Section: General Medicine

Original Research Article

A STUDY ON PREVALENCE OF LEFT VENTRICULAR DIASTOLIC DYSFUNCTION IN ASYMPTOMATIC INDIVIDUALS WITH DIABETES MELLITUS, HYPERTENSION AND DIABETES MELLITUS WITH HYPERTENSION

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Abstract

Background: Left ventricular diastolic dysfunction (LVDD) is a common early manifestation of cardiac abnormalities in individuals with diabetes mellitus (DM) and hypertension (HTN), even in the absence of symptoms. The interplay between these conditions may exacerbate cardiovascular risk, but the prevalence of LVDD in asymptomatic individuals remains under explored. This study aims to investigate the prevalence of LVDD in asymptomatic individuals with DM, HTN, and combined DM with HTN, with a focus on the potential pathophysiological mechanisms and implications for early intervention. **Materials and Methods:** A observational study was conducted involving 76 asymptomatic individuals, categorized into three groups: DM (n=18), HTN (n=14), and DM with HTN (n=44). Participants underwent detailed clinical evaluation, echocardiographic assessment, and Doppler imaging to assess left ventricular diastolic function. The presence and severity of LVDD were determined based on established echocardiographic parameters such as E/A ratio. **Result:** The study found a higher prevalence of LVDD in individuals with combined DM and HTN (36.4%) compared to those with DM alone (27.8%) or HTN alone (14.3%). The severity of LVDD was significantly associated with the duration and presence of both diabetes and hypertension. **Conclusion:** The prevalence of LVDD is notably high in asymptomatic individuals with DM, HTN, and particularly in those with combined DM and HTN. Early detection of LVDD in these populations is crucial for preventing further cardiovascular complications. Further longitudinal studies are needed to determine the long-term outcomes and efficacy of early interventions in reducing cardiovascular risk in these asymptomatic individuals.

INTRODUCTION

Heart failure (HF) is a common final pathway for most chronic cardiovascular diseases including hypertension (HTN), coronary artery disease and valvular heart disease. Numerous reports suggest that about one-third of patients with congestive heart failure do not have any abnormality of left ventricular systolic function. These patients presumably have heart failure on the basis of ventricular diastolic dysfunction. Type 2 diabetic patients may develop underlying CVD without experiencing or recognizing the telltale signs and symptoms until too late. Sub-clinical manifestations are therefore difficult to study and report, which makes the real scale of the problem an important question in an otherwise well- understood associated pathology. Many studies have reported that the incidence of heart failure (54.33%) in diabetic subjects is high even in the absence of hypertension and coronary artery disease.[1-7] Only a few studies have been conducted in India to establish this prevalence and association in diabetic patients. This study aims in evaluating the prevalence of diastolic dysfunction in patients with Diabetes Mellitus (DM), Systemic Hypertension and in patients with both Diabetes and systemic Hypertension.

Aim & Objectives

To determine the prevalence of LV diastolic dysfunction in asymptomatic Individuals with Hypertension, Diabetes, Diabetes with Hypertension.
To Grade the Diastolic dysfunction by echocardiography findings.

MATERIALS AND METHODS

Observational Study done in 76 asymptomatic individuals with hypertension, diabetes mellitus and with both hypertension and diabetes mellitus attending non communicable disease out patient facility of Department of General Medicine with cross departmental collaboration of cardiology department of Government Medical College Hospital, Virudhunagar during October 2022 to September 2023. Patients who consented for the study were subjected for baseline investigations (Hemogram, renal function test, ECG, Blood sugar etc) and echocardiography using ECHO Machine – MINIDRAY Model No: DC80x- insight version for assessing the E/ A ratio, to find out and assess the grades of Diastolic Dysfunction.

RESULTS

Data was collected and entered in MS excel master sheet and the analytical data was interpreted by Pearson Chi-Square test. The analysis and interpretation of statistical procedures were performed by the statistical package SPSS version 28. The value of P <0.05was considered as significant.

The study population was predominantly aged between 50-59 years (42.1%), followed by 40- 49 years (34.2%). The study participants comprised 59.2% males and 40.8% females, indicating a higher representation of male participants in the study.

In our study, participants with only diabetes was seen in 18 (23.7%), only hypertension was seen in 14(18.4%), both Diabetes & Hypertension was seen in 44 (57.9%).. Among only diabetes participants 61.1% had diabetes for less than 5 years, and 38.9% had diabetes for more than 5 years,The average random blood sugar level among only diabetic participants was 168 mg/dl (SD 41.19). The median RBS was 147.5 mg/dl, with values ranging from 126 to 288 mg/dl.

