Original Article

Left Ventricular Mass in Diabetic Patients

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Abstract

Background: The increased left ventricular mass (LVM) is a strong risk factor for cardiac mortality. Although the relationship between diabetes mellitus (DM) and LVM in adults is established, it is not universally accepted in young diabetic patients. We sought to determine LVM in young diabetics, healthy youngs with diabetic parents, and healthy youngs.

Methods: This is a descriptive case- control study. The non-probability convenience sampling was done to choose 30 young insulin dependent diabetics (group I), 30 healthy young with history of DM in one of his or her parents (group II), and 30 healthy young without history of DM in his or her parents (group III). The LVM of these 3 groups were measured by two-dimensional echocardiography and mean of LVM in 3 groups were compared by ANOVA.

Results: The mean age of patients was 14.3 ± 2.3 years. ANOVA showed significant difference between LVM in three groups. (F=5.005 p=0.009). According to Scheffe test, the difference between group II and group III was significant while there was no significant difference between group I and other groups.

Conclusion: This study showed that offsprings of diabetic patients have significantly higher LVM than normal healthy groups but diabetic patients have mildly increased LVM versus control group. The higher LVM in healthy youngs with diabetic parents must be noted and more studies must be performed on this group who may be benefited from risk factor modification.

Key words: Left Ventricular Mass, Diabetes, Diabetic Parents, Isfahan.

The degree of increased myocardial muscle mass is a strong and independent risk factor for cardiac morbidity and mortality[1, 2]. In addition, the risk of ventricular arrhythmia is increased at least two times in the presence of left ventricular hypertrophy (LVH)[3].

Although not only many variables such as hypertension, obesity, volume load, renin-angiotensin activity, and whole blood viscosity correlate with LVH[4, 5], but also close correlation between diabetes mellitus (DM) and LVH have been established[2, 6, 7, 8].

Postmortem studies in non-insulin dependent diabetic (type II) subjects who had died from heart failure revealed increased left ventricular mass (LVM), myocardial, and perivasculer fibrosis[9]. Insulin–dependent diabetes mellitus (IDDM) also associated with increased LVM[6] that may occur before the onset of hypertention[10].

In previous studies, the relation of DM, microalbuminurea creatinine clearance, and glycosylated hemoglobin (HbA_1c) with LVH have been evaluated and they found the correlation between these variables and increased LVM[6, 11]. Many factors such as hypertension, diabetic nephropathy, obesity, hyperinsulinemia, disautonomia, and genetic abnormalities are suggested that contribute to increased LVM in DM[16, 19, 20, 21, 22]. Since genetic abnormalities probably have influence on LVH, we sought to determine left ventricular mass in healthy youngs with diabetic parents and diabetic youngs.

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Materials and Methods

This study is a descriptive case - control survey. The study population consists of 30 insulin dependent diabetic patients (group I), 30 healthy youngs with history of NIDDM in one of his or her parents (group II), and 30 healthy matched individuals (group III).

Non-probability convenience sampling method was applied to choose 60 subjects from patients of Isfahan Endocrine and Metabolism Research Center and offsprings of diabetic patients in that center, in 2003. Subjects in control group were healthy volunteers that were referred from Isfahan schools. The age of participants was in the range of 10-19 years. IDDM was defined as requiring daily insulin administration to prevent the metabolic cascade of diabetic ketoacidosis[17]. The participants underwent a medical history and physical examination. Resting blood pressure (BP) was obtained in a sitting position and none of them had clinical or echocardiographic evidence of structural heart disease. Inclusion criteria were: history of IDDM for less than 6 years in group I, history of DM in one of parents in group II, Body Mass Index<25, BP below 95 percentile, absence of diabetic nephropathy (urinary protein excretion level<200 mg / 24 hr)[18]. The weight (wt) and height (ht) of participants were measured and body mass index (BMI) was calculated according to following formula[6]:

$$BMI = \frac{Wt(kg)}{Ht(m)^2}$$

The patients with IDDM also had a blood sample obtained for glycosylated hemoglobin (HbA1C) assay. All subjects underwent echocardiography by using ultrasound imaging system (wingmed model 800 A) by an expert cardiologist in the Isfahan Heart Research Center. Left ventricular end-diastolic dimension, septum, and posterior wall thickness of left ventricle at the end of diastole were measured, and LVM calculated in grams according to deveroux formula [15].

$$LVM = 1.04 \times [(LVID_{ED} + PWT_{ED} + IVS_{ED})^3 - (\mathrm{LVID}_{ED})^3] \times 0.8 + 0.6$$

These measurements include the interventricular septal thickness (IVS), the internal diameter of the heart (LVID), and the posterior left ventricular wall (PWT) in centimeter, all measured at the end of diastole in the left para–sternal long-axis view.

