International Journal of Medical and Health Research
ISSN: 2454-9142; Impact Factor: RJIF 5.54
Received: 02-05-2019; Accepted: 04-06-2019
www.medicalsciencejournal.com
Volume 5; Issue 8; August 2019; Page No. 06-10

The prevalence of left ventricular diastolic dysfunction in CHF resulting from systemic hypertension

MM Rahman[1], ZF Jesmin[2], SK Chakrovortty[3], Tahmid Rahman[4]
[1] Associate Professor, Shaheed Shaikh Abu-Naser Specialized Hospital, Khulna, Bangladesh
[2] Assistant Professor, Khulna Medical College Hospital, Khulna, Bangladesh
[3] Junior Consultant, Shaheed Shaikh Abu-Naser Specialized Hospital, Khulna, Bangladesh
[4] Intern, Ibrahim Medical College, Dhaka, Bangladesh

Abstract
Introduction: Left ventricular diastolic dysfunction is a major phenomenon in patients with Congestive Heart Failure (CHF). Diastolic dysfunction include alterations of both relaxation and filling, precede alterations of chamber systolic function and can induce symptoms of heart failure even when ejection fraction is normal. As only a few studies had been conducted about left ventricular diastolic dysfunction in CH29-*9-*-*/F in our country so we have arranged this study to know more about the issue.
Objective: The major objective of this study was to assess the prevalence of diastolic dysfunction in congestive heart failure resulting from systemic hypertension.
Methods: This was a prospective observational study was carried out in Shaheed Shaikh Abu-Naser Specialized Hospital, Khulna, Bangladesh during the period from January 2017 to December 2018. Sixty patients with systemic hypertension who had recently experienced CHF with normal, EF≥50% and no clinical history of ischaemic cardiomyopathy were the study population. The patients were divided into two groups according to the degree of echocardiographic hypertrophy. In Group I there were 32 patients with a ventricular mass/volume ratio >1.8 and in Group II there were 28 patients with a ratio <1.8.
Result: Among the first selected 290 cases with CHF 60 were with diastolic dysfunction. So ratio was 20.70%. Among the study population with CHF as well as left ventricular dysfunction, male are dominating and the ratio was 58.33% (35). Among total participants the highest ratio of diastolic dysfunction was found in 61-70 years' age group. So age is a major factor here. The highest suffered portion of diastolic dysfunction is 38.33% and their duration was <5 years. Second highest ratio was 25% and their duration was 6-10 years. Then 20% (11-15 years), 11.67% (16-20 years) and lastly 5% and their duration was >20 years.
Conclusion: Left ventricular diastolic dysfunction undoubtedly is a major factor in patients with Congestive Heart Failure (CHF) and demand more attention in cardiac treatment. The findings of this study may help in further studies and in the treatment of CHF but as it was a single centered study with a small sized sample so this result may not reflect the exact scenario of the whole country.

Keywords: diastolic dysfunction, congestive heart failure, systematic hypertension

1. Introduction

Diastole and systole are two phases of the cardiac cycle. They occur as the heart beats, pumping blood through a system of blood vessels that carry blood to every part of the body. Systole occurs when the heart contracts to pump blood out, and diastole occurs when the heart relaxes after contraction. Congestive heart failure (CHF) with normal lift ventricular systolic function an abnormal diastolic function is a common clinical entity. Typically, signs and symptoms are indistinguishable from those of heart failure related to systolic dysfunction [1]. Coronary artery disease; systemic hypertension and aging are all associated with diastolic congestive heart failure, DCHF [2]. In cases of CHF in elderly patients, the prevalence of left ventricular failure with normal ejection fraction is as high as 30-40 percent [3, 4, 5, 6]. with arterial hypertension being the most frequent etiologic cause. Several factors predispose to increased diastolic niftiness in a left ventricle with normal systolic performance. These include pericardial constriction and myocardial restriction [7]. Diastolic dysfunction is caused by at least two distinct, yet interrelated. Properties of the heart: the passive elastic properties and active relaxation of the myocardium [1]. With the loss of elastic properties of the heart, there is reduction in compliance and with impairment of relaxation; there is an increase in myocardial wall tension during diastole, both of which cause increased pulmonary venous pressure. The most common condition in which these factors conspire to elevate filling pressure is hypertension. Loss of elastic properties in hypertension leading to abnormal diastolic function results from the effect of hypertrophy and increase in collagen network of the myocardium. In a study [8] described the dynamic collagen turnover in the myocardium Collagen. With a high tensile strength, is a major determinant of chamber stiffness, factors that appears to contribute to the appearance of myocardial fibrosis through their effects as collagen turnover include hormones of the rennin-anmgitensin-aldosterone system, endothelia and bradykinin [9]. On the other hand, impaired active relaxation also contributes to the path physiology of ventricular diastolic dysfunction, resulting from systemic hypertension, coronary artery disease and aging. CHF caused by abnormal diastolic function may be far more

