ORIGINAL ARTICLE

Association of Uncontrolled Hypertension with Left Ventricular Diastolic

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ABSTRACT

Objective: To determine the association of Left ventricular diastolic dysfunction (LVDD) with uncontrolled hypertension.

Materials and methods: This case control study was done at cardiac department of Punjab Institute of Cardiology, Lahore. Study duration was six months from 24 November 2016 to 23 May 2017. Patients with uncontrolled and controlled hypertension, age between 20 and 70 years coming for echocardiography and either of gender were included. Blood pressure was measured after 5 minutes of resting sitting position. The average of 3 blood pressure readings taken at intervals of at least 1 minute, were taken as representing clinic blood pressure. Echocardiography was done and it is measures of E/A using pulsed Doppler technique at stage of the mitral valve leaflets tip were used to evaluate the absence or presence of diastolic dysfunction of the left ventricle. E wave deceleration time (DT), isovolumic relaxation time (IVRT) were also obtained at the same time. The threshold of <1.0 was used as an indication of reversed E/A ratio. Using above measured parameters LVDD assessed. All the information was collected via pre-designed study proforma.

Results: The mean age of cases group was 44.71±13.68 years and in control group was 47±13.68 years. Out of 160 patients the LVDD was found in 71(44.38%) patients. Statistically 11.68 times more risk of LVDD was found in case group than to control group. i. e OR [5.502-24.808].

Conclusion: The incidence of left ventricular diastolic dysfunction was observed to be frequently high among hypertensive patients as compared to controlled hypertensive individuals and doppler echocardiography is very useful tool in its diagnosis.

Key word: Left ventricular diastolic dysfunction, uncontrolled hypertension, odds ratio

INTRODUCTION

LVDD (left ventricular diastolic dysfunction) is a typical early alteration of several cardiovascular disorders.[1] The myocardial structure alters morphologically and functionally as a result of uncontrolled hypertension. The most prevalent of these functional changes is diastolic dysfunction.[2,3] Clinical importance of Left Ventricular Diastolic Dysfunction (LVDD) as either a cause of heart failure in hypertensive individuals with adequate systolic function is well understood.[2,3] Diastolic dysfunction is a disorder in which the left ventricle impaired (LV) function during diastole. LV diastolic dysfunction, may develops in individuals with hypertension, diabetes mellitus (DM), and/or age, poses a significant risk of heart failure and shortened lifespan even though asymptomatic or "preclinical,". Left ventricular diastolic dysfunction (LVDD) usually occurs before other cardiac symptoms and signs, but it can be diagnosed with an echocardiogram.[4] It is reported that even when LV systolic function is normal of the patients, diastolic dysfunction is linked to an elevated risk of death and morbidity.[4,5] Early detection and treatment of LV diastolic dysfunction allows for prevention of heart disease and heart failure.[4,6] Echocardiography has been used very extensively for evaluation of diastolic LV dysfunction and has been found very accurate tool. Mitral inflow velocity changes are very predictable in quantification of diastolic dysfunction.[7] The LV pressure–volume association considered as the gold standard for measuring diastolic function, although it necessitates an intrusive procedure. Noninvasive diastolic function and filling properties may now be assessed using conventional echocardiography with doppler measures of trans-mitral and pulmonary vein flows, and TDI mitral annular velocities. These approaches, however, are complicated, and no one test can accurately describe diastolic function. To estimate diastolic function as accurately as feasible, a complete evaluation of the number of factors is required.[8] Because this phase of the cardiac cycle is metabolically taxing, it slows and prolongs LV relaxation during an initial stage of LV diastolic dysfunction. Reduced early but increased atrial LV filling, as well as less forceful mitral annulus motion during early diastole compared to late diastole, are all characterized impaired myocardial relaxation. As a result, a decreased trans-mitral ratio of peak early filling (E) to peak atrial filling (A), as well as lower mitral annular early: late diastolic (E':A') velocity ratios and a longer isovolumetric relaxation period, could indicate poorer myocardial relaxation. So, because apex of LV remains nearly constant during the cycle of heart, alterations in the long axis are reflected as in motion of such mitral annulus. The normal E1 occurs virtually simultaneously with the LV inflow E velocity, indicating quick diastolic flow propagation towards the apex.[9] Flow propagation to the apex is retarded with diastolic dysfunction (slowed relaxation and lower elastic recoil), and E1 is diminished and delayed. The LV inflow velocity (E wave) increases when diastolic dysfunction causes an increase in left atrial pressure, while the deceleration time

decreases. As a result, an increase in the E/E1 ratio suggests increased left atrial pressure and can be used to detect diastolic heart failure without invasive testing. It's important to remember that the E/E1 ratio can be normal even if diastolic dysfunction hasn't nevertheless caused a raise in left atrial pressure. As a result, complete tissue doppler and 2D Doppler imaging technique is critical for assessing LV diastolic function.[10] The contribution of atrial systole is reduced when the heart rate rises. LV filling problems can be observed early in arterial hypertension and often precede the loss of left ventricular systolic function. Hypertension affects relaxation at all stages of diastole, and when left ventricular hypertrophy (LVH) occurs, it also impairs compliance, therefore all hypertensive patients should have their Doppler echocardiography parameters measured for diastolic function assessment.[1]Early detection of diastolic dysfunction may aid in further risk categorization and, as a result, the implementation of suitable pharmaceutical therapies. This study has been conducted to evaluate the association of Left ventricular diastolic dysfunction (LVDD) with uncontrolled hypertension.

