

**ORIGINAL RESEARCH ARTICLE****LEFT VENTRICULAR DYSFUNCTION IN HYPERTENSIVE PATIENTS: AN ECHOCARDIOGRAPHIC ASSESSMENT**Rishi Khatri<sup>1</sup>, Devendra Khatri<sup>1</sup>, Dhan Bahadur Shrestha<sup>1</sup>, Parag Karki<sup>1</sup>, Chiranjeevi Panta<sup>1</sup>, Raj Kumar Thapa<sup>1</sup>, Binod Karki<sup>1</sup><sup>1</sup>Department of Internal Medicine, Nepalese Army Institute of Health Sciences (NAIHS), Shree Birendra Hospital, Chhauni, Kathmandu*\*Correspondence to: Dhan Bahadur Shrestha, Shree Birendra Hospital, Chhauni, Kathmandu, Nepal.**Email: medhan75@gmail.com***ABSTRACT**

**Introduction:** Echocardiography is noninvasive procedure to assess heart. Ventricular mass increases due to left ventricular hypertrophy and performance of left ventricle decreases with increase in blood pressure. Left ventricular diastolic dysfunction (LVDD) is early sign of heart weakness which can be picked up early with Echo. This study was aimed to study cardiac anatomic and functional parametric alteration in echocardiography among hypertensive patients. **Methods:** This was a non-invasive, cross sectional hospital based retrospective review of the patient record from echo room among the hypertensive patient who undergone echocardiographic assessment from September 2017-February 2018 in Shree Birendra Hospital (SBH), Chhauni, Kathmandu. **Results:** Among 447 hypertensive cases, 232(51.9%) were having normal diastolic function while rest 215(48.1%) were having diastolic dysfunction of the heart. Among total cases evaluated, only 12(2.7%) patients were having ejection fraction lower than 55%, while in rest it was normal. There were 53 (11.9%) cases having some form of associated complication. Gender, Concentric Left Ventricular Hypertrophy and left atrial dilatation has significant difference ( $p < 0.05$ ) with LVDD. Statistically significant differences in age distribution of individuals with different categories of left ventricular systolic dysfunction (LVSD) and LVDD ( $p < 0.001$ ) was observed. **Conclusion:** Significant number of hypertensive individuals were having LVDD though in most of the individual LV ejection fraction was maintained.

**Key words:** Echocardiography, Hypertension, Left ventricular diastolic dysfunction, Nepal**INTRODUCTION**

Echocardiography is noninvasive procedure to assess cardiac anatomic and functional parameters. Ventricular mass increment due to left ventricular hypertrophy, decreased performance of left ventricle (LV) with increasing blood pressure and other parameters can be detected early with echo.<sup>1-4</sup> Hypertension is top most cause of diastolic dysfunction of heart, affecting elderly contributing to the chunk of heart failure cases.<sup>5,6</sup> Left ventricular diastolic dysfunction (LVDD) is early sign of heart dysfunction which can be picked up early with precise diagnosis with echocardiographic assessment so, it is necessary to seek early LVDD diagnosis and its prevention to improve the outcome of hypertensive individuals.<sup>4,6,7</sup>

From Nepal, few studies have been done to assess cardiac function in hypertensive patients and showed LVDD in about 60% of new and never treated essential hypertension which is also seems to be significantly associated with hypertension.<sup>8,9</sup> This study was aimed to study cardiac anatomic and functional parametric alteration in echocardiography among hypertensive patients presenting to echo in a tertiary center of Kathmandu.

**METHODS**

This was a non-invasive, cross sectional hospital based retrospective review of the patient record from echo room among the hypertensive patient who undergone echocardiographic assessment.

This study was conducted based on echo data among patient who underwent echo in last six months period from September 2017-February 2018 in Shree Birendra Hospital (SBH), Chhauni, Kathmandu. SBH is the only tertiary level hospital for the serving soldiers, veterans and their families where such study has not been done yet. The data of the interest were retrieved from echo room register based on data retrieval sheet after the approval of proposal from local institutional ethical committee of Nepalese army institute of health sciences (NAIHS) and respecting the human and animal rights for research based on Helsinki declaration.

