Mean Circumferential Fibers Shortening Velocity Assessment in Patients with type II Diabetes Mellitus in relation to their Diastolic Function Status

Asaad Hasan Noaman[1], Amina A. B. Al-Dejeli[2] and Falah Mahdi Dananah[3]

[1]PhD Cardiovascular Physiology, Diploma of Echocardiography. Department of Physiology/ Faculty of medicine/ University of Kufa. Department of Echocardiography, Al-Furat teaching Hospital, Najaf, Iraq, [2]Professor Assistant, PhD Cardiovascular Physiology. Department of Physiology/ Faculty of Medicine/ University of kufa. Department of Echocardiography, Najaf Catheterization Center, Najaf, Iraq, [3]PhD Physiology, Diploma of Internal Medicine. Department of Physiology/ Faculty of Medicine/ University of kufa. Najaf, Iraq

Abstract

Background: The most important cause of death in diabetic patients is the cardiac insult. Mean circumferential fibers shortening velocity (MCFSV) was used to detect the systolic cardiac dysfunction.

Objective: This study aimed to evaluate MCFSV in people who have Type 2 diabetes.

Patients and methods: This analytic observational study was performed in Al-Furat teaching hospital. Eighty type 2 diabetics were involved in this study. All patients were subjected to traditional Doppler measures: tissue Doppler-derived E/E› and MCFSV.

Results: Echocardiographic measures revealed 35 subjects having Grade I of Diastolic dysfunction (DD), 15 having Grade II while 10 were diagnosed with Grade III of this condition. MCFSV did not change in patients with normal diastolic function (0.00137±2.02) and those with grade I diastolic dysfunction (0.00148±3.5), (*P* value: 0.2) while significant reduction was documented in patients with grade II diastolic dysfunction (0.0011±9.1, *P* value: 0.00) and grade III diastolic dysfunction (0.001±6.02, *P* value: 0.00)

Conclusions: There is a connection between Reduction of MCFSV and increased grading of diastolic dysfunction (DD) in type II diabetics.

Key words: *Diabetes mellitus, Mean circumferential fibers shortening velocity, diastolic dysfunction.*

Abbreviations: MCFSV: Mean circumferential fibers shortening velocity. LV: left ventricle**.** DM: diabetes mellitus

Introduction

Heart disease is recognized as the most common cause of death of diabetic people .1 Atherosclerosis accounted for most of cases. Many studies showed that diabetes increase the possibility of experiencing heart failure as well as other abnormalities of cardiac function.(3-5) In absence of hypertension or significant valvular heart diseases, diabetic patient can develop diastolic dysfunction in early stages then progressed to systolic dysfunction.(6) MCFSV is an index of pumping function of left ventricle. Recently, it has been routinely calculated by using M-mode technique, a change in LV minor axis in systole with a change in ejection time was considered.(12) Cooper et al. demonstrated the reliability of this measure showing that MCFSV achieved by angiocardiography has a clear association with that achieved by the echocardiography test.(2)

Our study targeted at evaluation of the MCFSV in diabetic patients (type 2) in absence of other risk factors or diseases that might affect the results.

Patients and Methods

In this study, eighty patients with a known case of type II DM were recruited and subjected to a biochemical assessment. The study was agreed by the ethical committee of our institution. Fasting and random blood sugar, electrocardiography, renal function test and lipid profile were performed for all patients. A complete two dimensional echocardiography was done for all subjects using a commercially available ultrasound transducer and equipment (M5sc probe, GE, Vivid E9, 2015, USA). All procedures were conducted by the same operator adopting the left-lateral decubitus (LLD) position.

In order to measure transmitral inflow velocity values, we used a pulsed-wave sample at the tips of the mitral valve leaflets in the parasternal four-chamber view. Then, we obtained the following: peak E velocity (m/s), peak A velocity (m/s), and deceleration time in milliseconds. Diastolic dysfunction can be listed as: impairment of heart relaxation with GRADE II pseudonormal, and restrictive pattern.8 A pseudo-normal diastolic dysfunction was determined by TDI derived E/E' >15 as well as the use of valsalva maneuver. E' wave velocity was measured by tissue Doppler sample placed at medial mitral annulus in an apical 4 chamber view. (Figure 1).

Mean circumferential fibers shortening velocity (MCFSV) can be obtained by using M-mode technique by the following equation:

MCFV= [LVEDD – LVESD / LVEDD] ÷ LVET (mm/ms). Ejection time was calculated by placing continuous wave sample volume at aortic valve and then, the time from aortic valve opening to its closure was determined in the corresponding Doppler wave[10-13]

