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Prevalence of Left Ventricular Diastolic Dysfunction in Patients with Essential Hypertension

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ABSTRACT

Background: Left Ventricular Diastolic Dysfunction is considered a critical link between hypertension and heart failure, particularly in individuals with heart failure and preserved ejection fraction. The aim of this study is to assess the prevalence and factors associated with clinical parameters of left ventricular diastolic dysfunction in patients with essential hypertension.

Methods: A hospital-based cross-sectional study was done among 68 newly diagnosed and known hypertensive patients visiting out patientdepartmentat Bir hospital. Patients who meet the inclusion criteria were chosen alternatively by referring OPD register. Patients with hypertension had undergone echocardiography to see whether left ventricular diastolic dysfunction was present and was compared to other clinical parameters like age, sex, body mass index, and dyslipidemia using the student t-test/chi-square test.

Results: The prevalence of left ventricular diastolic dysfunction in essential hypertensive patients was 33.8%. About 25% patients had grade 1; 7.4% and 1.5% of patients had grade 2 and grade 3 diastolic dysfunction respectively. Patients who had a duration of hypertension of more than five years were more than nine times (OR 9.14; 2.89-28.87) more likely to have Left ventricular diastolic dysfunction. Age and Body Mass Index were found statistically significant with diastolic dysfunction ($P<0.05$).

Conclusions: Left ventricular diastolic dysfunction was found prevalent in hypertensive patients. Age, Body mass index, Dyslipidemia and Duration of hypertension were found to be statistically significant with diastolic dysfunction

Keywords: Diastolic dysfunction; hypertension; Nepal; prevalence.

INTRODUCTION

Hypertension is one of the leading causes of the global burden of disease.[1] Diastolic dysfunction is an early consequence of hypertension-related heart disease and is exacerbated by left ventricular hypertrophy and ischemia.[1,2]Several risk factors, like hypertension, coronary artery disease, obesity, and diabetes mellitus, are implicated in the development of Left Ventricular Diastolic Dysfunction (LVDD).[3]

Diastolic dysfunction is now well established as a cause of left sided heart failure and as a powerful predictor of cardiovascular events.[4]LVDD can cause symptoms of dyspnea, reduced exercise tolerance and heart failure. Studies have mainly focused on prevalence, geographical and ethnical variations however LVDD in hypertension and its associated risk factors remains unexplored in Nepal and prevalence of pre-clinical LVDD in hypertensive community is largely unknown.[5,6]The study aims to assess the prevalence of LVDD in hypertensive patients and find out the factors that are associated with LVDD in hypertensive patients.

METHODS

A hospital based cross-sectional study was conducted among sixty-eight newly and known hypertensive patients visiting OPD at Bir hospital, National Academy of Medical Science. All cases were evaluated by detailed

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history & clinical examination. Data was collected and recorded in proforma through interview schedule. Hypertensive patient who meet the inclusion criteria was taken from the OPD register.Simple random sampling technique was adapted to reach the number of participants.

The patients had undergone a detailed clinical evaluation and followed by required laboratory evaluation.Blood samples were drawn at hospital blood collection center where, hemoglobin, hematocrit, renal function test,thyroidstimulatinghormone, fasting blood glucose, lipid profile, ECG, Echocardiography were done as a part of routine investigation in hypertension. Ultrasonography(USG) abdomen and pelvis and renal artery Doppler were done when necessary, to rule out secondary cause in newly diagnosed hypertensive patients.

Data was entered in EPI Data and transferred to SPSS for the analysis. Results were analyzed using appropriate statistical methods and all the meaningful statistics was worked out. Analyzed data was presented as numbers and percentages for categorical variables. Chi-square test was applied to find the association for the categorical variable. For the continuous data, mean±standard deviation and median as appropriate were calculated and for determining the associated factors, student T-test was applied.

Ethical approval was taken from Institutional Review Committee (IRC) of NAMS. A written informed consent was taken from each participant after explaining the relevant details of the study. The information was used solely for academic purpose without affecting the physical, mental or social health of the patient. The patients were not given any extra financial burden and were given the right to withdraw from the study at any point of time if he/she wishes.

RESULTS

The socio-demographic characteristics of study participants are illustrated in Table 1 which showed three-fifth (60.3%) of the participants were above 50 years. The mean+SD age of the patients was 52.84 +10 years. More than half (51.47%) of patients were female. The mean systolic blood pressure of the patients was 144.12 mm Hg with the standard deviation of 15.04 and the mean diastolic blood pressure was 91.37 mm Hg with standard deviation of 10.38.