In our center, we first evaluate hypertensive cases with proper history and examination to look for various comorbidities and complications and we plan for echo evaluation. After the diagnosis by consultant as a case of hypertension or already under anti-hypertensive medication; to look for cardiac changes of hypertension we perform echo. All patient of hypertension asymptomatic or with some cardiac symptoms who underwent echo in study period were enrolled in the study. The data collected were for anatomic and functional echo findings of chamber dilatation, increased LV wall thickness, valvular regurgitations, presence of LV systolic and diastolic dysfunction which were evaluated using 2D, M Mode, and Colour wave Doppler. The data obtained was entered in Statistical Package for Social Sciences (SPSS). Various factors of interest and its association with LVDD was analyzed using SPSS version 22 using chi-square test with 5% standard error with 95% confidence interval with p-value of <0.05 as significant. LVDD and LVSD was compared with age using non-parametric tests (Mann-Whitney

U test and Kruskal- Wallis Test) respectively to check the difference in distribution.

## RESULTS

Total 447 patient's data were enrolled for analysis in the present study. The median age of the participants being 50 (IQR= 35-66) years. Among the studied population, 325(72.7%) were male while rest 122(27.3%) were females. Patients were categorized into three group (regular, retired and family) based on their serving status in the army profession. There were 185 (41.4%) regular and family each and 77 (17.2%) retired patients enrolled in the study. (Figure 1.)

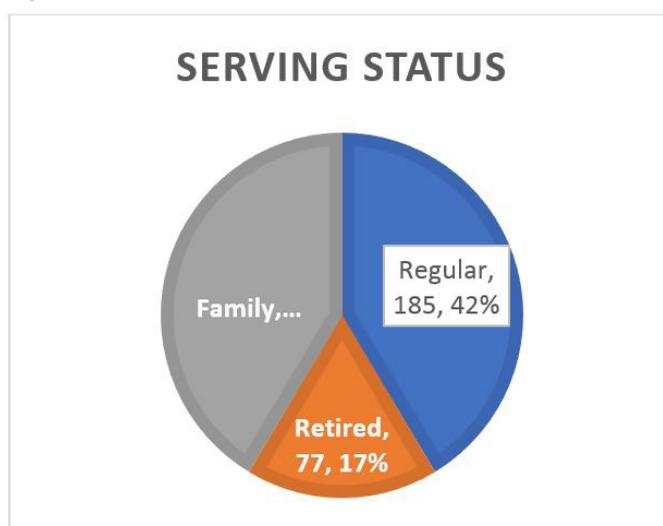


Figure 1. Serving status

There were 53 (11.9%) cases having some form of associated complication other than Hypertension while in rest cases solely hypertension was the comorbidity. COAD and DM were the commonly associated comorbidities (Table 1.)

**Table 1: Comorbidities among cases evaluated**

Comorbidities	Frequency	Percent	Cumulative Percent
None	394	88.1	88.1
Atrial Fibrillation (AF)	8	1.8	89.9
AF with hyperthyroidism	1	.2	90.2
AF with Valvular Heart Disease	1	.2	90.4
Coronary artery Disease (CAD)	1	.2	90.6
Chronic Obstructive Airway Disease (COAD)	18	4.0	94.6
Chronic Renal failure	1	.2	94.9

Comorbidities	Frequency	Percent	Cumulative Percent
Cerebrovascular Diseases	2	.4	95.3
Diabetes Mellitus (DM)	16	3.6	98.9
DM/COAD	1	.2	99.1
MI	1	.2	99.3
Paraplegia	2	.4	99.8
Seizure	1	.2	100.0
<b>Total</b>	<b>447</b>	<b>100.0</b>	

Among 447 hypertensive cases 232(51.9%) were having normal diastolic function while rest 215(48.1%) were having diastolic dysfunction of the heart. Gender, Concentric Left Ventricular Hypertrophy (CONCLVH) and left atrial dilatation has significant difference ( $p < 0.05$ ) with LVDD. While other valvular, chamber parameters showed no significant difference with LVDD. (Table 2.)