MATERIALS AND METHODS

This case control study was done at cardiac department of Punjab Institute of Cardiology, Lahore. Study duration was six months from 24 November 2016 to 23 May 2017. Patients with uncontrolled and controlled hypertension, age between 20-70 years coming for echocardiography and either of gender were included. All the individuals with cardiovascular diseases like congestive heart failure, ischemic heart disease, valvular heart disease, patients with other systemic disease like renal impairment, liver disease, thyroid abnormalities, rheumatic disease and individuals having diabetes history (Fasting blood sugar level >126 mg/dl) and atrial fibrillation were excluded. All the patients were divided in two groups. Patients with uncontrolled hypertension were enrolled in group A (cases) and patients of controlled hypertension were enrolled in group B (control). Measurements of the patient's blood pressure were takin after 5 minutes of resting sitting position and mean of the three readings of the blood pressure was taken at intervals of at least 1 minute, was taken as representative clinic blood pressure. Echocardiography was done and it is measures of E/A using pulsed Doppler technique at stage of the mitral valve leaflets tip were utilized to evaluate the absence or presence of diastolic dysfunction of the left ventricle. isovolumic relaxation time (IVRT) and E wave deceleration time (DT) was also obtained at the same time. The threshold of <1.0 was used as an indication of reversed E/A ratio. Using above measured parameters LVDD assessed. All the information was collected via pre-designed study proforma. SPSS version 21 was used for the analysis of data.

RESULTS

Mean age of the cases group patients was 44.71±13.68 years and mean age of control group was 47±13.68 years. Out of all 75(46.88%) subjects were male and 85(53.13%) subjects were females. Average BMI of case group was 25.88±5.061 kg/m^2 and control group was 26.42±4.86 kg/m^2. Mean duration of hypertension of case group was 11.06±7.03 months and 1.53±7.15 months of control group. Out of 160 patients the LVDD was found in 71(44.38%) patients and it was 11.68 times more among uncontrolled hypertensive case than control hypertensive controls i.e. OR [5.502-24.808] as shown in table 1.

Left ventricular diastolic dysfunction was statistically significant according to age and gender (p-<0.05) as showed in table 2 and 3.

Table.1 Frequency of Left ventricular diastolic dysfunction n=160

LVDD	Study Groups		Total	OR
	Case	Control		
Yes	57	14	71	11.68
No	23	66	89	[5.502-
Total	80	80	160	24.808]

P-value=0.001, Chi-value = 46.86

Table.2 Frequency of Left ventricular diastolic dysfunction according to age n=160

Age	LVDD	Study Groups		Total	p-value
		Case	Control		
<50 years	Yes	42	14	56	0.0001
	No	15	49	64	
>50 years	Yes	15	00	15	0.0001
	No	08	17	25	

Table.3 Frequency of Left ventricular diastolic dysfunction according to gender n=160

Gender	LVDD	Study Groups		Total	p-value
		Case	Control		
Male	Yes	27	7	34	0.0001
	No	13	28	41	
Female	Yes	30	7	37	0.0001
	No	10	38	48	

DISCUSSION

Heart failure is a complicated clinical illness caused by a variety of anatomical and functional cardiac abnormalities that affect LV filling and ejection. Myocardial structure will alter morphologically and functionally as a result of uncontrolled blood pressure. In cases of systemic hypertension, the clinical importance of LVDD as caused by heart failure despite normal systolic function is well understood.[11] Hypertension is a very important causative factor for LVDD in the general population, and it promotes the disease through a number of different mechanisms, include hemodynamic excess and myocardial ischemia.[12] Risk of the heart failure among hypertensive cases is higher in contrast to normotensive cases.[13] Consistently in this study LVDD was found in 71 patients and out of them 57 were uncontrolled hypertensive cases and 14 were control hypertensive cases (p-0.001). On other hand Leão RN et al[14] also reported that the LVDD occurrence among hypertensive cases was strongly linked to uncontrolled hypertension. Although in the study of Rosa EC et al[15] also observed that the diastolic dysfunction was highly prevalent among hypertensive study population. In this study mean age of the cases group patients was 44.71±13.68 years and mean age of control group was 47±13.68 years and overall males were 53.13%. These findings were similar to the study of Kalsoom W et al[13] as they reported that the patient's average age was 47.29±5.93 years and males

were 65 out of 97, while Araz M et al[16] found higher age average of the study subjects as 60.78±10.63 years. Diastolic dysfunction may also be a direct contributor to the adverse outcomes, perhaps by contributing heart failure progression through reserve limiting cardiac output, increases in neuroendocrine activation, raises breathlessness characterization, and physical inactivity encouragement, deconditioning, and fargility.[17] Serial assessment of LV diastolic function has the potential to be a highly powerful marker of all-cause mortality, not just cardiovascular death. This is especially surprising given the recent report from the Framingham Study[18] that noncardiac factors contribute significantly to the development of cardiac events, including heart failure, and others showing that once heart failure develops, noncardiac comorbidities contribute quite significantly to mortality.[19] It is likely that diastolic dysfunction and especially worsening diastolic dysfunction is a marker of increased risk. Early diagnosis and management results in improvement of clinical symptom/ signs as well as improved survival.

