



ORIGINAL RESEARCH PAPER

Cardiovascular

EVALUATION OF CARDIAC SYSTOLIC FUNCTION IN ASYMPTOMATIC DIABETES PATIENTS AND ITS CORRELATION WITH DURATION OF DIABETES

KEY WORDS: diabetes mellitus, systolic dysfunction, fractional shortening

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ABSTRACT

Echocardiography is a universally available and economical test for detecting early LV systolic dysfunction in normotensive and asymptomatic type 2 diabetic patients. This is a cross sectional study of such patients evaluating cardiac systolic function using 2D-Echocardiography. Ejection fraction and Fractional shortening are the two most sensitive indicators of it. Only 18% of patients had decreased LVEf and 6% showed reduced fractional shortening. Although longer duration of diabetes was positively correlated with reduction in systolic functioning of heart. Early identification of subclinical signs of heart failure by these noninvasive and less expensive methods may improve outcomes in type 2 diabetes patients.

INTRODUCTION

Diabetes mellitus is a syndrome often familial in nature and prevalent in Indian subcontinent. It is modulated by genetic, HLA and environmental factors.¹ Diabetic subjects have been reported to develop congestive heart failure in the absence of coronary heart diseases or any structural heart disease.² The term 'diabetic cardiomyopathy' has been used for this condition. Microangiopathic lesions of the myocardium and accumulation of lipids in myocardial cells are involved in pathogenesis of diabetic cardiomyopathy.³ Subclinical abnormalities of left ventricular function are recognized in both Type 1 and Type 2 diabetes mellitus using Doppler echocardiography.⁴ Abnormal systolic function may be an early indicator of cardiomyopathy.

It seems that diabetes increases the severity of heart failure at any given level of left ventricular systolic dysfunction. Interestingly the longer the duration of diabetes, more is the derangement of systolic parameters. This study thus aims to study the subclinical left ventricular systolic dysfunction in normotensive diabetic patients using noninvasive methods.

MATERIAL AND METHODS

The study was conducted on 50 adult normotensive, type 2 diabetes patients who attended the medical OPD of tertiary care institute of north India. Fifty patients between age group 18-60 were selected for the present study by Simple Random Sampling method. All the patients were evaluated for left ventricular systolic parameters after prior informed consent. Patient with any major comorbidities including CHF, CAD and chronic liver or kidney dysfunction were excluded.

A comprehensive history and examination was conducted by the principle investigator. Routine haematological investigation and imaging were performed and systematically documented. Cardiovascular assessment was made by non invasive tests including ECG and 2D Echocardiography (Agilent Image Point machine with 2.5 to 5 MHz probes). Following parameters were used to assess LV systolic dysfunction. LV stroke volume was determined in terms of the velocity-time integral and assessed by means of pulsed-wave Doppler positioned at the LV outflow tract.

1. Left Ventricular ejection fraction (LVEf)
2. Fractional shortening of ventricular chamber

These parameters were later on correlated with the duration of diabetes and triglyceride levels.

RESULTS

Baseline characteristics

Fifty diabetic patients who were normotensive and

asymptomatic were selected as per the inclusion criteria. Majority (68%) of patients were of age > 45 years. The mean age of the patients in the study is 48.8 years and Males were 56%. The mean duration of diabetes of patients in the study was 8.54 ± 3.21 years and mean BMI of the patients in the study was 26.9 ± 2.3 (kg/ m²). ECG, Chest roentogenograph, fundus examination was done in all the patients and were within normal limits. The majority of patients 27(54%) had total triglycerides above the normal limits. The mean triglycerides of patients was 165.16(mg/dl) with standard deviation 33.28.

Systolic parameters

1. Ejection fraction (LVEf)

The majority of patients had Ejection fraction within normal limits 35 (70%) whereas 9(18%) patients had systolic dysfunction which was not significant.(Table 1) The mean Ejection fraction of patients was 68.36% with standard deviation 10.75.

Table 1: Ejection Fraction values (%)

Ejection fraction (%)	No. Of Patients
<60	9 (18%)
60-80	35 (70%)
>80	6 (12%)
Total	50 (100%)

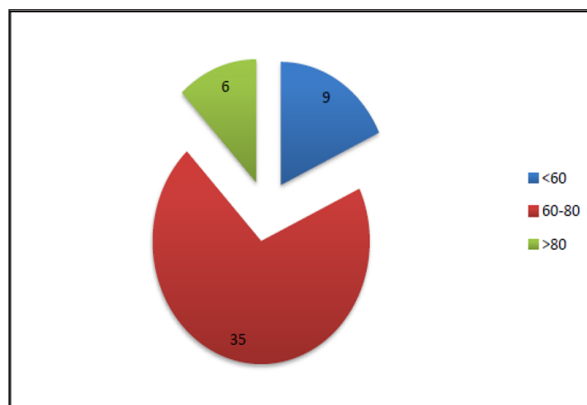


Fig: Depiction of distribution of patients with various LVEf values in percentage

1. Fractional shortening

The majority of patients had Fractional shortening value between normal limits 46(92%) whereas 3(6%) patients had reduced Fractional shortening indicating systolic dysfunction.(Table 2) The mean Fraction shortening of patients was 36.26 with standard deviation 5.34. NO significant changes were noted.