Table 1. Socio-demographic and Clinical characteristics of the participants .

Age groups in years	Number	Percentage
<30	2	2.9
31-50	25	36.8
>50	41	60.3
Mean age of the patients = 52.84+10 years		
Sex		
Male	33	48.53
Female	35	51.47
Ethnicity		
Dalit	10	14.7
Disadvantaged Janajati	11	16.2
Relatively advantaged Janajati	14	20.6
Upper caste	32	47.1
Religious minorities	1	1.5
Grade of DD		
Grade 1	17	25
Grade 2	5	7.4
Grade 3	1	1.5
None	45	66.2
Mean systolic BP 144.12 + 15.04 mm HG		
Mean diastolic BP 91.37+10.38 mm HG		

Table 2. Relation between duration of hypertension and diastolic dysfunction.

Duration of hypertension	No. of patients(N)	No of patients with LVDD
<6 month	13	3 (13%)
6 month -2 years	16	3(13%)
2-5 years	14	1(4.3%)
5-10 years	19	11(47.8%)
>10 years	6	5 (21.7%)
Mean duration of hypertension = 3.85+3.42 years		

Table 2 shows the relation between duration of hypertension and diastolic dysfunction. About 47.8% of patients with LVDD had duration of hypertension 5-10 years.

Table 3. Different parameters in the study population in the 2 groups with student's t test or chi square test comparison results.

Parameter		Patients with DD	Patients without DD	P value	OR
Age (yrs)		57.96+ 7.06	50.00+9.82	0.001	
Sex					
Male		9	24	0.268	
Female		14	21		
Duration of HTN					
<5 years		7(16.3%)	36(83.7%)	<0.001	9.14(2.89-28.87)
≥5 years		16(64%)	9(36%)		
BMI		27.27 + 3.82	25.38 + 3.50	0.046	
Dyslipidemia	Present	20 (42.6)	27 (57.4)	0.023	
	Absent	3 (14.3)	18 (85.7)		

The mean age of patients with diastolic dysfunction was 57.96+7.06. Age (p 0.001), Duration of HTN (p<0.001), BMI (p 0.046), Dyslipidemia (p 0.023) was found statistically significant with diastolic dysfunction. Patients who had duration of HTN more than five years were more than nine times (9.14; 2.89-28.87) likely to had LVDD compared to the patients who had diagnosed HTN less than five years is illustrated in Table 3.

Table 4. Clinical presentation of the patient.

Patient type	Number(N)	Number of Diastolic dysfunction cases				Percentage of DD
		GR 1	GR2	GR 3	Total	
Asymptomatic		14	4	0	18	32.14%
NYHA 1	6	1	0	0	1	16.67%
NYHA 2	5	2	1	0	3	60%
NYHA 3	1	0	0	1	1	100%
NYHA 4	0	0	0	0	0	0 %
Total	68	17	5	1	23	33.8%

Table 4 shows one-third (33.8%) of the patients were found to have diastolic dysfunction. Very few (7.35%) patients presented with NYHA Class II symptoms. Majority (82.35%)of the patients were asymptomatic.

Table 5.Systolic and Diastolic blood pressure and LVDD.

Characteristics	Grades of Diastolic Dysfunction				Total
	GR1	GR2	GR3	None	
Systolic BP					
<140 mm Hg	10(25)	4(10)	0	25(62.5%)	39
140-159 mm Hg	3(21.4)	1(7.1)	0	10(71.4)	14
>=160 mm Hg	4(26.7)	0	1(6.7)	10(66.7)	15
Total	17(25)	5(7.4)	1(1.5)	45(66.2)	68
Diastolic BP					
<90 mm Hg	14(33.3)	1(2.4)	1(2.4)	26(61.9)	42
90-99 mm Hg	0(0)	4(44.4)	0(0)	5(55.6)	9
>=100 mm Hg	3(17.6)	0(0)	0(0)	14(82.4)	17
Total	17 (25)	5(7.4)	1(1.5)	45(66.2)	68

More than one-third (35%) of patients who had SBP less than 140 had LVDD. About 28.5% patient who had SBP between 140-159 mm Hg had LVDD. About two-fifth (38.1%) of the patient who had DBP less than 90 had LVDD. Nearly one fifth (17.6%) of the patient who had DBP greater or equal to 100 mm Hg had LVDD which is presented in Table 5.