common than previously recognized. The diastolic disorder must be distinguished from systolic abnormalities because treatment is significantly different. A history of myocardial infarction, cardiomegaly, Q-wave on the electrocardiogram and an S, gallop favours systolic dysfunction. To accurately distinguish between systolic and diastolic dysfunction, left ventricular function must be assessed. This can be accomplished with echocardiography, radionuclide angiography or radiographic ventriculography. So left ventricular diastolic dysfunction is an important issue in the treatment of congestive heart failure. Echocardiography appears great adventurous because of its portability and lack of radiation as well as its ability to evaluate valvular function, pericardial status, wall motion and chamber hypertrophy. Ideally the diagnosis should be confirmed by documenting elevation of left ventricular diastolic pressure, but this is often impractical. Therefore, noninvasive procedures such as radionuclide and echocardiogram studies to be widely used. While radionuclide angiography is a powerful tool for excluding left ventricular systolic dysfunction, its use for diagnosing diastolic dysfunction is limited [2]. Doppler echocardiography, a noninvasive and simple procedure, provides insight into left ventricular diastolic dysfunction [10, 11]. The most commonly used Doppler parameters of Diastolic dysfunction are derived from left ventricular inflow and pulmonary venous inflow. A PW Doppler sample volume is placed at the mitral valve leaflet tips to evaluate left ventricular diastolic function which reveals prolonged isovolimic relaxation time, prolonged deceleration time, decreased E-wave to A-wave ratio on mitral inflow. A PW Doppler study at pulmonary vein reveals increased S-wave to D-wave ratio and pulmonary vein 'a'-wave reversal duration prolonged and velocity increased [12]. The syndrome of diastolic heart failure is common but neglected event in the evaluation of hypertensive patients. The signs and symptoms may be similar to those in patients with systolic heart failure. The prognosis may be different due to heterogeneity in the parent population. There is no uniformity in how to diagnose and how to tear patients with heart failure with diastolic dysfunction. Therefore, the present study was undertaken to evaluate the left ventricular diastolic dysfunction in congestive heart failure resulting from systemic hypertension in our population.

2. Objective

General Objective

To assess the prevalence of diastolic dysfunction in CHF resulting from systemic hypertension.

Specific objectives

To assess the effectiveness of several diagnostic procedures in diagnosis of complication related to CHF.