Table 2. Fractional shortening results

Fractional shortening(%)	
<25	3(6%)
25-45	46(92%)
>45	1(2%)
Total	50(100%)

The duration of diabetes in terms of multiples of 10 was also noted and correlated with both the above parameters. The results showed that with longer duration of diabetes, there was decrease in Ejection fraction (<60%) and fractional shortening (<25%) as shown in table 3a and 3b (P-value =0.0001 and 0.2073 respectively), which is statistically highly significant.

Table 3a: LVEf and diabetes duration

Ejection fraction in groups based on duration of diabetes			
Duration of diabetes	n	mean	S.D
<10	36	72	7.289915
≥10	14	59	12.71583

Table 3b: Fractional shortening and diabetes duration

Fraction Shortening in groups based on duration of diabetes			
Duration of diabetes	n	mean	S.D
<10	36	37.27778	4.192586
≥10	14	33.57143	7.16524

DISCUSSION

Although the pathogenesis of diabetic cardiomyopathy is believed to be multifactorial but with the exact cause remaining unknown, a number of mechanisms such as hyperglycemia and hyperinsulinemia have been reported to play an important role in its etiology^{5,6}. A patient with diabetes has higher mortality for cardiovascular reasons rather than because of the diabetes itself⁷. It is therefore important to improve the early detection and of this connection.

Diabetic cardiomyopathy is currently defined by diastolic dysfunction, which is the earliest alteration in the course of disease⁸. However it is affected by many other factors, such as age, hypertension, and LV hypertrophy. This suggests that diastolic dysfunction should not be taken as the first marker of a preclinical diabetic cardiomyopathy⁹.

Ernande et al. First documented the presence of LV systolic dysfunction in DM patients with preserved LVEF, assessed by Global Longitudinal Strain(GLS), despite these patients' normal diastolic function¹⁰. Hypertriglyceridemia in particular is thought to be a cause of myocardial steatosis, resulting in subclinical LV systolic and diastolic dysfunction^{11,12}. Our findings were thus in agreement with these previous studies.

The most reliable technique for assessing systolic function is invasive cardiac catheterisation which is still the golden standard. It is, however invasive not generally accessible. For this reason, echocardiographic and Doppler techniques are more useful in daily practice. 2D-Echocardiography is still the most reliable, safe, inexpensive and non-invasive tool for assessing systolic function of the heart. In particular, the fractional shortening correlates closely with left ventricular systolic function and ventricular health¹³. Our subjects did not show any significant derangements in these parameters thus need for new markers and GLS measurement is deemed necessary.¹⁴

The effect of ageing and young onset of diabetes has clearly been studied in population based studies¹⁵. However there are very limited research on the time frame in which the subclinical cardiac dysfunction is evident on 2D Echo. We hereby found out to have a positive correlation of duration of diabetes beyond 10 years and systolic dysfunction. Thus young diabetic patients need to be screened early for these changes to get a better prognosis.

The detection of diabetic cardiomyopathy in the early stages is important for the prevention of HF that will develop in the future in asymptomatic DM patients with preserved LVEF. There is also a need for refinement of the diagnostic opportunities and techniques. Currently available methods are not sufficiently specific and demanding. Inclusion of longitudinal systolic function parameters including GLS would be more specific and sensitive on a routine basis. It would then be of paramount importance to see whether it is possible to detect this kind of dysfunction without cardiovascular symptoms, hopefully creating an opportunity to counteract progression from subclinical towards advanced symptomatic heart failure. To summarise; cardiologists and diabetologists need to work in symphony and include these diagnostic tests in basic routine evaluation of outdoor diabetic patients.

CONCLUSIONS

LV systolic dysfunction is commonly seen in asymptomatic normotensive Type 2 DM patients. Diabetic complications, duration, hypertriglyceridemia are closely associated with early LV systolic myocardial dysfunction in asymptomatic DM patients with preserved LVEF.

- Alteration of LVEf and Fractional shortening is a sensitive and specific indicator of early systolic dysfunction. LV systolic dysfunction in asymptomatic normotensive patients with type 2 DM without evidence of coronary heart disease was not significant contradictory to the belief. Significant changes were however seen in subjects with more than 10 years of diabetes diagnosis. Hypertriglyceridemia is also positively correlated with systolic dysfunction. Conventional echocardiography is a simple economical test for detecting subclinical LV but subtle changes could be picked up by Global longitudinal strain (GLS) values. It could help in early detection and prevention of macrovascular complications.

Limitations of study

This cross-sectional study covered a relatively small number of patients in a single centre, so that future studies including larger populations with longitudinal cohort designs are necessary to assess our findings. We included only type 2 diabetes patients in our study thus outcomes of type 1 diabetes patients need to be cross examined.

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