

# Diastolic Dysfunction in Normotensive Patients with Diabetes Mellitus-A Double Blind Randomised Prospective Multicentre Study in North India

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## Abstract

**Aim:** To study the Ventricular function of Older Patients with diabetes but without hypertension. **Type of Study:** Prospective Analysis. **Methodology:** 2500 Patients diagnosed as suffering from Diabetes Mellitus (either type 1 or type 2), who were normotensive but older than 18 years and visited Medicine or Cardiology Out Patient Departments in four different hospitals, were included in the study. All the patients were subjected to a detailed history and clinical examination. The mean age of patients was 48.8yrs. 55.4

**Index terms**— diabetes, hypertension, echocardiography, ventricle.

## 1 Introduction

The term Diabetes mellitus which in Greek means "to run through" or "Siphon," was first coined by Arataeus of Cappadocia in 2nd century AD as a generic description for conditions causing increased urine output.

Diabetes mellitus is a syndrome characterized by chronic hyperglycemia and disturbances of carbohydrate, fat and, protein metabolism associated with an absolute or relative deficiency in insulin secretion and insulin action, which is modulated by genetic and environmental factors resulting in micro and macroangiopathy. Important differences in the types and frequency of Diabetes mellitus and its complications have been reported between countries as well as ethnic and cultural groups. 1 Indians are genetically more susceptible to Diabetes mellitus compared to other races. 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". 1,2 Subclinical abnormalities of left ventricular function are recognized in both Type 1 and Type 2 diabetes mellitus. Studies using Doppler echocardiography have confirmed the findings of abnormal diastolic function as an early indicator of cardiac involvement in asymptomatic patients with Type 1 or Type 2 diabetes mellitus. 3 The term 'diabetic cardiomyopathy' has been introduced for this condition. It has been suggested that microangiopathic lesions of the myocardium, altered composition and, fibrosis of myocardial interstitium and accumulation of lipids in myocardial cells are involved in the pathogenesis of diabetic cardiomyopathy. 4 In 2001, Nichols et al. reported on the close link between diabetes and heart failure. 5 II.

## 2 Material and Methods

Our was a prospective study conducted across four centers in different states in North India. The present study was approved by the ethical committee of the Department of Cardiology, Hindu Rao Hospital, North Delhi Municipal Corporation medical college, New Delhi. 2500 Patients diagnosed as suffering from Diabetes Mellitus (either type 1 or type 2), who, were normotensive but older than 18 years were selected randomly without awareness of both the clinician and the patient (double-blind)

## 3 Results

2500 Patients were analyzed and compared on various parameters. Figure 1 shows the demographics of the patients involved in the study. 55.4 % were Males, 44.4 % were Females, and 0.2 % were not otherwise specified. The mean age of patients was 48.8yrs. The majority of the patients belong to the duration of less than ten years

of diabetes (Figure 2). The mean duration of diabetes of patients was 8.54yrs with a standard deviation of 3.21. All the patients in the study were also evaluated for Body Mass Index, and it was found that around 80 % were either overweight or obese. Details are clearly shown in Figure 3. Echocardiography was done in all patients. E/A ratio that is Peak velocity of early mitral flow/ Peak velocity of late mitral flow was less than 1 in 85 % of cases where as it was between 1 to 2 in the remaining 15 % of cases (Figure 4). E/A ratio is the most specific and sensitive indicator of diastolic dysfunctions. IVRT that is Isovolumetric Relaxation Time was higher than 100 millisecond in 65% of cases where as it was between 60 and 100 in the remaining 35% of cases (Figure 5).

## 4 Discussion

Diabetic cardiomyopathy has been proposed as an independent cardiovascular disease, and left ventricular diastolic dysfunction may represent the first stage of diabetic cardiomyopathy. It has been related to an increase in left ventricular wall thickness and myocardial mass and, early in the process, signs of myocardial diastolic dysfunction occur. 6 There is experimental and clinical evidence of enhanced cellular apoptosis with myocyte loss as a consequence of oxidative stress induced by hyperglycaemia. 7 Sanderson et al. suggested that impairment of the diastolic function of the left ventricle, i.e., its filling abnormalities are far more common than systolic dysfunction. 8 The present study reports left ventricular dysfunction by m-mode, 2-D echo, and color Doppler studies.

