MEDICO RESEARCH CHRONICLES
ISSN NO. 2394-3971
DOI No. 10.26838/MEDRECH.2023.10.1.676
Contents available at www.medrech.com

PREVALENCE OF LV DIASTOLIC DYSFUNCTION IN PEOPLE WITH TYPE 2 DIABETES MELLITUS WITH A NORMAL SYSTOLIC FUNCTION

Dr. Sanjay Sud
Visiting Consultant, Department of Medicine, Konnagar Matri Sadan Municipal Hospital, Konnagar, District-Hooghly, W.B.
Director of Doctor Sud's Clinic, Serampore, Hooghly, West Bengal, India

ARTICLE INFO

Article History
Received: November 2022
Accepted: January 2023
Key Words: Left Ventricular Diastolic Dysfunction, Left Ventricular Ejection Fraction, Sodium-Glucose co-Transporter 2 inhibitors, Heart Failure

Corresponding author
Dr. Sanjay Sud

ABSTRACT

Background and Aims: To determine the incidence of LV diastolic dysfunction (LVDD) in type 2 diabetics having a normal LV systolic function. This observational study aimed to determine the prevalence of LVDD in a normotensive T2DM population with a preserved Left Ventricular Ejection Fraction (LVEF) and to impress the importance of initiating early therapy with agents like SGLT2 inhibitors.
Materials and Methods: Persons diagnosed with T2DM underwent standard TTE and assessment of their LVEF and grading of LV diastolic dysfunction. LVEF ≥ 50% was considered as normal. All the subjects underwent resting transthoracic 2-dimensional echocardiography and Doppler imaging, to assess left ventricular systolic and diastolic function. A total of 2,150 cases were assessed at the hospital, over 4 years.
Results: Of the 2,150 cases included 56% (1204) were males, and 44% (946) were females,
72% (1548), [59% males and 41% females] had Grade I LV diastolic dysfunction.
Conclusion: This observational study concludes that there is a huge prevalence of LV diastolic dysfunction, in people with T2DM, which is an important risk factor for cardiac morbidity and mortality, which may lead to the development of overt heart failure and progression to coronary artery disease if not corrected early.

ORIGINAL RESEARCH ARTICLE

2023, www.medrech.com

BACKGROUND AND AIMS

Heart failure (HF) with preserved ejection fraction is often preceded by Left Ventricular Diastolic Dysfunction (LVDD). CVD (Cardio Vascular Disease) is currently the leading cause of death in India and its prevalence is projected to rise. In 2000, there were an estimated 30 million people with coronary heart disease (CHD) alone in India or a nearly 3% prevalence[1,4]. The annual

incidence of HF for patients with CHD ranges from 0.4% to 2.3% per year, suggesting that 120,000–690,000 Indians could develop symptomatic HF due to CHD every year, assuming none has HF at baseline and the at-risk population does not diminish.[1] The burden of HF in India appears high, and estimates of prevalence range from 1.3 million to 4.6 million, with an annual incidence of 491,600–1.8 million[2,3] However, reliable data are lacking because of inadequate surveillance systems. Population, epidemiological and health transitions will continue to play an important role in the future burden of HF in India.[5,6]

Heart failure (HF) is a fast-growing worldwide clinical problem and one of the most common causes of death in developed countries. It is a complex clinical syndrome that results from any structural or functional cardiac disorder that impairs the ability of the ventricles to fill correctly or eject blood completely, leading to congestion and reduced systemic perfusion. Echocardiography is the most comprehensive imaging test for the diagnosis of HF. The test provides structural, functional, and hemodynamic information non-invasively.

Echocardiography plays an important role in the diagnosis and management of patients with heart failure (HF). It is widely used to assess cardiac anatomy and physiology[7,8]. All stages of left ventricular (LV) remodeling and failure have been characterized by two-dimensional echocardiography (2DE). Two-dimensional echocardiography has also been the single most useful diagnostic tool that can guide the management of patients with HF.

Approximately half of all heart failure cases occur with preserved ejection fraction (HFpEF)[9]. Heart failure with preserved ejection fraction develops from the interplay among several mechanisms, including (but not limited to) left ventricular diastolic dysfunction, left ventricular systolic dysfunction, pulmonary hypertension, and extracardiac volume overload[10], but it is clear that LVDD is a critical element underlying heart failure with preserved ejection fraction in many individuals[11]. Preclinical LVDD (LVDD with normal ejection fraction and no symptoms of heart failure, i.e., stage B heart failure) is an independent predictor of incident clinical heart failure[12].

