



A STUDY ON CORRELATION OF HBA1C LEVELS WITH LEFT VENTRICULAR DIASTOLIC DYSFUNCTION IN PATIENTS WITH TYPE 2 DIABETES MELLITUS

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ABSTRACT More than 60% of patients who present with symptomatic chronic heart disease have abnormal glucose homeostasis. Patients with DM and established cardiovascular disease have an unfavourable prognosis. In fact, diabetes and insulin resistance are powerful predictors of cardiovascular morbidity and mortality. The present study is to assess the incidence of L.V diastolic dysfunction in patients with type 2 diabetes and to correlate diastolic dysfunction and HbA1c levels in type 2 diabetic patients.

KEYWORDS : Diabetes Mellitus, Left Ventricular Dysfunction

INTRODUCTION:

The incidence and prevalence of diabetes mellitus (DM) are both rising rapidly. DM affects 350 million people around the world, and the World Health Organization (WHO) has projected that diabetes-related deaths will double between 2005 and 2030. Within this burgeoning health care problem of worldwide proportions, obesity-related type 2 diabetes mellitus (T2DM) accounts for more than 90% of all diagnosed diabetes in adults. Furthermore, more than 60% of patients who present with symptomatic chronic heart disease have abnormal glucose homeostasis. Patients with DM and established cardiovascular disease have an unfavourable prognosis. In fact, diabetes and insulin resistance are powerful predictors of cardiovascular morbidity and mortality. The term diabetic cardiomyopathy, although admittedly vague, refers to the multifactorial manifestations of diabetes-related left ventricular (LV) failure characterized by both systolic and diastolic dysfunction. Echocardiographic studies confirm that diastolic abnormalities occur in young diabetic patients who have no known diabetic complications. India will have the largest number of diabetic subjects in the world by 2025 and one out of 5 diabetic subjects in the world will be an Indian. India is going to be the "Diabetic capital of the world". Subclinical abnormalities of left ventricular function are recognized in both type 1 and type 2 diabetics. Shapiro et al found that asymptomatic diabetic subjects had impaired left ventricular relaxation on digitalized M-mode echocardiography as compared with non-diabetic controls. Studies using Doppler echocardiography have confirmed the findings of abnormal diastolic function as an early indicator of cardiomyopathy in asymptomatic patients. Left ventricular dysfunction (LVDD) may result the first stage of diabetic cardiomyopathy preceding changes in systolic function, reinforcing the importance of early evaluation of ventricular function in individuals with type 2 DM. The diabetic abnormalities are present in diabetic patients in absence of diabetic complications of cardiovascular system. So far, very few population based studies have been carried out in India to demonstrate the prevalence of diastolic dysfunction in type 2 Diabetic patients. Doppler echocardiography is ideally suited for assessment of diastolic function, being widely available, non-invasive and less expensive than other techniques. The assessment of diastolic function should be based on a comprehensive echocardiographic study integrating all available two dimensional and Doppler data. Measurement of HbA1c levels is the standard method for assessing long-term glycemic control. HbA1c is the primary predictor long term complications of diabetes.

MATERIALS AND METHODS:

Source of data:

A total of 100 diabetic patients with minimum 5 years duration of diabetes were selected from Government General Hospital, Kurnool attached to Kurnool Medical College, Kurnool between May 2016 to April 2017.

Method of collection:

Patients with minimum history of 5 years of type 2 diabetes in Government General Hospital, Kurnool were scrutinized for Doppler echo cardiography and HbA1c levels.

Inclusion criteria:

- Age group 30-55yrs independent of sex.
- Patient's with history of type 2 diabetes for a minimum period of 5 yrs duration.

Exclusion criteria:

- Patients with systemic hypertension.
- Patients with thyroid disease.
- Patient with peripheral vascular disease.
- Patients with age above 55 years.

Study design:

It is an observational study of patients with type 2 diabetes with minimum of 5 years duration of disease was evaluated for Doppler echocardiography and HbA1c levels. In Doppler study following variables will be studied.

- E-Peak velocity of early mitral flow (E-Cms-1)
- A-Peak velocity of late mitral flow (A-Cms-1)
- E/A ratio
- VTIM-Velocity time integral of the entire mitral curve (VTIM-cms-1)
- VTIA-Velocity time integral of the atrial curve (VTIA-cms-1)
- VTIA/VTIM ratio
- PHT-Pressure half-time (PHT - ms)
- IRT-Isovolumic relaxation time (IRT - ms)
- EF%-Ejection fraction

Investigations:

- Echo cardiogram
- HbA1c%
- FBS
- PPBS

RESULTS

In the present study 4 patients belong to group with ghb% <5.6 out of which 2 were positive for diastolic dysfunction and 2 were negative. 28 patients belong to HbA1c% range of 5.7-6.4 out of which 2 were positive for diastolic dysfunction and 26 were negative. 68 patients belong to HbA1c range of >6.4 out of which 54 were positive diastolic dysfunction and 14 were negative. Chi-square test is 42.63 and P value is <0.001(HS).