Values are presented as mean ± SD. Data analysis was performed with SPSS software package and data of three groups were statistically compared by analysis of variance (ANOVA) method. Post hoc test was conducted using Scheffe test. The relation between BMI and LVM was evaluated by Pearson correlation coefficient.

Results

The study population consisted of three groups: The first, 30 patients with IDDM (15 boys and 15 girls; age 14.3 ± 2.8 years, duration of DM 3 ± 2.1 years); The second, 30 healthy youngs with history of DM in one of his or her parents (15 boys and 15 girls; age 14.7 ± 2.3 years); and the third, 30 healthy individuals (15 boys and 15 girls; age 13.4 ± 1.6).

BMI was not significantly different among three groups (F=0.873, P=0.421). LVM was directly associated with increased BMI in each group (r=0.61, p=0.002, r=0.54, p=0.002, r=0.56, p=0.001). Analysis of variance showed significant difference in LVM between three groups. (F=5.005, P=0.009). According to Scheffe test, the difference of LVM between the second and third groups was significant, while comparisons between first and third groups, and the first and second groups were not significant (table 1).

Group I was divided into two subgroups based on the level of glycosylated hemoglobin (> 7 mg and ≤ 7 mg). These two subgroups were not significantly different with respect to LVM (76.3 ± 28.3 in > 7 mg subgroup vs. 68.2 ± 45.6 in ≤ 7 subgroup; P = 0.569)

Table 1. The averages BMI and LVM in three groups.

	Groups			
	I	II	III	P Value
BMI	19.7 ± 4.2	20.3 ± 3.7	19.1 ± 3.2	0.421
LVM	74.4 ± 32.4	82.1 ± 24*	61 ± 21.5	0.009

* P < 0.05 compared to group III

I= Diabetic patients, II= Healthy youngs with diabetic parents, III= Healthy youngs

Discussion

Although the relation of diabetes mellitus and increased LVM is established[2, 6, 7, 8] the presence of cardiac abnormalities and left ventricular

hypertrophy in young diabetic patients is not universally accepted[6]. Kimball showed that diabetic young patients have significantly increased level of LVM compared with control subjects[6].

In this study, there was no significant difference in LVM between diabetic young patients and control group that may be dueto short duration (3 ± 2.1 years) of diabetes in our patients group versus Kimbal study (9 ± 5 years). Also Chen and his colleagues found that there was no significant difference between LVM in diabetic young patients and control group. The duration of IDDM in their study was 4.02 ± 4.07 years which is comparable to our findings. Lind and his colleagues have shown that LVM was only marginally and not significantly elevated in diabetic patients[4].

In this research, we also found that there is a significant difference of LVM between healthy youngs with diabetic parent and control group which must be noted because increased LVM is associated with increased cardiovascular morbidity and mortality[1, 2] and its early diagnosis and prevention is important and drug therapy can causes improvement of left ventricular function and decrease of cardiovascular morbidity[13].

The high prevalence of LVH in healthy youngs with diabetic parent supports this idea that early echocardiographic screening, may be beneficial to these patients.

In this regard we suggest that in future study, offsprings of diabetic patients will be evaluated for other risk factors of LVH such as hyperlipidemia, hypertension, and albuminuria.

The result of our study showed that LVM was associated with increased BMI. The relationship between LVM and obesity has been well documented[13, 14] and this relationship in other studies has been confirmed[6, 8, 11].

In our study, LVM did not significantly correlate with glycosylated hemoglobin level in diabetic young patients. This result was agreed with Chen[7] and Hirayama[1] studies. But, Kimball has showed that glycosylated hemoglobin level had significant correlation with left ventricular mass[6].

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