3. Materials and Methods

This was a prospective observational study and it was carried out in Shaheed Shaikh Abu-Naser Specialized Hospital, Khulna, Bangladesh during the period from January 2017 to December 2018. The aim of this study was to assess the left ventricular diastolic dysfunction in congestive heart failure resulting from systemic hypertension. Sixty patients with systemic hypertension who had recently experienced CHF with normal, EF≥50% and no clinical history of ischaemic cardiomyopathy were the study population. The patients were divided into two groups according to the degree of echocardiographic hypertrophy. In Group I there were 32 patients with a ventricular mass/volume ratio >1.8 and in Group II there were 28 patients with a ratio <1.8. Fifty randomly selected hypertensive patients of congestive heart failure (CHF) with diastolic dysfunction were taken from indoor departments of the above centers; Informed consents were taken from the patients. Inclusion criteria were: Patients with history of hypertension for >5 years, patients with dyspnoea of cardiac origin (NYHA class II, III and IV), pulmonary oedema verified by CXR-P/A view, Echocardiographic ally determined ejection fraction ^50% and Sinus rhythm. On the other hand exclusion criteria were: Secondary hypertension, history of angina or myocardial infarction, history of diabetes mellitus, chronic renal failure and hypertrophic, history of rheumatic fever and rheumatic heart disease, congested heart disease and any systemic diseases that causes left ventricular hypertrophy, any endocardial, myocardial or pericardial disease and poor echo-windows. Detailed history and physical examination findings were recorded in study report sheet. ECG, chest X-ray two-dimensional and M-mode echocardiography reports were recorded on the same sheet. Doppler echocardiography was done by a cardiologist and evaluation involved pulse-wave Doppler sampling of mitral inflow (tips of leaflets) and pulmonary vein inflow (right upper vein 1-2 cm deep). Flow patterns across the mitral inflow (E/A ratio), deceleration time (m/s), isovolumic relaxation time (m/s) and flow patterns across pulmonary inflow S/D ratio, atrial reversal (AR) velocity, Ad/ARd ratio were recorded. Only eligible patients underwent stress testing and coronary angiography. At the first stage we got 290 cases with CHF. Then 172 were eliminated on the basis of ejection fraction (EF) <0.5. Among the remaining 118 cases, 43 were eliminated because of rheumatic heart disease (RHD), hypertrophic cardiomyopathy (HCM) and dilated cardio-rnyopathy (DCM). In the third and final stage among rest 75 cases 15 were deducted because of poor echocardiogram, or because they were incompatible of stress testing due to unfitness. Data have been expressed in frequency, percentage and mean ±SD as applicable. Comparison between groups was done by Chi-square test and Fisher exact test, as applicable. Data were analyzed by SPSS Virsion 20. P value <0.05 was taken as significant.

4. Result

Among the first selected 290 cases with CHF 60 were with diastolic dysfunction. So ratio was 20.70%. That 60 (20.70%) patients of CHF with diastolic dysfunction were classified into two groups according to the degree of echocardiographic hypertrophy in group I (32 patients with a mass/volume ration > 1.8) and group II (28 patients with M/V ration < 1.8). Among 32 participants of Group I 19 (59.38%) were male and 13 (40.63%) were female. On the other hand among 28 participants of Group II 16 (57.14%) were male and 12 (42.86%) were female. Among the study population with CHF as well as left ventricular dysfunction, male are dominating and the ratio was 58.33% (35). Age distribution of the patients of congestive heart failure with diastolic dysfunction has been displayed in the Table I. Among total participants the highest ratio of diastolic dysfunction was found in 61-70 years' age group. The ratio was 35% (21 out of 60). Then in 51-60 years' age group

28.33% (17.33%), 41-50 years' age group 28.33% (17), 31-40 years' age group 5% (03) and 20-30 age group 3.33% (02). There were some clinical findings in this study. According to the cardiac condition in 30 (90%) patients of Group I and in 27 (96%) patients of group Dyspnoea was associated. The mean age was 55.85±12.11 and 54.88±10.35 in Group I and Group II respectively. In Group I, 59.38% participants were male and 40.63% were female. On the other hand, in Group II, 57.14% participants were male and rest 42.86% was female. In both the groups male were dominating. The mean heart rate was 81.11±6.21 in Group I and 78.28±5.48 in Group II. The heart sound (S3) was found in 15.63% patients of Group I and 36% of Group II. On the other hand, heart sound (S4) was found in 50% of Group I patients and in 21.42% of Group II. The mean Systolic Blood Pressure (BP) was 168.82±24.81 in group I and 175.98±27.54 in Group II patients. In Group I the mean Diastolic BP was 93.75±9.07 and in Group II it was. Here the p value was 0.0457 (Significant). In ECG (LVH) test 78% positive result and 22% negative result was found in Group I. On the other hand only 25% positive result and 75% negative result was found in Group II. Cardiomegaly positive was found in 15.62% patients from Group I and 25% positive in Group II. Among 60 CHF patients with diastolic dysfunction we collected the data of duration suffering from diastolic dysfunction. The highest suffered portion is 38.33% and their duration was <5 years. Second highest ratio was 25% and their duration was 6-10 years. Then 20% (11-15 years), 11.67% (16-20 years) and lastly 5% and their duration was >20 years.