Among only hypertensive participants, the average duration of hypertension was 6.00 years (SD=3). The median duration was 5 years, with a range from 2 to 10 years. Among participants with only hypertension, 57% had hypertension for less than 5 years, and 43% had hypertension for more than 5 years.

The average systolic blood pressure among hypertensive participants was 127.14 mmHg (SD 14.37). The median SBP was 130.00 mmHg, with values ranging from 110 to 160 mmHg.The average diastolic blood pressure among hypertensive participants was 79.3 mmHg (SD 8.3). The median DBP was 80 mmHg, with values ranging from 70 to 100 mmHg.

For participants with both hypertension and diabetes mellitus, the average duration was 5.57 years (SD 3.23). The median duration was 5 years, with a range from 1 to 15 years.Among participants with both hypertension and diabetes mellitus, the average random blood sugar level was 184.91 mg/dl (SD 49.04). The median RBS was 177.00 mg/dl, with values ranging from 118.00 to 289.00 mg/dl.For participants with both hypertension and diabetes mellitus, the average systolic blood pressure was 132.50 mmHg (SD 13.14). The median SBP was 130.00 mmHg, with values ranging from 110.00 to 160.00 mmHg.For participants with both hypertension and diabetes mellitus, the average diastolic blood pressure was 81.82 mmHg (SD 9.47). The median DBP was 80.00 mmHg, with values ranging from 60.00 to 100.00 mmHg.

For the overall participants, the average random blood sugar level was 168.2 mg/dl (SD 49.5). The median RBS was 154.5 mg/dl, with values ranging from 103 to 289.00 mg/dl.For the overall participants, the average systolic blood pressure was 127 mm Hg (SD 14.2). The median systolic blood pressure was 130 mg/dl, with values ranging from 100 to 160 mm Hg.For the overall participants, the average Diastolic blood pressure was 79.5 mm Hg (SD 9.5). The median diastolic blood pressure was 80 mm Hg , with values ranging from 60 to 100 mm Hg.
Overall the 45 (59.2%) of the participants had the duration of illness for less than 5 years, remaining 31(40.8%) had the illness for more than 5 years.

The average Echo E wave velocity was 0.80 m/s (SD 0.19). The median E wave velocity was 0.8 m/s, with values ranging from 0.44 to 1.56 m/s.The average Echo A wave velocity was 0.83 m/s (SD 0.24). The median A wave velocity was 0.84 m/s, with values ranging from 0.41 to 1.80 m/s.The average E/A ratio was 1.03 (SD 0.34). The median E/A ratio was 0.98, with values ranging from 0.48 to 2.02. Diastolic dysfunction was present in 30.3% of the total participants. Among participants with diastolic dysfunction, 26.3% had Grade I and 4% had Grade II diastolic dysfunction. The majority (69.7%) had a normal diastolic function.

Among participants aged 30- 39, only 3.8% had diastolic dysfunction, while 25.0% had it in the age group of 50-59. The majority (87.5%) of those over 60 years had diastolic dysfunction. But there was no significant association between gender and the presence of diastolic dysfunction.

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Table 1: Association between duration of Diabetes Mellitus (DM) and Diastolic Dysfunction.

DM Duration	Diastolic Dysfunction Present n (%)	Diastolic Dysfunction Absent n (%)	Total n (%)	Chi-square Test
<5 years	1 (9.1%)	10 (90.9%)	11 (100%)	$\chi^2 = 4.923$, p = 0.026
>5 years	4 (57.1%)	3 (42.9%)	7 (100%)	
Total	5	13	18	

Among participants with diabetes duration less than 5 years, only 9.1% had diastolic dysfunction, whereas 57.1% of those with diabetes duration more than 5 years had diastolic dysfunction. The chi-square test ($\chi^2 = 4.923$, $p = 0.026$) indicates a significant association between the duration of diabetes mellitus and the presence of diastolic dysfunction.