CONCLUSIONS:

It has been observed that the incidence of left ventricular diastolic dysfunction was frequently high among cases of uncontrolled hypertension as compared to controlled hypertensive individuals and doppler echocardiography is very useful tool in its diagnosis. By the proper management of the hypertension the such morbidity can be decreased. Future large-scale studies are suggested.

REFERENCES

1 Palmiero P, Zito A, Maiello M, Cameli M, Modesti PA, Muiesan ML et al. Left ventricular diastolic function in hypertension: methodological considerations and clinical implications. Journal of clinical medicine research. 2015 Mar;7(3):137.

2 Adamu GU, Katibi AI, Opadijo G, Omotoso A. Prevalence of left ventricular diastolic dysfunction in newly diagnosed Nigerians with systemic hypertension: a pulsed wave Doppler echocardiographic study. African health sciences. 2010;10(2).

3 Ike SO, Onwubere BJ. The relationship between diastolic dysfunction and the level of blood pressure in Blacks. Ethnic Dis. 2003;13(4):463–469.

4 Aksoy S, Durmuş G, Özcan S, Toprak E, Gurkan U, Oz D, et al. Is left ventricular diastolic dysfunction independent from presence of hypertension in metabolic syndrome? An echocardiographic study. Journal of cardiology. 2014 Sep 1;64(3):194-8.

5 Achong N, Wahi S, Marwick TH. Evolution and outcome of diastolic dysfunction. Heart. 2009;95(10):813-8.

6 von Bibra H, Sutton MSJ. Diastolic dysfunction in diabetes and the metabolic syndrome: promising potential for diagnosis and prognosis. Diabetologia. 2010;53(6):1033-45.

7 Ventricular Diastolic Function by Echocardiography: An Update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. J Am Soc Echocardiogr 2016;29:277-314.

8 Kuznetsova T, Herbots L, Jin Y, Stolarz-Skrzypek K,. Systolic and diastolic left ventricular dysfunction: from risk factors to overt heart failure. Expert review of cardiovascular therapy. 2010;1;8(2):251-8.

9 Hasegawa H, Little WC, Ohno M, Brucks S, Morimoto A, Cheng H-J, et al. Diastolic mitral annular velocityduring the development of heart failure. Journal of the American College of Cardiology. 2003;41(9):1590-7.

10 Oh JK, Hatle L, Tajik AJ, Little WC. Diastolic heart failure can be diagnosed by comprehensive two-dimensional and Doppler echocardiography. Journal of the American College of Cardiology. 2006;47(3):500-6.

11 Adamu G, Katibi A, Opadijo G, Omotoso A, Araoye A. Prevalence of left ventricular diastolic dysfunction in newly diagnosed Nigerians with systemic hypertension: a pulsed wave Doppler echocardiographic study. African health sciences. 2010;10(2).

12 Nadruz W, Shah AM, Solomon SD. Diastolic dysfunction and hypertension. Medical Clinics. 2017 Jan 1;101(1):7-17.

13 Kalsoom W, Hanjra HH, Rauf H, Zain-ul-Abidin S, Batool H, Amjad A. Frequency of left ventricular diastolic dysfunction in hypertensive patients via echocardiography. IJSER 2020;11;4;1062-79

14 Leão RN, da Silva PM, Pocinho RM, Alves M, Virella D, Dos Reis RP. Determinants of left ventricular diastolic dysfunction in hypertensive patients. Hipertension y riesgo vascular. 2018;1;35(4):160-8.

15 Rosa EC, Moysés VA, Rivera I, Sesso RD, Kohlmann N, Zanella MT. Left ventricular diastolic function in essential hypertensive patients: influence of age and left ventricular geometry. Arquivos brasileiros de cardiologia. 2002;78(5):472-7.

16 Araz M, Bayrac A, Çiftçi H. The impact of diabetes on left ventricular diastolic function in patients with arterial hypertension. Northern clinics of Istanbul. 2015;2(3):177.

17 Murad K, Kitzman D. Frailty and multiple comorbidities in the elderly patient with heart failure: implications for management. Heart Fail Rev. May31, 2011.

18 Lam CSP, Lyass A, Kraigher-Krainer E, Massaro JM. Cardiac dysfunction and noncardiac dysfunction as precursors of heart failure with reduced and preserved ejection fraction in the community/clinical perspective. Circulation. 2011;124:24–30

19 Lee DS, Gona P, Albano I, Larson MG. A systematic assessment of causes of death after heart failure onset in the community/clinical perspective. Circ Heart Fail. 2011; 4:36–43.