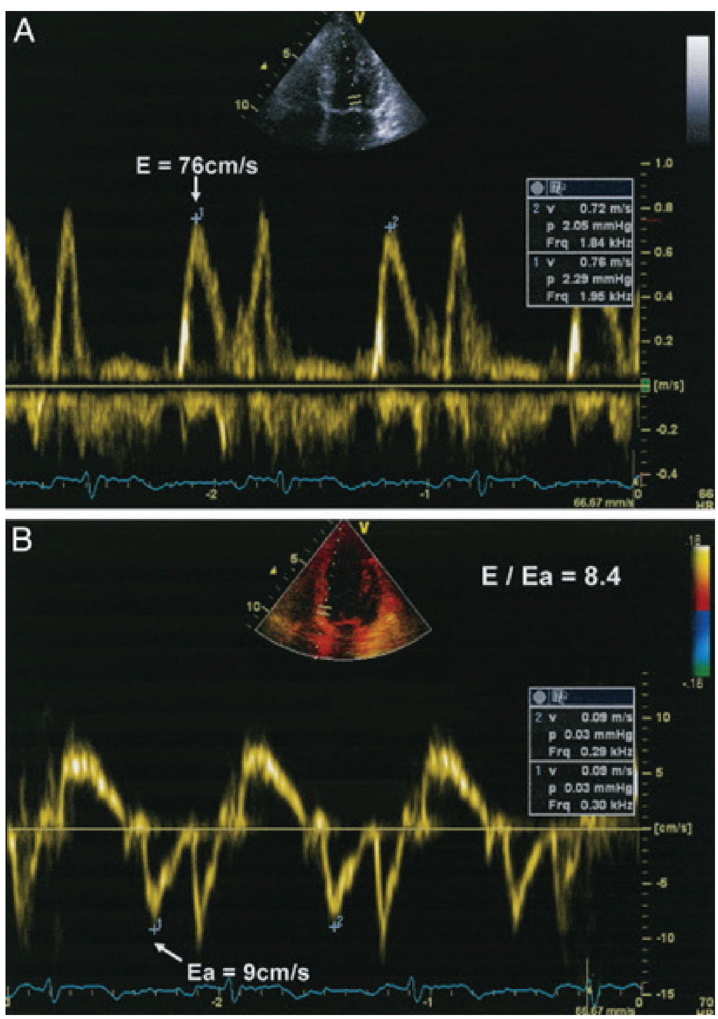

Figure 1 Calculation of E/E'

Statistical Analysis

All data were presented as mean ± SD. In this study, one-way analysis of variance (ANOVA) was performed to determine whether there are any statistically significant differences between the variables of this study. A p-value of 0.05 was set as the threshold of statistical significance. The statistical treatment was done using the SPSS package software version 18.

Results

Table (1) displays the baseline characteristics of the eighty patients involved in this study. The subjects were grouped into four categories according to their Diastolic dysfunction conditions and as follows: The first group (Group A) included 20 subjects with no diastolic dysfunction. Group B included 15 patients with Grade I Diastolic dysfunction. The third group (Group C) consisted of 15 patients with Grade II diastolic dysfunction. The remaining 10 patients with Grade III diastolic dysfunction were put into Group D.

No significant change of MCFSV was found in both group A (normal diastolic function) and Group B, which consisted of patients with grade I diastolic dysfunction. While significantly decreased in group C and D i.e. decreased with increased severity of diastolic dysfunction. Table (2) compares the groups of patients in terms of echocardiographic parameters.

Table 1 : A run-down of Baseline characteristics of all 80 subjects

Age (years)	53.3±9
Female, male (%)	62, 38
Duration of DM (years)	5±3.38
BMI	25.9±2
SBP	115.9±14.47
DBP	81.8±8.58
FBS	120.1±23.02
HbA1c	7.76±1.57
T. Triglyceride	133.8±25
T. Cholesterol	178.02±15.9

Table 2 Compares the values of echocardiographic parameters of the recruited groups

	Group A	Group B	Group C	Group D	.Group (A) vs. Group (B) P value	Group (A) vs. Group (C) P value	Group (A) vs. Group (D) *P* value
Age (years)	47.9±10.89	52.01±7	57.9±7.02	59±7.1	0.1	0.00	0.00
Duration of DM (years)	5±1.47	5.29±2.4	7.9±3.01	7±2.9	0.00	0.00	0.00
E/A	1.19 ± 0.55	0.79 ±0.17	1.22 ± 0.14	2.08 ± 0.75	0.00	0.7	0.00
E/E,	9.5 ± 6.42	12.01 ± 4	16.41 ±2.72	22.02 ± 8.6	0.00	0.00	0.00
MCFSV (mm/ms)	0.00137±2.02	0.00148±3.5	0.0011±9.1	0.001±6.02	0.2	0.00	0.00

Discussion

Diabetic cardiomyopathy is considered as a major cause of death of diabetics and is also considered as an independent cardiovascular insult. Many factors can lead to such insults as microvascular, autonomic and metabolic disorders.(4)

Left ventricular performance can be assessed by simple and satisfactory index called the MCFSV which can be used even when other cardiac abnormalities coexist.(8) Cooper et al. studied the MCFSV measured by echocardiography and compared it with those taken by cineangiocardiography. A good relationship was documented.(2) Our results dovetail with a study that showed circumferential as well as longitudinal dysfunction was found in diabetic (type II) subjects without significant coronary artery disease.(1)

A study by J. Salazar et al. demonstrated that there is no association between the duration of diabetes and any of the echocardiographic measures investigated including the MCFSV. The study concluded that echocardiographic test did not show the existence of Diabetic cardiomyopathy (DCM) in diabetic patients. These results contradicted our results as we found that MCFSV as an echocardiographic index for cardiac performance is connected with an increase in the severity of diastolic dysfunction in diabetic subjects.(14)

Virendra et al. demonstrated high frequency of diastolic impairment in subjects showing diabetes symptoms, an outcome that was related with the diabetes duration and HbA1c levels.(11)

Studies have described a high occurrence of subclinical diastolic insult among individuals with diabetes.(9) These studies documented that diastolic dysfunction occurs at an early stage during the process of diabetes before affecting systolic function and the related pathogenesis is not yet understood. All these studies approached our results as most of our patients have various levels of diastolic dysfunction. The golden finding in this study is the occurrence of systolic dysfunction in late stages of diastolic dysfunction of diabetic patients by the reduction in velocity of circumferential fiber shortening.

Conclusion

We conclude that there is no connection between Reduction of MCFSV and increased grading of diastolic dysfunction found in type II diabetics.

Conflict of Interest: The authors have no financial, consultative, institutional, and other relationship that might lead to bias or conflict of interest. Therefore we declare that we have no conflict of interest

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Ethical approval: We declare that the study does not need ethical approval.

Ethical Clearance: The study was conducted with approval from research ethics committee at faculty of medicine / Kufa University.

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