We can easily infer that the late atrial filling wave (A) was significantly increased, probably due to elevated LV filling pressure secondary to impaired relaxation among diabetic individuals. The diastolic abnormalities in diabetic patients most likely indicate reduced LV compliance secondary to small vessel disease, infiltrative myocardial process, metabolic derangement, or a combination of the three. Hence, our study clearly outlines the ongoing cardiac damage in diabetic patients even when the blood pressure stays within the normal range.

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## 5 Conclusion

Though invasive procedures like Coronary Angiography and Scintigraphy are Gold Standard in demonstrating the Cardiovascular Compromise in suspected patients, Echocardiography serves as a gold standard screening tool in detecting early functional changes in heart, especially in diabetic patients. We strongly recommend it to be included in routine investigations leading to the work of diabetic patients.

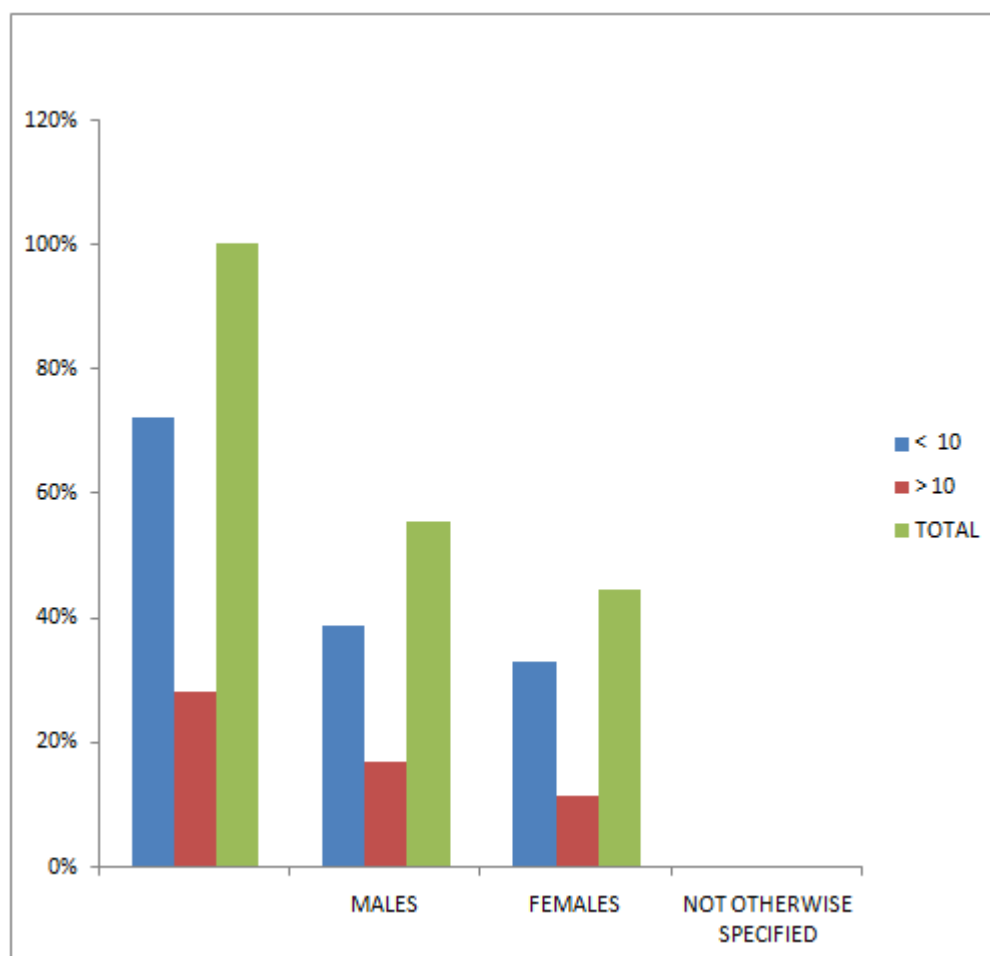


Figure 1:

