple views, and coronary stenoses were seen by an experienced angiographers, and significant coronary artery disease was considered present

if there was 70% and more lumen diameter stenoses except for the left main coronary artery (LMCA) was 50% and more. ^[13]

The statistical analysis of the results were done by SPSS version 16.

RESULTS

The study included 82 patients with diabetes milletus, 40 had insulin dependent diabetes milletus with a mean age of 30.3 ± 2.83 years and 42 patients had non-insulin dependent diabetes milletus with a mean age 48.11 ± 6.36 years. Of the studied 82 diabetic patients, 41 were males and 41 were females. The study also included a control group of 82 persons had no diabetes milletus, with a mean age 41.75 ± 7.55 years, 42 of them were males and 40 were females. Exercise stress test shown in (Table-1), the result of the study shows that the prevalence of positive exercise stress test in patients with diabetes milletus was 21.95%, it was significantly (P-value < 0.01) higher than in control group 7.31%. There was no statistically significant (P > 0.05) difference in the prevalence of positive exercise stress test between patients with IDDM and NIDDM as shown in (Table-2).

Table 1. Prevalence of positive exercise stress test in diabetic and control patients.

Test	Patients with diabetes milletus		Controls	
	No.	%	No.	%
Positive	18	21.95	6	7.31
Negative	64	78.05	76	92.69
Total	82	100.0	82	100.0

Chi-Square =7.029 P value = 0.008

Table 2. Prevalence of positive exercise stress test in IDDM and NIDDM patients.

Test	Patients with IDDM		Patients with NIDDM		Total	
	No.	%	No.	%	No.	%
Positive	6	15	12	28.57	18	21.95
Negative	34	85	30	71.43	64	78.05
Total	40	100.0	42	100.0	82	100.0

Chi-Square =2.20 P value =0.138

The result of exercise stress test among diabetic patients with two different duration of disease was compared; patients with diabetic duration of 10 years and more and patients with diabetic duration less than 10 years. The prevalence of positive exercise stress test was higher in diabetic patients with longer duration of disease

as shown in (Table-3), it was statistically significant ($P < 0.05$). Among patients with duration of diabetes mellitus of 10 years and more 12 (33.33%) compared to 6 (13%) showed positive test of patients with diabetic duration less than 10 years.

Table 3. Positive exercise stress test in relation to duration of DM.

Test	Duration < 10 y		Duration > 10 y		Total	
	No.	%	No.	%	No.	%
Positive	6	13	12	33.33	18	21.95
Negative	40	87	24	66.67	64	78.05
Total	46	100	36	100.0	82	100.0

Chi-Square = 4.853 P value = 0.028

Patients with positive exercise stress test subjected to coronary angiography to confirm the presence of coronary artery disease. (Table-4), shows highly significant association ($P < 0.01$) between CAD and positive exercise stress test in diabetic group than in control, CAD was

present in 50% (8/16) of patients with DM and positive exercise stress test whereas in control group no one of them had CAD (0/6). The majority of patients with significant coronary artery disease in diabetic group are those with type II 14.28% compared to 5 % in type I.

Table 4. Prevalence of IHD among diabetic and control groups

Angiography	Type I Diabetes mellitus		Type II Diabetes mellitus		Controls	
	No.	%	No.	%	No.	%
Positive	2	5	6	14.28	0	0
Negative	38	95	36	85.72	82	100
Total	40	100.0	42	100.0	82	100.0

Chi-Square =12.21 DF = 2 P value = 0.002

DISCUSSION

As silent ischaemia presented mostly in diabetic patients than non-diabetic patients (14-16), the present study evaluates the association between the presence of diabetes mellitus and coronary artery disease among asymptomatic patients by exercise stress test and confirmation by coronary angiography (for detection of silent ischaemia). The positive exercise stress test was significantly higher in diabetic patients than in control group ($P < 0.01$) in whom coronary

angiography was performed to confirm the presence of coronary artery disease and it was highly significant ($P < 0.01$), and the coronary artery disease was higher in patients with NIDDM than in IDDM (14.28 % vs 5%). This is compatible with Blandine et al,^[17] who were prospectively screened 203 diabetic patients without chest pain or anginal symptoms and who had normal resting ECGs with exercise ECG tests, 16% of them had an abnormal stress

test, whereas 9% had silent CAD as defined by angiography. The vast majority of patients (84%) with silent angiographic CAD had type 2 DM(NIDDM). The present study also showed that the positive exercise stress test was higher in diabetic patients with longer duration of disease (patients with diabetes of 10 years and more than in patients with diabetes duration of less than 10 years), this is similar to the recommendations of American College of Cardiology/American Heart Association and American Diabetes Association^[18,19] that recommend an exercise ECG test be performed in patients with DM who have T2DM for > 10 years, additional atherosclerotic risk factors, known or suspected CAD. The pathophysiology of silent ischemia remains controversial, and other factors may also play a role, including ischemic damage to nerve endings, differences in plasma opioid receptors, and psychological factors. Regardless of the cause, silent ischemia may mask or delay the diagnosis of CAD, contributing to more advanced disease when it is finally diagnosed.^[20]

In conclusion, there is highly significant association between diabetes mellitus and coronary artery disease and since the exercise stress testing remains, inexpensive and a well-established test.

We recommend, screening for coronary artery disease with exercise stress test in patient who have DM with duration > 10 years even if he/she is asymptomatic.

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