Since LVDD is a predictor of future heart failure, descriptive and analytical epidemiologic studies of LVDD will be essential to understanding the natural history of heart failure with preserved ejection fraction. Sodium–glucose co-transporter 2 (SGLT2) inhibitors, a class of drugs used for the therapeutic management of people with diabetes, have been shown to reduce the development and progression of heart failure in people with type 2 diabetes and those with heart failure and a reduced ejection fraction. However, the effect of these drugs in patients with heart failure and a preserved ejection fraction was not well established until the EMPEROR PRESERVE trial got published[13]. The trial concluded that an SGLT2 inhibitor (Empagliflozin) reduced the combined risk of cardiovascular death or hospitalization for heart failure in patients with heart failure and a preserved ejection fraction, regardless of the presence or absence of diabetes. People with type 2 diabetes who were at high risk for cardiovascular events and received Empagliflozin, as compared to those who received a placebo, had a lower rate of the primary composite cardiovascular outcome and of death from any cause when the study drug was added to the standard care[14]. Among patients with heart failure and a reduced ejection fraction, the risk of worsening heart failure or death from cardiovascular causes was lower among those who received Dapagliflozin than among those who received a placebo, regardless of the presence or absence of diabetes[15].

MATERIALS AND METHODS

People diagnosed with T2DM following the ADA criteria and disease duration of ≤ 2 years, and on oral anti-hyperglycemic agents (except SGLT2 inhibitors), underwent standard TTE (Trans Thoracic Echocardiography) and assessment of their LVEF and grading of LV diastolic dysfunction. Overall LVEF (systolic function) was calculated by modified Simpson's method and LVEF ≥ 50% was considered normal.

All those having E:e' ≤ 8, (Grade I LV diastolic dysfunction/impaired relaxation) assessed by Tissue Doppler interrogations (TDI) were shortlisted. Detailed medical history was collected from each eligible subject after getting informed consent. All of them underwent biochemical investigations. After a 12-hour fast, a venous blood sample was collected and sent to the biochemistry laboratory for estimation of the following: Plasma glucose level and HbA1c. All the subjects underwent resting transthoracic 2-dimensional echocardiography and Doppler imaging, to assess left ventricular systolic and diastolic function. A TTE with pulsed Doppler evaluation of trans-mitral inflow and TDI and 2D echocardiography was performed to minimize the errors in assessing the diastolic dysfunction. Peak velocities of the early phase (E) and late/atrial phase (A) of the mitral inflow and their ratio (E/A) were measured using pulse wave Doppler recordings of trans-mitral flow at the mitral valve leaflet tips. Using tissue Doppler imaging, early peak diastolic mitral annular velocities (e′) at the septal and lateral mitral annulus were measured. Average e′ was calculated from the average of the septal and lateral mitral annulus. E/e′ ratio was then calculated. E-wave deceleration time was measured. In all phases of diastolic dysfunction, the early diastolic velocity of the mitral annulus (Ea) is reduced and it does not increase with high filling pressure. Since mitral E velocity increases with a higher filling pressure and tissue Doppler Ea remains reduced, the ratio of the mitral E velocity and the mitral annulus velocity of Ea (E/Ea) has a good correlation with the pulmonary capillary wedge pressure or left ventricular filling pressure. E/Ea ratio >15 usually indicates pulmonary capillary wedge pressure of greater than 20mmHg when septal Ea is used; and if the ratio <8, the filling pressure is usually normal and for the ratio between 8 and 15, there may be a requirement for further diastolic parameters to estimate diastolic filling pressures [8,9,17.] Echocardiography (TTE) was performed by harmonic imaging mode with Acuson-Siemens-X 300 echocardiography machine (2-4 MHz multi-frequency linear phased array cardiac probe) according to the standard protocol. Exclusion criteria were - patients with hypertension/on antihypertensive medications, evidence of coronary artery disease [excluded by the history of angina, chest pain, Electrocardiogram (ECG) changes, and abnormal Treadmill test (TMT) results], subjects with evidence of valvular heart disease, on insulin and HbA1c > 9% were also not included in the study. A total of 2,150 cases were assessed with the inclusion criteria stated above at the hospital, (Konnagar Matri Sadan Municipal Hospital, located in Hooghly District, lying in the southern part of the state of West Bengal situated in eastern India) over 4 years.