DISCUSSION

In our study, the prevalence of LVDD in essential hypertensive patients was 33.8% which was slightly lower than the study done by Mohamed et al. (44%) and Swierblewska E et al. (50.3%), Kirillova V. et al. (18.3%).[5-7]

In our study, majority (82.6%) of patients with diastolic dysfunction were above 50 years, 17.4% were between 31-50 years which contrasts to the findings of the study of Ingle V et al. which showed 57% of the patients with LVDD were above 50 years of age and 29% were between 31-50 years.[8]

In the present study, among patients with LVDD, 39.1% were males and 60.9% were females; which contrasts with the findings of Ingle V et al.which showed 58% were male and 42% were female.[8]This might be due to the disproportionate in the sample selection. In our study, sex was not found statistically associated with diastolic dysfunction (p 0.268) which corresponds with the findings of Paul R et al. (p 0.085).[9]

In our study, one-fourth (25%) of hypertensive patients had grade 1 Left Ventricular Diastolic Dysfunction, 7.4% hypertensive patients had grade 2 Left Ventricular Diastolic Dysfunction and 1.5% hypertensive patients had grade 3 Left Ventricular Diastolic Dysfunction which is similar to the study done in Poland by Swierblewska E et al. which showed 24.4% hypertensive patients were identified as grade 1 Left Ventricular Diastolic Dysfunction and 19.3% had grade 2 Left Ventricular Diastolic Dysfunction, none were diagnosed as grade 3 Left Ventricular Diastolic Dysfunction.[6]Another study showed by Paul R et al.showed 10.8% patients had grade 1 Left Ventricular Diastolic Dysfunction, 19.75% had grade 2 Left Ventricular Diastolic Dysfunction and 8.7% had grade 3 Left Ventricular Diastolic Dysfunction.[9]Study done by Ingle V et al. showed 58% hypertensive patients had grade 1 Left Ventricular Diastolic Dysfunction, 24% had grade 2 Left Ventricular Diastolic Dysfunction, 10% had grade 3 Left Ventricular Diastolic Dysfunction.[8]Another study by KirillovaV. et al showed 44% hypertensive patients had grade 1 Left Ventricular Diastolic dysfunction, 23% grade 2. [7]

In our study the body mass index was found statistically significant with diastolic dysfunction (p 0.046) which is similar to the study done by Paul R.[9] Asymptomatic patients were found to had left ventricular diastolic dysfunction in our study whereas study done by Paul R showed LVDD was found higher in patients with NYHA symptom grade. In NYHA grades III and IV, 59% and 57% of the patients respectively were found to have DD In our study, 32.14% asymptomatic patients had LVDD However, study done by Paul R et al showed 16% of apparently asymptomatic patients had LVDD F. .

In our study, duration of HTN was found statistically significant ($p < 0.001$) with LVDD which corresponds with the findings of study done by Knezevic et al which showed significant difference between diastolic dysfunction in hypertension patients who had hypertension more than five years duration compared to less than five years..[10]

Different population-based studies have shown that a large number of patients with congestive heart failure has normal ejection fraction.[10,11] Thus, assessment of diastolic function of LV should be done by echocardiography. Studies from Asia have shown that even patients without any cardiac structural alteration, like increase left ventricular mass in echocardiography, can also have significant DD, making them prone to serious cardiac events[12]

All the scientific studies complete with some constraint. Similarly, this research has also some limitations, which are supportive for further investigations in future. In patients with diastolic dysfunction who were symptomatic with complain of dyspnea, diastolic heart failure couldnot be ruled out due to unavailability of NT pro BNP in our hospital. Early detection and timely treatment of hypertension and other risk factors delay the progression to LVDD and heart failure to a large extent.

CONCLUSIONS

Left ventricular diastolic dysfunction was prevalent in hypertensive patients. Age, Body mass index, Dyslipidemia and Duration of hypertension was found to be statistically significant with diastolic dysfunction. Diastolic dysfunction prevail with increase in age, and those with longer duration of hypertension . Increase in grade of left ventricular dysfunction was not found to be associated with increasing severity of dyspnea. Lifestyle modification would aid to improve body mass index,

dyslipidemia among hypertensive patients, decreasing the risk of LVDD.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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