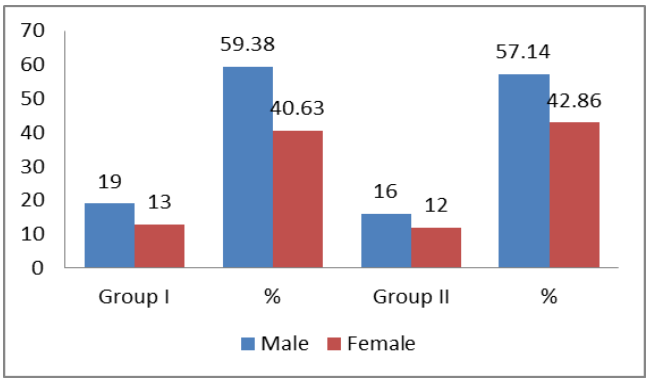

Fig 1: Male-female ratio in both Groups (n=60)

Table I: Age distribution of CHF patients with diastolic dysfunction (n=60)

Age (yrs.)	Group-I (32)		Group-II (n=28)		Total (n=60)	
	n	%	n	%	n	%
20-30	1	3.13	1	3.57	2	3.33
31-40	2	6.25	1	3.57	3	5.00
41-50	7	21.88	10	35.71	17	28.33
51-60	10	31.25	7	25.00	17	28.33
61-70	12	37.50	9	32.14	21	35.00
Total	32	100.00	28	100.00	60	100.00

P value=0.432 (Significant)

Table 2: Clinical findings according to the degree of cardiac condition (n=60)

Variables	Group 1 (Mean± SD)	Group II (Mean± SD)	P Value
Dyspnoea	30 (94%)	27 (96%)	NS
Age (yrs.)	55.85±12.11	54.88±10.35	0.462
Sex			
Male	19 (59.38)	16 (57.14%)	
Female	13 (40.63%)	12 (42.86%)	
Heart Rate	81.11±6.21	78.28±5.48	NS
Heart Sound			
S3	5(15.63%)	10 (36%)	
S4	15(50%)	6(21.42%)	
Systolic BP (mmHg)	168.82±24.81	175.98±27.54	NS
Diastolic BP (mmHg)	93.75±9.07	97.96±9.69	0.0457
ECG(LVH)			
Positive	25 (78%)	7 (25%)	0.0427
Negative	7 (22%)	21 (75%)	
Cardiomegaly			
Positive	5 (15.62%)	7 (25%)	0.0381
Negative	21 (65.62%)	16 (57.14%)	

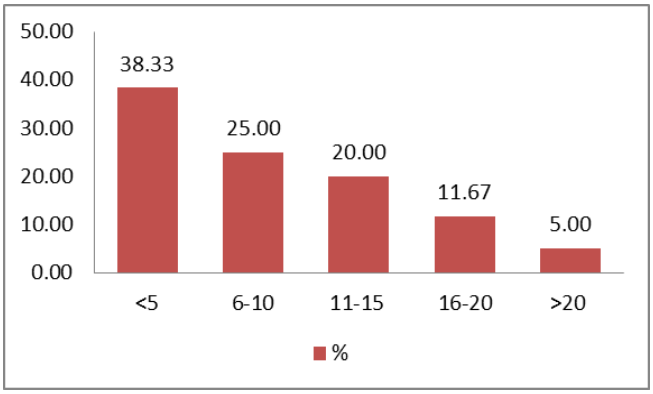

Fig 2: Duration of diastolic dysfunction of patients (n=60)