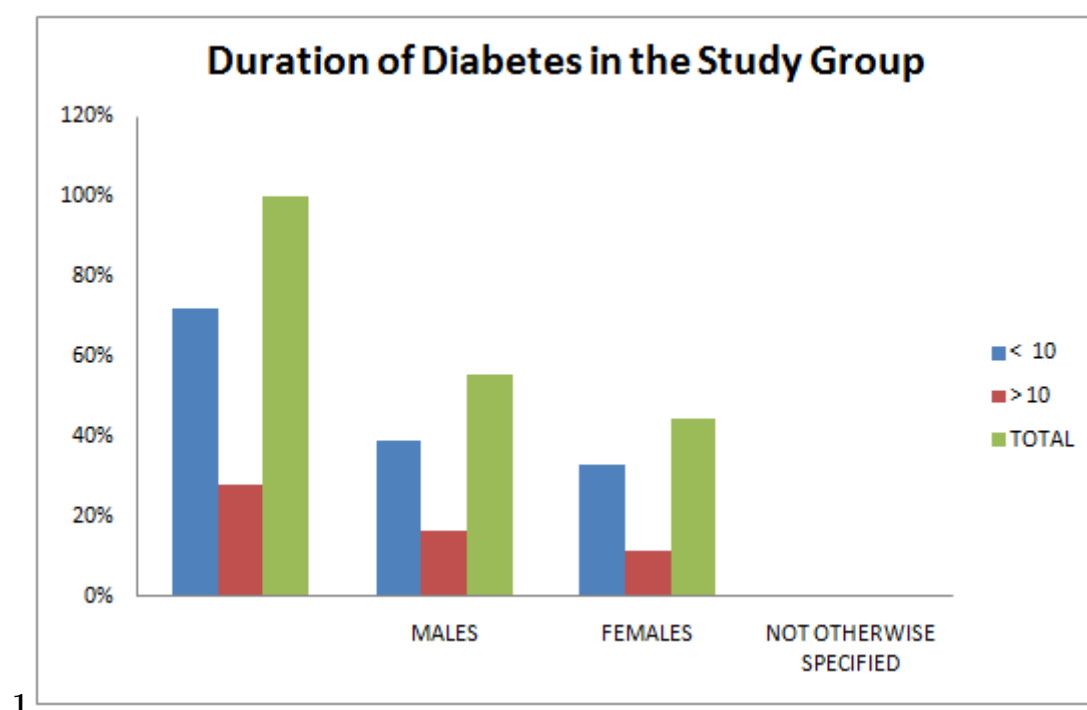


Figure 2: Figure 1 :

