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Comparative study of cardiovascular functions among asymptomatic diabetic elderly and nondiabetic elderly

KEYWORDS: diabetes, elderly, cardiovascular dysfunction, ejection fraction

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ABSTRACT *Background: Diabetes has always been linked to ischaemic heart disease. The aim of this study was to compare cardiovascular function in asymptomatic diabetic elderly versus nondiabetic elderly. Methods: Case-control study, 60 diabetic patients and 60 nondiabetic patients, age and sex matched no symptoms of any heart disease. Consent, medical history, blood sample (fasting blood sugar, 2hr postprandial blood sugar, lipid profile, C-reactive protein), and trans-thoracic echocardiography were done. Results: The left ventricular end diastolic diameter (LVEDD), left ventricular end systolic diameter (LVESD), left atrial diameter (LAD) and intima media thickness (IMT) were significantly higher in diabetics while ejection fraction (EF) and fraction shortening (FS) were significantly lower in diabetics and the results were similar in both genders. Conclusion: Many studies have shown that diabetic hearts demonstrate cardiac dysfunction and the current study backs up these results. Left ventricular affection was specifically common between all studies despite the absence of ischemia.*

Introduction

Within the age group 65 and above, cardiovascular disease will remain the leading cause of death, and the cost associated with treatment will continue to increase. [1]. Previous studies in normotensive subjects have shown a slight decline in resting left ventricular pump function and midwall contractility with aging [2].

Moreover, Selvin et al., 2006 [3] documented a high prevalence of diabetes and high rate of poor glycemic control among elderly individuals.

Epidemiologic data from the Framingham study has shown that diabetes is a major independent risk factor for cardiovascular disease even after adjusting for other confounding risk factors such as age, hypertension, hypercholesterolemia, and tobacco abuse [4].

An ejection fraction lower than 55% indicates some degree of heart failure [5]. Large epidemiological studies have confirmed diabetes mellitus to be an independent risk factor for the development of heart failure [6]; Rubler et al. [7] first described the existence of 'diabetic cardiomyopathy' in 1972 based on four adult diabetic patients with congestive heart failure (CHF) that could not be explained by coronary artery disease (CAD), hypertension, valvular heart disease, or alcoholism. Subsequently, the term 'diabetic cardiomyopathy' as a diastolic and/or systolic CHF in diabetic patients in the absence of significant concomitant CAD or arterial hypertension has been defined.

While diastolic dysfunction plays an important role regarding CHF in diabetic patients, the results regarding the systolic function were not conclusive. It is well known that LVEF is an important prognostic variable [8]. Moreover, people who have diabetic heart disease tend to have less success with some heart disease treatments, such as coronary artery bypass grafting and angioplasty [9].

The prognostic importance of subclinical dysfunction and the possibilities for intervention are not fully known, and further studies are warranted before introducing general early echocardiographic screening in patients with diabetes. [10].

Hence, this study was intended to compare the cardiac parameters in asymptomatic elderly nondiabetics and elderly diabetics.

Materials and methods

Participants and design

A case-control study recruited 120 subjects, 60 years or above from Ain Shams University outpatient clinics. Subjects with comorbidities other than diabetes were excluded (e.g. ischemic heart disease). Sixty subjects with diabetes (cases), previously diagnosed and on therapy and sixty apparently healthy subjects with no history of any disease (controls).

Informed oral consent, full medical history, body mass index calculated=weight/(height)^2, 12hour fasting venous blood sample and 2hr after food was taken and transthoracic echocardiography were performed.

The serum was used to measure fasting blood sugar, 2hr postprandial blood sugar, cholesterol, LDL, HDL, triglycerides and C-reactive protein.

The transthoracic echocardiography was done via 2.5-3.5 MH transducer, measurements were from transapical or parasternal views (except in poorly echogenic subjects a subcostal view was used).

Statistical analysis

Data collected was revised, and analyzed using version 17 of the statistical package for social sciences. Qualitative data was presented as frequency. Quantitative data was presented in the form of mean ± standard deviation. Independent t test was used to compare groups with quantitative continuous variables. The probability of error at 0.05 was considered significant, while at 0.01 and 0.001 are highly significant.

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Results

The mean age of the diabetic group was 67.78±5.71 years and the nondiabetic group was 66.70±4.65 years. The mean duration of diabetes in the diabetic patients was 11.12±4.79 years. Table 1 demonstrates several cardiac parameters in both groups studied and among genders; table 2.