Diastolic wall strain is usually low in patients with HFpEF, suggesting higher stiffness when compared to control despite normal EF. Among patients with HFpEF, patients with lower diastolic wall strain have more abnormal geometry, impaired relaxation, higher filling pressures, and worse prognosis, when assessed by Doppler. Echocardiography is the imaging modality of choice in patients with HF for multiple reasons including cost compared to other imaging modalities, reproducibility, availability, noninvasiveness, as well as diagnostic and prognostic values. It is the most useful tool in guiding HF

management in both, Systolic and Diastolic HF patients[7,16].

RESULTS

Of the 2,150 cases included in this observational study 56% (1204) were males, with a mean age of 48.4 ± 4.2 years, and 44% (946) were females, with a mean age of 43.2 ± 3.7 years.

72% (1548), [913 males (59%) and 635 females (41%)] had Grade I LV diastolic dysfunction and HFpEF.

CONCLUSION AND DISCUSSION

This observational study concludes that there is a huge prevalence of LV diastolic dysfunction, in people with T2DM, (The prevalence was as high as 72%) which is an important risk factor for cardiac morbidity and mortality, HF, especially HFpEF, which is asymptomatic, may lead to the development of overt heart failure and progression to coronary artery disease if not corrected early. As there is strong evidence of the benefits of SGLT2 inhibitors in reducing cardiovascular mortality and hospitalization for heart failure in people with T2DM with a preserved LVEF all these patients should be treated with these agents as an add-on therapy to Metformin and lifestyle modifications. SGLT2 inhibitors may even be considered as a first-line therapeutic agent for the management of people with diabetes unless contraindicated.

ACKNOWLEDGEMENTS

I am indebted to the staff of the Department of Radiology, Konnagar Matri Sadan Municipal Hospital and the staff of Doctor Sud's Clinic for their immense help in compiling and recording of the data and all the people with diabetes who consented to let me use their data to conclude this observational study.

REFERENCES:

1. Natl Med J India. 2010 Sep-Oct; 23(5): 283–288.
2. National Commission on Population, Government of India. [3 March 2010]; Available at http://populationcommission.nic.in/
3. Gupta R, Joshi P, Mohan V, Reddy KS, Yusuf S. Epidemiology and causation of coronary heart disease and stroke in India. Heart. 2008; 94:16–26.
4. Yusuf S, Sleight P, Pogue J, Bosch J, Davies R, Dagenais G. Effects of an angiotensin-converting-enzyme inhibitor, ramipril, on cardiovascular events in high-risk patients. The Heart Outcomes Prevention Evaluation Study Investigators. N Engl J Med. 2000; 342:145–53.
5. Vakil RJ. A statistical study of 1281 cases of congestive cardiac failure or myocardial insufficiency in India. Indian Physician. 1949; 8:281–9.
6. Rodgers A, Ezzati M, Vander Hoorn S, Lopez AD, Lin RB, Murray CJ. Comparative risk assessment collaborating group distribution of major health risks: Findings from the global burden of disease study. PLoS Med. 2004;1: e27.
7. Oh JK. Echocardiography in heart failure: beyond diagnosis. Eur J Echocardiogr. 2007; 8(1):4-14.
8. St. John Sutton MG, Plappert T, Rahmouni H. Assessment of left ventricular systolic function by echocardiography. Heart Fail Clin. 2009;5(2):177-190.
9. Ammar KA, Jacobsen SJ, Mahoney DW, et al. Prevalence and prognostic significance of heart failure stages: application of the American College of Cardiology/American Heart Association heart failure staging criteria in the community. Circulation. 2007; 115(12): 1563–1570.
10. Oktay AA, Rich JD, Shah SJ. The emerging epidemic of heart failure with preserved ejection fraction. Curr Heart Fail Rep. 2013;10(4):401–410.

11. Burke MA, Katz DH, Beussink L, et al. Prognostic importance of pathophysiologic markers in patients with heart failure and preserved ejection fraction. Circ Heart Fail. 2014;7(2):288–299.
12. Kane GC, Karon BL, Mahoney DW, et al. Progression of left ventricular diastolic dysfunction and risk of heart failure. JAMA. 2011;306(8):856–863.\
13. N Engl J Med. Emperor Preserve Trial Oct. 14, 2021; 385:1451-1461
14. N Engl J Med EmpaReg Trial Nov 26, 2015; 373:2117-2128
15. N Engl J Med, DAPA-HF Trial, Nov 21, 2019; 381:1995-2008
16. European Journal of Echocardiography, Volume 8, Issue 1, January 2007, Pages 4–14,
17. How to diagnose heart failure: a consensus statement on the diagnosis of heart failure with normal left ventricular ejection fraction by the Heart Failure and Echocardiograph Associations of the European Society of Cardiology. Eur. Heart Journal 2007; 28:2539-2550