5. Discussion

This prospective observational study was undertaken to evaluate left ventricular diastolic dysfunction in congestive heart failure resulting from systemic hypertension. As the sample size was not very large, they may not be representative of all hypertensive heart diseases with congestive heart failure in the community. In this prospective observational study, age of the study population ranged from 20 to 70 years, with incidence in 61-70 years comprising 35%, followed by 51-60 years 28.33%, 41-50 years 28.33%, 31-40 years 5% and 20-30 years 2%. Paul and Gheorghiade *et al.* [1] also found diastolic dysfunction more in elderly (50 to 60 years) group. Although by standard echocardiographic criteria is reversal of E/A ratio favors the diagnosis of diastolic dysfunction [13], have shown that this inversion may be normal in older subjects. In this study LV volumes were calculated on the basis of end-systole and end-diastole diameter. To evaluate the Influence

of the ventricular mass and rate of regional ischemia, the cutting point is mass/volume ratio is 1.8 with maximal level of differentiation between hypertrophy and ischaemia [14]. Diastolic dysfunction was common in male (58.33%) than female (41.67%). Less number of female patients was involved in the study as small number of female patients attends the hospital for treatment. High incidence of hypertrophy was found in male patients in comparison to female but incidence is ischaemia were same in both male and female. The most significant findings according to echocardiographic left ventricular hypertrophy were increased left ventricular posterior wall thickness and interventricular septal thickness, decreased LV end-diastolic and end-systolic diameter, increased LV mass and higher ejection fraction in group I (hypertrophic group) than in group II (ischaemic group). These results are somewhat similar to the results described by 'Topol and Araill [15]. Duration of hypertension did not correlate with the incidence of diastolic dysfunction and there was no significant difference between group I and group II. There was no published data both at home and abroad to compare the relationship between duration of hypertension and incidence of diastolic dysfunction with the present study. Doppler patterns of diastolic dysfunction include normal diastolic function, impaired relaxation, pseudonormal filling and restricted filling. These patterns evolve from one to another in a single individual with changes in disease evaluation, treatment and loading condition as described by Gerald *et al.* (1996) [16]. In most cases, left atrial and left ventricular and diastolic filling pressure are elevated, the left atrium is increased in size and patients often complain of exertional dyspnea [17]. The restricted filling pattern is characterized by increased E: A ratio, decreased IVRT on mitral flow, and decreased S: D ratio, increased AR velocity and Ad/ARd ratio is decreased on pulmonary venous flow. At stage III, it represents a severe decrease in LV chamber compliance. Diastolic filling pressures are elevated and patients are markedly symptomatic and demonstrate a severely reduced functional capacity. The left atrium is dilated and hypocontractile [10]. Cardiac catheterization were done only in 22 cases, of which 18 showed elevated LV end-diastolic pressure more than 15 mmHg and 4 showed normal LV end-diastolic pressure, all of them showed diastolic dysfunction by Doppler assessment. Thus, Doppler evaluation provides a noninvasive, safe and rapid bedside alternative to cardiac catheterization for the assessment of LV diastolic dysfunction [18]. Exercise tolerance tests were done hi all cases that were physically active. Out of 60 cases, 24 were positive for provocable myocardial ischaemia. Among 24, group I showed 5 positive cases and group II showed 19 positive cases. Thus, there were two distinct subgroups: group I characterized by high degree of reactive hypertrophy and low incidence of ischaemia and group II with only moderate hypertrophy and high risk of ischaemia. These findings correlated well with the results of Iriate *et al.* (1993) [19]. There was no significant difference between groups for NYHA class, age, sex, heart rate, systolic blood pressure. A fourth sound was more common in group II, whereas the third sound was more frequent in group II. ECG evidenced LHV were more frequent in group I than group II, CXR evidenced cardiomegaly in group II than group I. The findings correlate well with the study of Iriate *et al.* (1993) [19]. Our findings indicate that patients with diastolic dysfunction in hypertensive heart disease with CHF with normal ejection presented by two ways: one characterized by severe hypertrophy and the other by a high rate of ischaemia. But their clinical profile was uniform and indistinguishable from CHF due to depressed LV systolic function as reported by Echeverria *et al.* [3] During this study we got the learning of necessity of large sample size for more specific analysis.

