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PREVALENCE OF PREDIABETES IN EGYPTIAN PATIENTS WITH ISCHEMIC HEART DISEASE UNDERGOING CORONARY ANGIOGRAPHY

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Contribution
All the authors contributed significantly to the research that resulted in the submitted manuscript.

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ABSTRACT

Objectives: We aimed to determine the prevalence of prediabetes among Egyptian patients who were not known to have diabetes or prediabetes & referred for coronary angiography.

Methodology: The study included 1000 consecutive Egyptian patients who were referred to undergo coronary angiography for suspected ischemic heart disease (IHD). They were screened for prediabetes with either impaired

Results: The study included 1000 consecutive Egyptian patients who were referred to undergo coronary angiography for suspected ischemic heart disease (IHD). They were screened for prediabetes with either impaired fasting glucose (IFG) or impaired glucose tolerance (IGT). The mean age was 52.35 ± 7.02 years. Overall 23% of patients had prediabetes, either isolated IFG, isolated IGT or both.. Among female patients 26.33 % were prediabetic while 21.43% male patients were prediabetic. Females and prediabetic patients had a higher Body Mass Index (BMI). Prediabetes was more prevalent among patients with acute coronary syndrome (ACS) than patients with stable ischemic heart disease (IHD).

Conclusion: Prevalence of prediabetes is higher among Egyptian patients with IHD and they should be screened for it.

Key Words: Prediabetes, Diabetes, Egyptian, Prevalence

INTRODUCTION

Prediabetes is an asymptomatic condition preceding diabetes including both impaired glucose tolerance (IGT) & impaired fasting glucose (IFG) and refers to blood glucose level higher than normal but not reaching the level at which diabetes is diagnosed[1,2]. IFG is defined as fasting blood glucose (FPG) values of 100 to 125 mg/dl (Normal fasting glucose level < 100 mg/dl).[2] IGT is defined as 2 hours post prandial glucose (PPG) of 140 to 199 mg/dl (Normal 2 hours postprandial glucose level < 140 mg/dl).

The progression from normal glucose tolerance to type 2 diabetes is characterized by dual defects; insulin resistance that means decreased tissue sensitivity to insulin & insulin secretory defects by pancreatic Beta cell dysfunction[3]. The first glucose abnormality that is detected is a rise in the postprandial glucose levels due to reduced first-phase insulin secretion. With time, further decline in Beta cell function leads to elevation of fasting glucose levels. Eventually, diabetes occurs, with more insulin secretory loss.[4]

Both prediabetes & diabetes highly predispose to cardiovascular alterations. Diabetes is also associated with worse outcomes of revascularization in the form of increased instent restenosis & increased MACE in PCI & CABG. Very recently fasting blood glucose was found to be an independent risk factor for poor long term outcome & was associated with enhanced platelet reactivity & low response to clopidogrel in patients with ACS & poor long term outcome of PCI[5].

METHODOLOGY

Study protocol was approved by the institutional review committee. All patients gave informed consent. The study included 1000 consecutive Egyptian non diabetic patients (no previous diagnosis of diabetes nor prediabetes) presenting to the National Heart Institute cath. lab in Cairo governorate, from January to June 2010 with either new ischemic event in the form of ACS or were known stable IHD patients. They were referred for coronary angiography that showed significant lesions according to ACC/AHA definitions and were screened for prediabetes with either impaired fasting glucose through checking their fasting blood sugar or impaired glucose tolerance through checking their 2 hours postprandial blood sugar.

All patients were subjected to detail medical history, clinical examination. Electrocardiogram (ECG), laboratory analyses including fasting blood sugar, 2 hours post prandial blood sugar and serum creatinine and coronary angiography was done using the standard techniques.

All non diabetic patients (no previous diagnosis of diabetes or prediabetes) referred for coronary angiography either after ACS or suspected to have chronic ischemic heart disease and patients diagnosed as having coronary artery disease (50 % stenosis) [ACC/AHA definition of significant coronary artery disease] were included in the study.