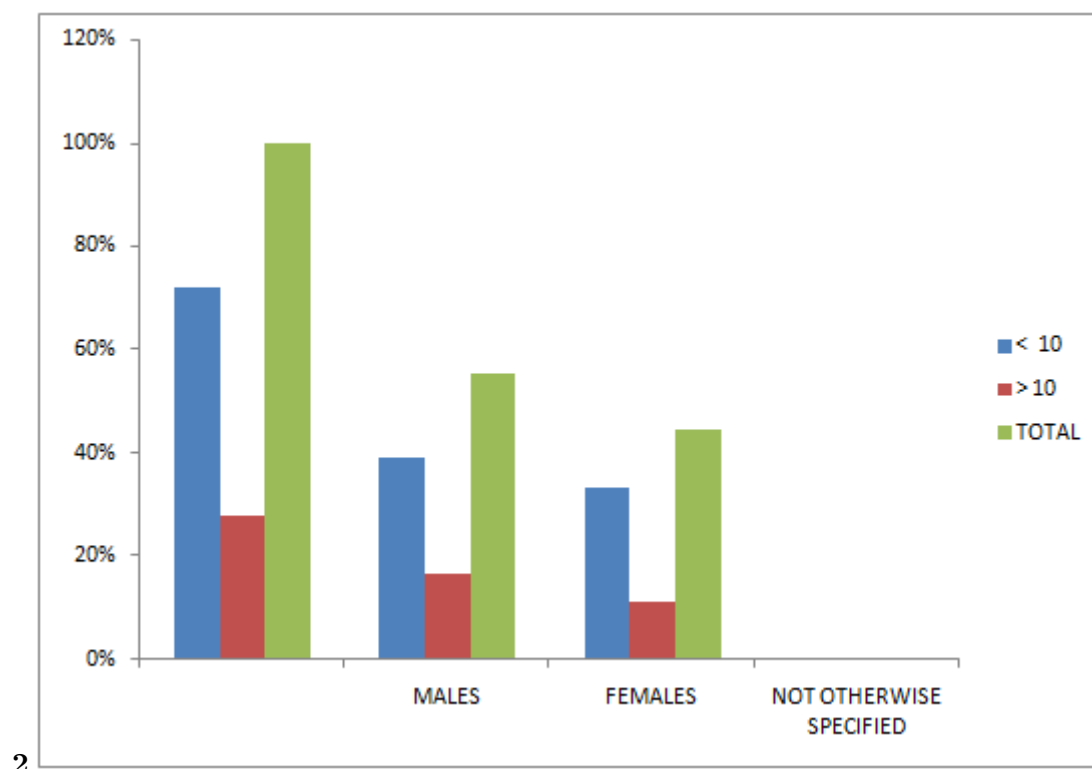


Figure 3: Figure 2 :

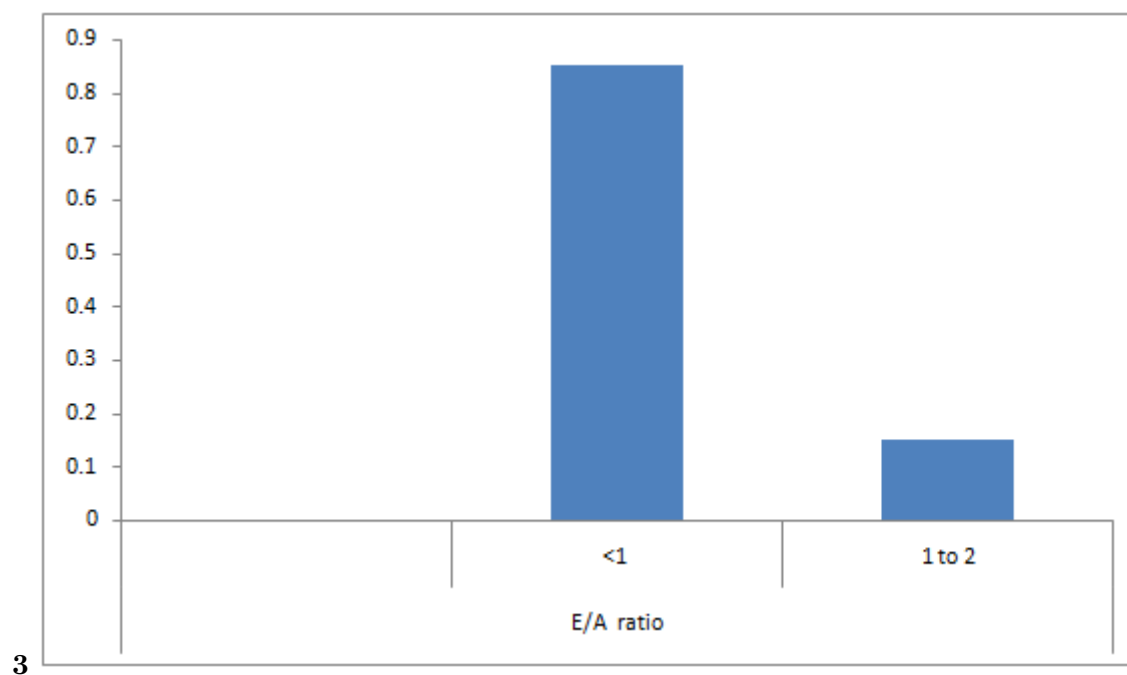


Figure 4: Figure 3 :