COMPARISON OF LV FILLING PATTERNS

Variables	DD +		DD -		DD + v/s DD -				
	Mean	SD	Mean	SD	Mean Diff	t vale *	p value		
E	69.45	9.08	73.76	6.68	- 4.31	- 2.61	0.01	S	
A	67.62	7.82	59.90	9.46	7.72	4.46	0.00	HS	
E/A Ratio	1.04	0.20	1.21	0.24	- 0.17	- 3.64	0.00	S	
VTIM	11.20	4.40	11.89	3.04	0.07	0.95	0.35	NS	
VTIA	3.80	1.15	3.26	0.97	0.54	2.54	0.01	S	
VTIA/VTIM	1.14	2.97	0.41	0.70	0.73	1.80	0.08	NS	
PHT	58.79	8.83	54.19	7.20	4.60	2.77	0.01	S	
IRT	83.52	6.98	75.62	13.71	7.90	3.77	0.00	HS	
LVIDd	4.56	0.59	4.29	0.60	0.26	2.18	0.03	S	
LVIDs	3.17	0.52	2.91	0.48	0.27	2.62	0.01	S	
RVIDd	9.93	1.12	10.48	1.06	- 0.55	- 2.45	0.02	S	
LAcM	4.81	6.58	3.14	0.30	1.67	1.64	0.10	NS	
AOcm	2.74	0.27	3.93	5.90	- 1.20	- 1.54	0.13	NS	
EF%	63.44	7.97	68.88	9.77	- 5.44	- 3.06	0.00	S	

* Unpaired t test, S : Significant, NS : Non-significant, HS : Highly significant

DISCUSSION

Together with diabetic nephropathy, retinopathy, and neuropathy, a specific heart disease due to diabetes, termed diabetic cardiomyopathy has been suggested. The pathogenesis of diabetic cardiomyopathy is unsettled where as proposed mechanisms include small vessel disease and metabolic alteration of the diabetic myocardium.

Diastolic dysfunction may be the earliest marker of a diabetes induced heart muscle disease which leads to the progressive development of cardiac failure. In the present study the patients with above conditions which affect LV diastolic function were avoided. Patients with systolic dysfunction also were avoided. It was found out that 58% of patients in our study group comprising of 100 patients had significant LV diastolic dysfunction.

The mean peak velocity of early mitral flow (E) value was 69.44. The mean peak velocity of late mitral flow (A) value 67.62, pressure half time (PHT) was 58.79, Isovolumic relaxation time (IRT) was 83.51, E/A ratio was 1.04, and left ventricular ejection fraction (EF%) was 63.43. There was significant correlation between diastolic dysfunction and HbA1c(P=0.001).

No significant difference in incidence of diastolic dysfunction was observed in males and females. The present study revealed that, echo Doppler can detect diastolic dysfunction in diabetic subjects much before clinical symptoms appear. If left untreated, diastolic dysfunction can progress to clinically significant heart failure.

Therefore by early detection of diastolic dysfunction we can start early treatment for the same and can either retard or arrest the progression of LV diastolic dysfunction.

The disease in India was first suggested by Tripathy et al^{1,2} in 1967 from clinical findings of five diabetic patients. Subsequent work by Thanikachalam et al described a pre-clinical state of left ventricular dysfunction detected by laboratory investigation. This was further confirmed by Tripathy et al.²

Hamby et al³ noted an increased incidence of diabetes in patients with idiopathic cardiomyopathy. Sixteen (22%) of 73 patients with idiopathic cardiomyopathy were diabetic, compared with only 11% in an age and sex matched cohort without cardiomyopathy. The duration of diabetes in affected subjects were quite variable, ranging from less than 1 year to 11 years.¹⁹

Markuszewski .L. et al studied 57 subjects (35 men and 22 women) with DM 2, without coronary stenosis in coronarography, with normal and elevated HbA1c levels. The subjects were divided into two groups depending on HbA1c level: with HbA1c < or = 6.1% and HbA1c >6.1%. Parameters of left ventricular diastolic function were assessed in echocardiography according to criteria of European Society of Cardiology. Diastolic dysfunction was observed in 43% of patients with HbA1c >6.1% comparing to 4.5% of patients in the group with HbA1c < or = 6.1%. In the group with HbA1c >6.1% in 38% of the patients abnormal relaxation in early filling phase and in 5% abnormal isovolumetric relaxation were noted.

CONCLUSION

This study findings indicate that myocardial damage in patients with diabetes affects diastolic function before systolic function. HbA1c can be a very good indicator of long term prognosis. Diabetic cardiomyopathy is characterized by an early diastolic dysfunction and a later systolic dysfunction. Impaired diastolic function was not affected by sex or type of diabetes. Even young patients with diabetes with normal systolic ventricular function have diastolic dysfunction, which serves as a marker of a diabetic cardiomyopathy. Diastolic impairment seems not to correlate with disease duration.

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