Frank diabetic patients (previously diagnosed) and individuals with normal coronaries were excluded from the study.

RESULTS

The mean age of all patients in our study was 52.35 ± 7.02. There was no statistically significant value of affection of certain range of age with prediabetes nor with CAD.

Patients were classified into 4 groups according to the results of their fasting plasma glucose (FPG) after fasting for 8 – 10 hours & PPG 2 hours after 75 gm oral glucose intake, based on 2007 ADA guidelines as group I: Isolated IFG (FPG 100 – 125 mg/dl & PPG < 140 mg/dl), group II: Isolated IGT (FPG 100 – 125 mg/dl & PPG 140 – 199 mg/dl), group III: combined IFG & IGT (FPG 100 – 125 mg/dl & PPG 140 – 199 mg/dl) & group IV: normal glucose tolerance (FPG < 100 mg/dl & PPG < 140 mg/dl).

It was noticed that 23 % of the included patients had prediabetes. Group I (IFG) included 48 patients (4.8 %), group II (IGT) included 123 patients (12.3 %), group III (IFG & IGT) included 59 patients (5.9 %). The prediabetic male patients were 146 [29 in group I, 72 in group II & 45 in group III] representing 21.43 % of total number of males (681 patients) while prediabetic female patients were 84 [19 in group I, 51 in group II & 14 in Group III] representing 26.33 % of total number of females (319 patients). This shows that females are more significantly affected with prediabetes than males (Table 1).

Patients admitted with ACS were 761 (76.1 %)] while those admitted with stable CAD were 239 (23.9 %)]. There were 179 (23.52 %) prediabetics among the patients with ACS [41 in group I, 100 in group II & 38 in group III] and 51 (21.34 %) among stable IHD [7 in group I, 23 in group II & 21 in group III] . It was noticed that prediabetes was more prevalent among patients with ACS than among patients with chronic IHD {Table 2}(Figure 1).

BMI was 22.2 - 34.4 with a mean of 26.701 ± 2.657 in group I, 21.5 – 31.7 with a mean of 26.957 ± 2.025 in group II, 20.5 – 34.3 with a mean of 26.877 ± 2.496 in group III & 21.3 – 33.8 with a mean of 24.096 ± 2.037 in group IV. It is noticed that the mean BMI among patients of group IV with normal glucose tolerance is lower than that of the other 3 groups of prediabetes that was statistically significant. It was noticed also that the mean BMI among prediabetic female patients was higher (Table 3).

Table1: Gender and group wise distribution of Prediabetes

Group	Male (681)	Female (319)	Total (1000)
I n (%)	29 (4.28)	19 (5.95)	48 (4.8)
II n (%)	72 (10.57)	51 (15.98)	123 (12.3)
III n (%)	45(6.8)	14 (4.38)	59 (5.9)
Total n (%)	146 (21.43)	84(26.33)	230 (23.0)

Table 2: Distribution of Prediabetes in ACS vs stable IHD

Group	ACS (761)	Stable IHD (239)	Total (1000)
I n (%)	41 (5.38)	7 (2.92)	48 (4.8)
II n (%)	100 (13.14)	23 (9.62)	123 (12.
III n (%)	38 (4.99)	21 (8.78)	59 (5.9)
Total n (%)	179 (23.52)	51 (21.33)	230 (23.0)

Figure 1: Prediabetes was found to be more prevalent among patients admitted with ACS