Table 2: Association between duration of Hypertension (HTN) and Diastolic Dysfunction

HTN Duration	Diastolic Dysfunction Present n (%)	Diastolic Dysfunction Absent n (%)	Total n (%)	Chi-square Test
<5 years	0 (0.0%)	8 (100.0%)	8 (100%)	$\chi^2 = 3.111$, p = 0.078
>5 years	2 (33.3%)	4 (66.7%)	6 (100%)	
Total	2	12	14	

None of the participants with less than 5 years of hypertension duration had diastolic dysfunction, while 33.3% of those with more than 5 years of hypertension duration had diastolic dysfunction. The chi-square test ($\chi^2 = 3.111$, $p = 0.078$) indicates that the association between hypertension duration category and the presence of diastolic dysfunction is not statistically significant. However, there is a trend towards higher diastolic dysfunction with longer hypertension duration.

Table 3: Association between duration of Combined Hypertension and Diabetes Mellitus (HTN+ DM) and Diastolic Dysfunction

Combined Hypertension and Diabetes Duration	Diastolic Dysfunction Present n (%)	Diastolic Dysfunction Absent n (%)	Total n (%)	Chi-square Test
<5 years	2 (7.7%)	24 (92.3%)	26 (100%)	$\chi^2 = 22.578$, p = 0.000
>5 years	14 (77.8%)	4 (22.2%)	18 (100%)	
Total	16	28	44	

Among participants with less than 5 years of combined hypertension and diabetes duration, only 7.7% had diastolic dysfunction, while 77.8% of those with more than 5 years of combined hypertension and diabetes duration had diastolic dysfunction. The chi-square test ($\chi^2 = 22.578$, $p = 0.000$) indicates a highly significant association between the duration of combined hypertension and diabetes and the presence of diastolic dysfunction. This suggests that a longer duration of both conditions is significantly associated with a higher prevalence of diastolic dysfunction.

DISCUSSION

Studies have reported a high prevalence of diastolic dysfunction among subjects with type 2 DM. Early detection of LVDD may have important diagnostic, prognostic and therapeutic implications.[5] Freire et al,[8] stated the Diastolic Dysfunction in Diabetes patients. In our study conducted in a sample of 76 asymptomatic individuals of DM, HTN, DM with HTN Diastolic dysfunction was present in 30.3% of the participants. Among the participants with diastolic dysfunction, 26.3% had Grade I and 4 % had Grade II diastolic dysfunction.

Srivastava PM et al., confirmed that ageing is an independent predictor of cardiac and diastolic dysfunction in patients with type 2 diabetes. In our study the population was predominantly aged between 50-59 years (42.1%). The majority (87.5%) of those over 60 years had diastolic dysfunction. Wachter R,[9] showed that the presence of diabetes affects diastolic function in men, but didnot differ between diabetic and non-diabetic populations in women.

Our study shows that 31.1% of males and 29% of females are having diastolic dysfunction. Our study suggests that there is no significant association between the gender and the diastolic dysfunction.[10]

Khalil S I et al,[11] (2007) showed that the prevalence of diastolic dysfunction increases with duration of diabetes. In a study by Ashour K, it was concluded that patients with duration of diabetes of six years and more had a higher prevalence of diastolic dysfunction as compared with those patients with less duration (83.67% versus 35.13%).[11] In our study participants with DM alone, 38.9% had diabetes for more than 5yrs. Our study states that the asymptomatic patients with DM alone for longer duration are having significant association with diastolic dysfunction.

Though our study showed no significant association between the duration of HTN and the diastolic dysfunction there is an increased risk of developing LVDD in patients with longer duration.

This finding emphasizes the need for screening of all patients with HTN at the earliest with ECHO is necessary to avoid developing further complications.

Among participants with both hypertension and diabetes mellitus, 59.1% had the conditions for less than 5 years, and 40.9 % had the conditions for more

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than 5 years. Our study strongly suggests that more the duration of combined DM and HTN higher the risk of developing LV Diastolic dysfunction. Although the presence of Grade-I & Grade-II diastolic dysfunction may not seem alarming at present in our study population as they are asymptomatic; evidence from prospective studies suggested that even patients with Grade-I LVDD can progress to symptomatic heart failure. Hence, monitoring of all these patients is essential.

CONCLUSION

Our study suggests that there is higher prevalence of Diastolic dysfunction in patients with DM and HTN than in patients with DM alone and HTN alone. This study shows that older the age group h a v e higher the risk of developing diastolic dysfunction, especially in those individuals over 60 years of age . The study strongly represents that a longer duration of both DM and HTN is associated with a higher prevalence of diastolic dysfunction. Longer the duration of DM alone and the presence of diastolic dysfunction is statistically significant in our study.

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