**Table 2: LVDD status and its relationship with the several parameters**

Variables		LVDD		p-value	Odds-ratio
		No	Yes		
Sex	MALE	184	141	0.001	2.01(1.31-2.07)
	FEMALE	48	74		
CONCLVH	No	225	199	0.034	2.58(1.04-6.41)
	YES	7	16		
Mitral Regurgitation	NONE	210	196	0.547	-
	MILD	14	15		
	MODERATE	8	4		
Aortic Regurgitation	NONE	220	197	0.396	-
	MILD	9	13		
	MODERATE	3	22		
Tricuspid Regurgitation	NONE	199	184	0.77	-
	MILD	28	26		
	MODERATE	5	4		
	SEVERE	0	1		
Right Atrium	NORMAL	228	213	0.446	0.53(0.09-2.95)
	DILATED	4	2		
Right Ventricle	NORMAL (0.7-2.3 CM)	228	213	0.446	0.53(0.09-2.95)
	DILATED	4	2		
Left Atrium	NORMAL (2.0-4.0 CM)	225	215	0.01	0.97(0.94-0.99)
	DILATED	7	0		

Variables		LVDD		p-value	Odds-ratio
		No	Yes		
Left Ventricle	NORMAL (ED=3.5-5.6 CM; ES=2.0-4.0 CM)	229	212	0.925	1.08(0.21-5.41)
	DILATED	3	3		
EF reduced	YES	6	6	.894	0.92(0.29-2.91)
	NO	226	209		

Among total cases evaluated, only 12(2.7%) patients in rest it was normal. (Table 3.) were having ejection fraction lower than 55%, while

**Table 3: LVSD among evaluated cases**

LVSD	Frequency	Percent
None (EF>=55%)	435	97.3
Mild (EF=45-54%)	7	1.6
Moderate (EF=30-44%)	5	1.1
<b>Total</b>	<b>447</b>	<b>100.0</b>

There is statistically significant differences in age distribution of individuals with LVDD. ( $p < 0.001$ ) (Figure 2.).

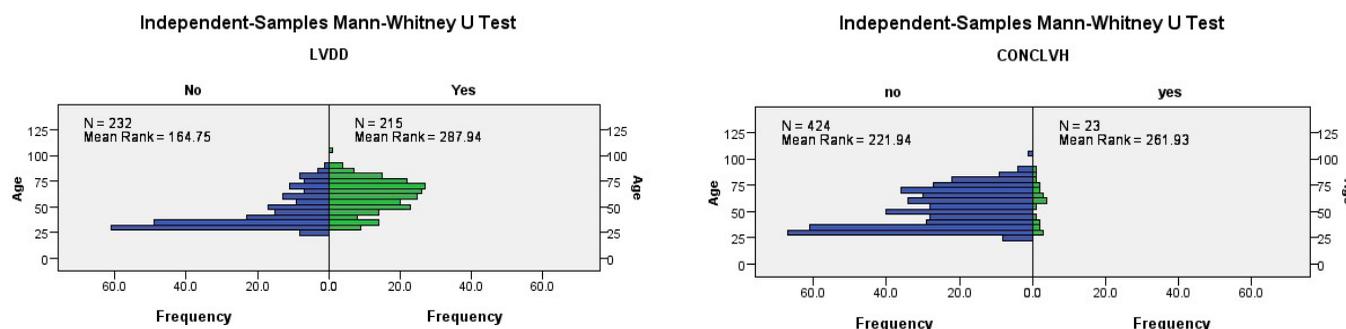


Figure 2. Man-Whitney U test

Also, there is statistically significant differences in age of LVSD ( $p < 0.001$ ) while that for CONCLVH was same distribution of individuals with different categories for age ( $p = 0.148$ ) (Figure 3.).