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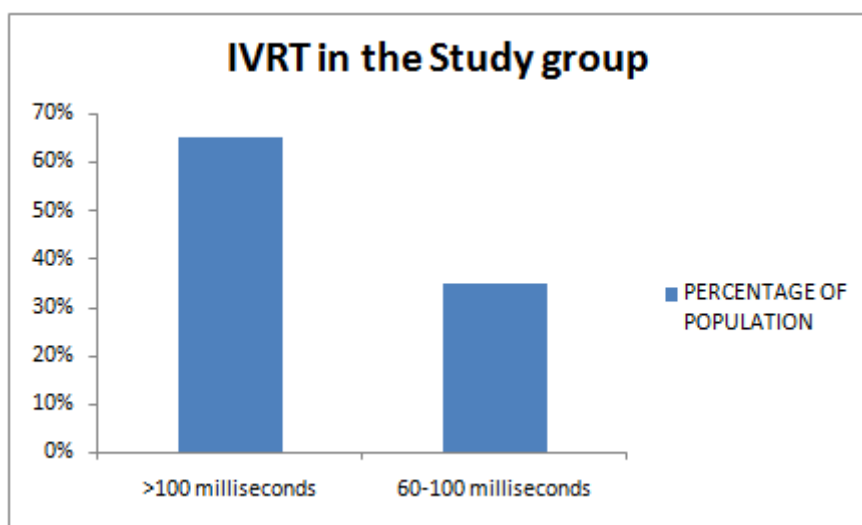


Figure 5: Figure 4 :

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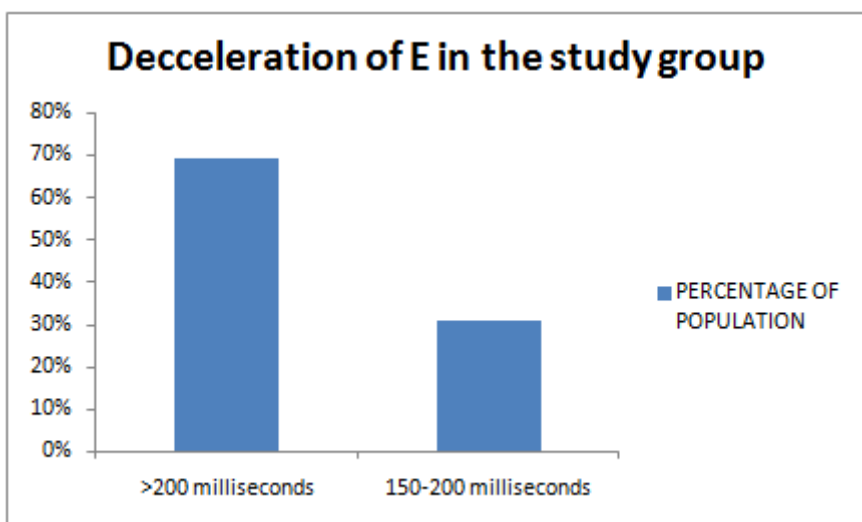


Figure 6: Figure 5 :