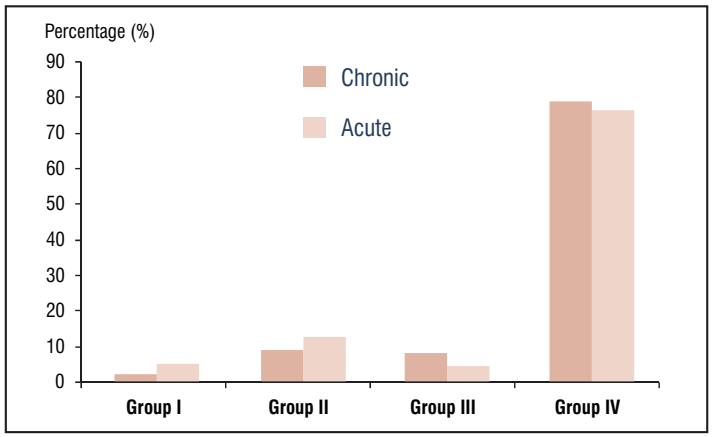

Table 3: Mean BMI among prediabetic male and female patients

BMI	Range	Mean ± SD
Males	22.3 – 33.5	25.602 ± 2.314
Females	20.5 – 34.4	27.861 ± 2.251

DISCUSSION

Diabetes and CVD often appear as the two sides of a coin: on one side, DM has been rated as an equivalent of CAD, and conversely, many patients with established CAD suffer from DM or its pre-state. Categories of abnormal glucose homeostasis have been defined with the goal of screening for diabetes risk.[6] IGT and the more recently created category of IFG identify individuals at increased risk for developing diabetes, based on postchallenge or fasting glucose levels, respectively. It has been suggested that IGT and IFG are associated with varying rates of progression to diabetes and differences in CVD risk.[6]

As already remarked, diabetes and pre-diabetes are painless and remain undetected if not investigated. Screening for elevated glucose (pre-diabetes) is therefore important for prognostic reasons.

In this study we selected patients who were neither diabetics nor prediabetics by medical history but known to have

coronary artery disease documented by coronary angiography aiming to detect the prevalence of prediabetes among them. We have measured fasting blood glucose after overnight fasting for 8 – 10 hours and 2 hours postprandial blood glucose to diagnose IFG and IGT respectively according to ADA 2007 criteria.

We found that 23 % (n= 230) of patients included in the study had prediabetes that was not previously diagnosed. More than half (n= 123) of the prediabetic patients had isolated IGT while the other half had either isolated IFG (n= 48) or combined IFG & IGT (n= 59).

The Euro Heart Survey on Diabetes and the Heart, a cohort of 4961 people from 110 centers in 25 countries across Europe presenting with CAD, revealed that a third of the patients with acute and stable CAD were known to have DM. When an OGTT was performed, another 15 % of acute patients and 10 % of stable patients were shown to have diabetes that was not yet recognized. Furthermore, about 25 % had IFG or IGT. Thus, the majority of patients with acute or chronic CAD had an abnormal glucose metabolism. A coronary event often was the first manifestation of diabetes.[7]

Similar results were found in the AusDiab study, a population-based national survey of the Australian general population aged 25 years residing in 42 randomly selected urban and rural areas, which revealed that among 1515 Australian men and women, 4.2 % had IFG & 10.5 % had IGT in the year 2004.[8]

However, in the China Heart Survey aimed at characterizing the glucometabolic state of patients with CAD in China, the results were different. This multicentre study recruited 3513 patients hospitalized for CAD. At entry, 1153 patients had known type 2 diabetes and 97 had newly diagnosed diabetes. OGTT was performed in the remaining patient. It was revealed that 37.3 % had impaired glucose regulation (1.4 % had isolated IFG, 32.6 % had isolated IGT and 3.3 % had combined IFG & IGT) while 26.9 % had newly diagnosed DM. This suggests that abnormal glucose regulation is more common in patients with CAD in China.[9] The large number of patients in China Heart Survey and different study protocols might be a cause of divergent results from ours.

Sourij et al, in their study, enrolled 1040 patients undergoing coronary angiography for evaluation of suspected or established CAD. In patients without previously established DM, an OGTT was performed. Prospectively, mortality and macrovascular events were recorded over a mean follow-up period of 3.8 years. Patients who had NGT were 394 (37.9%), while 280 patients (27%) had post-challenge hyperglycemia including IGT and post-challenge DM. Finally conventional diabetic patients were 366 (35.1 %).[10]

Patients involved in the present study were referred to undergo coronary angiography after having new ischemic event (ACS) or were chronic IHD patients and referred to do angiography electively. Prediabetes was prevalent among 23.52% of the newly ischemic patients (n=179) while it prevailed among 21.34% of the chronic ischemic patients (n= 51) that was nearly similar although a little bit higher in the acute group. This might be due to the more stressful condition of patients in the acute group than those in the chronic group. It was noticed also that isolated IGT was commoner in both groups followed by combined IGT & IFG and finally came isolated IFG.