6. Limitation of the Study

This was a single centered with a small sample size. So the findings of this study may not reflect the exact scenarios of the whole country.

7. Conclusion

In this short term study we had tried to know more about the prevalence of diastolic dysfunction in congestive heart failure CHF resulting from systemic hypertension. To know more about the issue and to get some clear concepts about the treatment we would recommend for conducting more study with larger sample size in different places.

10. References

1. Paul R, Gheorghiade M, Bonow RO. Mechanism and management of heart failure due to diastolic dysfunction. Curr Opinion Cardiol. 1996; 11:269-75.
2. Spencer Lang. Diastolic heart failure, 1997, https://doi.org/10.3810/pgm.1997.01.142.
3. Echeverria HH, Bilsker HS, Myerburg RJ, Kessler KM. Congtestive heart failure: echocardiographic insights. Is J Med7. 1983; 5:750-5.
4. Dougherty AH, Naccarelli GV, Gray EL, Hicher CH, Goldstein RA. Congestive heart failure with normal systolic function. Am J Cardiol, 1984.
5. Soufer R, Wohlgelernter D, Vita NA, Amucheslegui M, Sonftnan HD. Berger failure. Am J Cardiol. 1985; 55:1032-6.
6. Kessler KM. Heat failure with normal systolic function: update to prevalence, differential diagnosis, prognosis and therapy. Arch Intern Med. 1988; 148:2109-11.
7. Bonow RO, Udelson JE. 1992. Left ventricular diastolic dysfunction as a cause of congestive heart failure: Mechanisms and management. Ann Intern Med 117:502-10.
8. Weber ME, *et al*. Sedimentation processes within channel-ridge systems, southeastern Weddell Sea, Antarctica. Paleoceanography. 1994; l9(6):1027-1048, https://doi.org/10.1029/94PA01443
9. Weber Brilla CG. Athological hypertrophy and cardiac interstitium. Fibrosis and renin-angiotensin-aldosterone system. 1991; 83(6):1849-65.
10. Appleton CP, Hatle LK, Popp RL. Relation of transmitral flow velocity patterns to left ventricular diastolic function: new insights from a combined haemodynamic and Doppler echocardiographic study. J Am Coll Cardiol. 1988; 12:426-40.
11. Appleton CP. Doppler assessment of left ventricular diastolic function. J Am Coll Cardiol. 1993; 21:1697-700.
12. Klein AL, Burstow DJ, Tajik AJ, Zachariah PK, Bailey KR, Seward JB. Effects of age on left ventricular dimensions and filling dynamics in 117 normal persons. Mayo Clin Proc. 1994; 69:212-24.
13. Marantz PR, Tobin JN, Derby CA, Cohen MV. Age associated changes in diastolic filling: Doppler E/A

ratio is not associated with congestive heart failure hi the elderly. South Med J. 1994; 87:728-35.
14. Miguel I, Hekana M, Domingo S. Congestive heart failure from left ventriclar diastolic dysfunction in systemic hypertension. Am J Cardiol. 1993; 71:308-12.
15. Topol EJ, Araill TA. Hypertensive hypertrophic cardiomyopathy of the elderly. N Engl J Med. 1985; 312:277-83.
16. Gerald 1C, Joseph EP, James DT, Alan LK. A practical guide to assessment of ventricular diastolic function using Doppler echocardiography. J Am Coll Cardiol. 1996; 27:1753-60.
17. Ishida Y, Meisner JS, Trujioka K, Gallo JI, Yoran C, Prater RWM, *et al*. Left ventricular filling dynamics: Influences of left ventricular relaxation and left atrial pressure. Circulation. 1986; 74:187-96.
18. Kaul S. Doppler echocardiography in critically ill cardiac patients. Cardiol Clin. 1991; 9:711-32.
19. Iriarte M, Murga N, Sagastagoitia D, Molinero E, Morillas M, Salcedo A, *et al*. Congestive heart failure from left ventricular diastolic dysfunction in systemic hypertension. Am J Cardiol. 1993; 71:308-12.