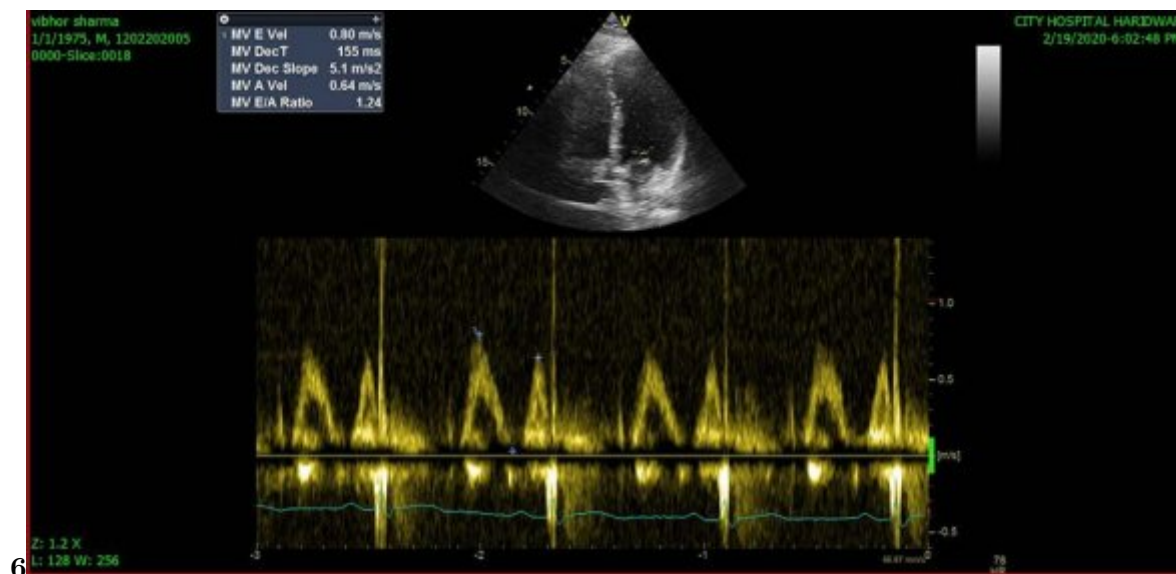


Figure 7: Figure 6 :

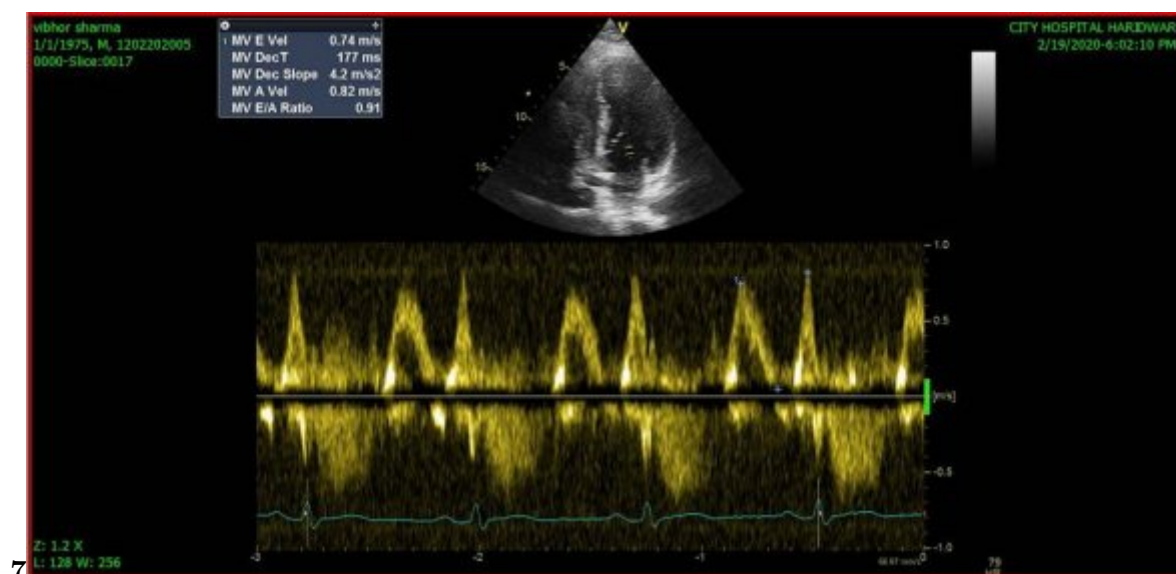


Figure 8: Figure 7 :

Glycated haemoglobin, Kidney function test, Complete blood count, Chest radiograph, Electric Cardio Gram (ECG), microscopy, Urine sugar and ketones. Also, Tread Mill Test (TMT), Thyroid profile, and Lipid profile were done in indicated cases. Echocardiography gives a detailed picture of diastolic dysfunction. The study was conducted in accordance with "Recommendations guiding physicians in biomedical research involving human subjects," adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964.

Echocardiography,

Figure 9:

.1 Conflict of Interest: NIL

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