In contrast to our results, Dtevall et al. found in their analysis of 4855 patients having CAD within the framework of the Euro Heart Survey that there were no major differences in the influence of diabetes on clinical presentation and symptoms between men and women. Differences between patients with diabetes and those with NGT were usually more apparent than differences between patients with impaired glucose regulation and normal glucose metabolism, respectively.[11] Different study populations, and a larger number of subjects with diabetes in their study, might explain the divergent results between their study and our one. In China Heart Survey, patients admitted in acute condition represented 35.13 % of the total number of included patients (n=1234) while those admitted electively represented 64.87 % of the total number of included patients (n=2729). Among the OGTT cohort, it was found that patients with new impaired glucose regulation among acute group represented 39.1 % (n=302) while they represented 36.4 % (n=542) among elective group patients.[9] This might be also explained by larger number of patients and different protocol as well as racial reasons.

In the DECODE study, a large cohort study in which a total of 13 studies from 9 European countries with 7680 men and 9251 women aged 30 – 89 years were included in the data analysis, it was found that the prevalence of impaired glucose regulation rose with age in each study. In most of the study population, the prevalence of IGR was less than 15 % at 30 – 59 years of age and between 15 and 30 % after 60 years of age. The prevalence of IGT increased linearly with age, but the prevalence of IFG did not.[13]

In our study, the high risk profile among the prediabetic patients varied, with hypertension being commoner in prediabetic females than in prediabetic males (56.4 % in females and 43.6 % in males) and higher BMI in prediabetic females than in prediabetic males (mean of 27.8 in females and mean of 25.6 in males).

In contrast to our results, The Honolulu Heart Program found that the rates of hypertension, mean levels of BMI, waist-to-hip ratio, triglycerides and fasting insulin were higher in men with IGT and diabetes compared with normal subjects. Opposite trends were observed for HDL cholesterol. No significant differences were observed for current smoking and alcohol intake. Differences in risk factor levels by glucose tolerance status remained after adjustment for age,

physical activity, BMI and waist-to-hip ratio[12]. It should be noted that the results were taken and analyzed from only men, who completed OGTT.[12]

It should be stressed that in our study, the prediabetic patients were diagnosed according to both FPG and 2h-PG as recommended by ESC guidelines on prediabetes, DM and CVD. 23 % were found to have prediabetes, more than half of which (n=123) would be missed if only FPG was measured as IGT group that were diagnosed according to ESC guidelines criteria by isolated elevation of 2-h PG.

This comes in agreement with many studies that justify the crucial role of 2-h PG in OGTT in diagnosing prediabetic patients who do not meet criteria of IFG detected by measuring FPG only. In the Euro Heart Survey prediabetic patients were detected through OGTT.[7] In the Honolulu Heart study, prediabetic male patients were detected after completing OGTT.[12] In the AusDiab study the diagnostic criteria of IFG and IGT were based on values from the OGTT[8]. In the China Heart Survey, 87.4 % of patients with impaired glucose regulation would have remained undiagnosed if OGTTs had not been performed.[9] The DECODE study also followed the same protocol. It reported that IGT, not IFG, was a strong predictor of all-cause and cardiovascular mortality, independent of FBG.[13]

CONCLUSION

Based on the results of the current study, it can be concluded that prediabetes (isolated IGT, isolated IFG or combined IGT & IFG) is prevalent among CAD Egyptian patients at a considerable ratio that's why they should be screened for having it. 2 hours post-prandial blood glucose measurement is crucial in diagnosis of IGT patients who do not meet diagnostic criteria of IFG that is diagnosed by fasting blood glucose.

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