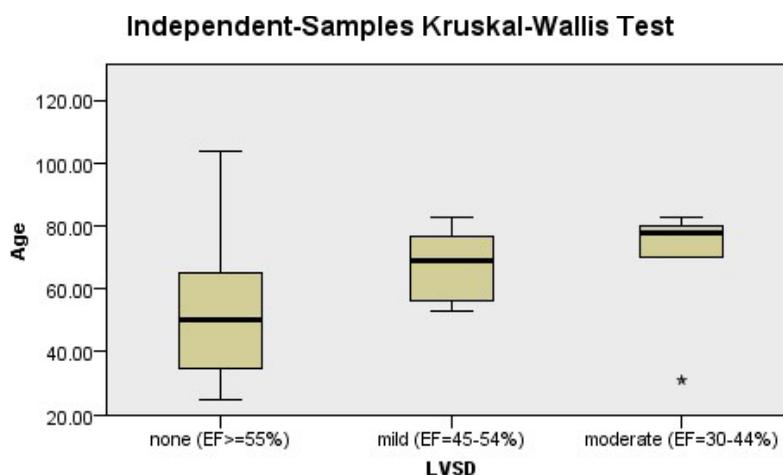


Figure 3. Kruskal-Wallis Test

## DISCUSSION:

Hypertension is the main determinant of LVDD though other risk factors include diabetes, renal disease etc. Substantial hypertensive individuals tend to have LVDD and the proportion varies based on the study population and the echocardiographic variables ranging from 18-84%.<sup>5</sup> In present study there were 48.1% individuals were having LVDD while only in 2.7% there were LVSD preserving the ejection fraction suggesting in most of the cases there were isolated diastolic dysfunction. A large cross-sectional observational study showed 25.8% patients having LVDD based on trans-mitral peak velocities while it was 45.6% using deceleration time to define LVDD with age, gender, and mass of LV as significant variables comparable to our study.<sup>10</sup> Hypertension mainly affects relaxation phase of the left ventricle even left ventricular hypertrophy making the low compliance of the left ventricle leading to diastolic dysfunction though left ventricular ejection function may be preserved.<sup>6</sup> By Echocardiographic assessment we can easily study the left ventricular function and detect the early dysfunction and heart failure accurately in competent hands.<sup>2,4</sup>

In 5.1% of the cases there was concentric left ventricular hypertrophy observed through echo in our study population. There were 15-46% of the hypertensive patients having LVH in different study population in echo findings.<sup>5,8</sup> In present study the median age of the participants was 50 years with predominance of male. Similarly, another study conducted in Nepal also revealed mean age of 50 with male predominance suggesting the hypertension is common with elderly and male who have more chances of getting enroll in echocardiographic examination.<sup>9</sup>

Studies have shown that higher age, reduced EF, obesity, history of hypertension, diabetes, myocardial infarction as predictors of diastolic dysfunction.<sup>11</sup> Also, heart failure and left ventricular diastolic dysfunction is common in elderly age group.<sup>12</sup> In another Indian study, there was LVDD in 55.70% of 30-60 years hypertensive individuals with significant association with elderly age and LVDD and progression of LVDD with sedentary lifestyle.<sup>13</sup> Which is also fairly true with our case showing significant difference in age distribution with LVDD and LVSD

showing more elder with heart dysfunction. With time, adjusting the contributory variables diastolic dysfunction itself is associated with heart failure so it should be timely diagnosed and manage appropriately to prevent myocardial remodeling in time.<sup>14</sup> Antihypertension therapy to reduce blood pressure to the target will reduce cardiac load, which will regress LVH, and its progression and improve cardiac function.<sup>15</sup>

This was retrospective study based on limited data available from echo data records so further larger prospective study with more variables need to be done to add more in the topic.

## CONCLUSION

Significant number of hypertensive individuals were having LVDD though in most of the individual LV ejection fraction was maintained. There is significant difference ( $p < 0.05$ ) between gender, CONCLVH and left atrial dilatation with LVDD. Also, there is statistically significant differences in age distribution of individuals with different categories of LVSD and LVDD ( $p < 0.001$ ) while it was same with CONCLVH ( $p = 0.148$ ).

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