Discussion

In the current study when comparing asymptomatic diabetics with healthy elderly many echocardiographic parameters differed. The LVEDD, LVESD, LAD and IMT were significantly more in diabetics while EF and FS were significantly less in diabetics. In the last decades, the systolic function in diabetic vs. non-diabetic patients has been investigated repeatedly, although mostly in cohorts with few patients and with different LVEF measurement methods; in addition, the results were not conclusive: regarding LVEF, most of the studies did not report a difference between diabetic and non-diabetic patients [11, 12, 13], despite some studies that demonstrated a slightly lower LVEF in diabetic patients [14, 15]. In the studies in which a lower LVEF was shown, it was mainly attributed to the fact that CAD is more common and also more often severe in diabetic patients even though the presence and extent of CAD were not taken into account [11, 16, 17, 18]. This gap has been closed in a study by Niklas et al., 2011 [19] were the LVEF was compared in patients without evidence of CAD or in comparable groups when it came to the extent of CAD. Diabetic patients had a lower LVEF than non-diabetic patients (even though the overall difference was small). This difference could be demonstrated regardless of CAD extent and may in part explain their worse cardiac survival compared with non-diabetic patients on an epidemiological level.

Only a few smaller studies have taken the presence of CAD into account, e.g. Htay et al. [12] evaluated the LVEF in 70 patients with diabetes mellitus type 2 and compared the results with gender-matched controls; after having excluded the presence of CAD, mean LVEF was shown to be comparable at least in men with and without diabetes ($p=0.16$) but was lower in women with diabetes compared with women without diabetes ($p=0.04$).

Similarly, the Framingham study reported a significant increase in LV wall thickness only in women with diabetes [20]. In contrast, the Strong Heart Study found that both men and women with diabetes had higher LV mass and wall thickness [21]. Increased LV mass was observed only in patients with diabetes but not in patients with impaired fasting glucose or impaired glucose tolerance [22], suggesting that changes in myocardial geometry in diabetes might not be an early defect but rather a consequence of long term diabetes-associated changes [23]. Diabetic cardiomyopathy might be present even in asymptomatic subjects with normal resting LV dimensions and function. However in some of these individuals with early stage disease, LV dysfunction can be induced by exercise [24].

Despite the gender difference found in some of the above mentioned studies this research only found a widened aortic root diameter in diabetic males when compared to females of the same group, and this difference was not found in the healthy group.

Conclusion:

Many studies have shown that diabetic hearts demonstrate cardiac dysfunction and the current study backs up these results. Left ventricular affection was specifically common between all studies despite the absence of ischaemia.

Disclosure: None.

Table (1): Comparison between the parameters of the cases and the controls

	Cases Mean±SD	Control Mean±SD	t	p
BMI	24.35±2.76	23.87±2.02	0.85	0.40
FBS	159.52±45.95	92.70±14.41	7.76	0.00
2hrs pp	240.35±57.64	136.03±35.95	9.06	0.00
T.Chol.	213.08±34.19	189.00±44.01	2.86	0.00
TG	118.25±21.64	111.27±17.29	1.54	0.13
HDL	44.75±10.66	46.30±11.77	0.63	0.53
LDL	126.08±25.39	121.03±17.65	0.98	0.33
CRP	6.90±2.88	0.57±0.30	11.99	0.00
LVEDD	52.16±6.22	47.97±5.08	3.20	0.00
RWT	0.20±0.05	0.20±0.06	0.40	0.69
LVESD	34.92±8.12	30.12±4.97	2.97	0.00
EF	58.57±14.22	67.47±6.48	3.26	0.00
FS	33.68±8.90	37.45±5.71	2.11	0.04
LAD	43.37±7.06	35.93±4.90	5.18	0.00
Aortic-RD	30.78±4.60	30.25±3.80	0.54	0.59
IMT	3.71±1.06	2.51±0.61	5.72	0.00

BMI=body mass index, FBS= fasting blood sugar, 2hrs pp=2hour postprandial blood sugar, T.chol= total cholesterol, TG=triglycerides, HDL= high density lipoprotein, LDL= low density lipoprotein, CRP= C-reactive protein, RWT= relative wall thickness, Aortic-RD= aortic root diameter.

Table (2): Comparison between data of both genders in both groups

	Cases (mean±SD)		t test	Controls (mean±SD)		t test
	Males	females	P	Males	Females	p
LV EDD	51.98±6.17	52.34±6.36	0.83	48.20±4.33	47.73±5.89	0.81
RWT	0.21±0.05	0.20±0.04	0.20	0.22±0.06	0.18±0.06	0.15
LV ESD	33.89±7.70	35.94±8.52	0.33	30.20±4.30	30.03	0.93
EF	61.33±12.97	55.80±15.09	0.13	67.47±6.95	67.47±6.22	1.00
LAD	42.31±5.41	44.44±8.35	0.25	34.47±5.69	37.40±3.54	0.10
AARD	32.43±5.02	29.12±3.49	0.00	30.71±3.54	29.80±4.11	0.52

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