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Left Ventricular Hypertrophy and its Determinants among Hypertensive Patients Attending a Cardiac Specialty Hospital, Kathmandu

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Abstract

Introduction: Left ventricular hypertrophy (LVH) is one of the common and potentially modifiable cardiovascular risk factors among hypertensive clients in most of the Asian countries including Nepal.

Methods: A hospital based, descriptive cross-sectional study was conducted to determine prevalence of left ventricular hypertrophy and its determinants among 215 hypertensive patients of Manmohan Cardiothoracic Vascular and Transplant Center's Outpatient department.

Non- probability purposive sampling technique was used. LVH was assessed using echocardiographic parameters available on records. An interview schedule consisting of semi-structured questionnaires was used to measure the risk factors of LVH. Data were analyzed using SPSS 20. Descriptive statistics such as frequency, percentage, mean, range and standard deviation were used. Chi-square were calculated to measure the association of Left Ventricular Hypertrophy with selected variables. Bivariate and multivariate binary logistic regression were used to identify the determinants of LVH.

Results: It was found that the prevalence of LVH was 59.6% among the respondents. LVH was statistically significantly associated with age (p=0.036, OR= 0.556), sex (p=0.001, OR =2.491), Body Mass Index (p=0.001, OR= 0.038,) duration of smoking (p=0.03, OR= 0.098) Alcohol use (p=0.037, OR=1.821), dyslipidemia (p= 0.00,OR= 5.411). Multivariate analysis showed that determinant of LVH was Body Mass Index (p=0.014, adjusted OR 0.171).

Conclusion: LVH was more common among hypertensive patients suggesting that the factors which are significantly associated with LVH need to be given more importance while planning health program among hypertensive patients as well as starting awareness program.

Keywords: Determinants; Echocardiography; Hypertension; LVH; Risk factors

Introduction

Cardiac Problem like hypertension is detected every day during normal examination especially on those who have high risk factor and might go without being noticed till the onset of severe complication [1].

Hypertensionis a disease characterized by end-organ complications, leading to high morbidity and mortality in many cases. People with untreated or uncontrolled hypertension often run the risk of developing complications directly associated with the disease [2].

Globally cardiovascular disease accounts for approximately 17 million deaths a year, nearly one third of the total of these, complications of hypertension account for 9.4 million deaths worldwide every year [3]. Hypertension is a global public health problem with 1/4 adults worldwide estimated to have high blood pressure [4].

LVH is considered to be a compensatory adjustment to heart muscle to an increased cardiac workload. LVHis recognized as an independent predictor of cardiovascular morbidity and mortality in hypertensive clients [5].

Various studies show the increased prevalence of LVH in different countries. The prevalence of LVH in different study shows differences in different population. Surprisingly, Russian hypertensive population showed prevalence of LVH from 52.2 % to 72.2% [6]. Similarly a study done in Malaysia found 24% of respondents had fulfilled the criteria of LVH [7]. In a study done in Chinese population, prevalence of LVH shows 42.7% [8]. In a study done in Nepal, The prevalence of echocardiography based LVH was 64% [9].

Thus the study was conducted with the objective of identifying the status of LVH and and its determinants.

Methods

Hospital based Descriptive cross sectional study design was used to determine LVH and its determinantsamong 215 hypertensive adult patients, equal to or above the age of 20 years of Manmohan Cardiothoracic Vascular and Transplant Center's Outpatient Department. Diagnosed hypertensive patients who had arrived for follow up were selected

purposefully. Sample size was calculated using Cochran formula. The sample was taken purposively excluding the Clients with known case of structural heart diseases and arrhythmias as it may affect the prevalence of LVH. Semi structured interview schedule was developed based on the review of literature and validated with consultation with experts such as cardiologists, advisors, co-advisors. The questionnaire consisted of5 parts :such as socio-demographic characteristics, anthropometric measurement and blood pressure, lifestyle comorbidities investigation, treatment and medication for hypertension. Instruments used to measure the variables in the study were report review of properly calibrated Echocardiography machine (GE and Philips Company), Blood pressure sphygmomanometer, Height measuring Stadiometer (same throughout the study), weighing machine (same calibrated machine throughout the study). The schedule was also translated into Nepali Language.

Ethical approval was taken from Institutional Review Committee (IRC), Institute of Medicine, Tribhuvan University. Informed consent was taken from each patient prior to data collection.Privacy and confidentiality of participants were maintained. Data were as collected through face to face interview technique.

Respondents' height and weight was measured using weighing machine with stadiometer .Body mass index (BMI) was calculated. Blood pressure (BP) was measured using sphygmomanometer (Gamma) at least after 10 minutes of arrival. Laboratory values were recorded as the selected laboratory investigations which were done routinely as per hospital protocol. Echocardiography report was reviewed to find out the status of LVH. The average time required to complete the interview was about 15-20 minutes. The duration of data collection was four weeks from 10 am to 1pm on 6 working days. The collected data were checked for missing and incomplete information and the obtained data was edited, classified, coded and entered. The number of questions in the interview schedule was recorded and analyzed by using SPSS version 20. The collected data was analyzed by using descriptive and inferentialstatistics. Chi- square and Odds ratio were calculated with 95% confidence interval and binary logistic regression was used to find out the significance of association and determinants.

Results

Among all of the respondents, 59.6% of patients had LVH. Average InterventricularSeptal Wall Diameter on diastolic phase was 11.6mm ± 1.524mm and Left Ventricular Posterior wall Diameter was 10.93 ± 1.535 mm .

Variables	Status of LVH			
	Present	Not present	Chi - square	p-value
Age				
≤ 50	52	48	4.406	0.04*
>50	76	39		
Sex				
Male	71	29	10.201	<0.001*
Female	57	58		
Ethnicity Brahmin/ Chhetri Others	59 69	49 38	2.167	0.14
BMI Final Less than25		50	11.229	<0.001*
25 and above	84	37		
Blood Pressure				
Controlled	96	68	0.593	0.29
Elevated	32	19		

Table1: Association of selected demographic variables to lvh of respondents.

Regarding demographic data of respondents, there was significant association of LVH with age (p= 0.04) and Sex (p<0.001). There was significant association between LVH and Body Mass Index (p< 0.001) (Table 1) .There was significant association between LVH and duration of smoking (p=0.04) and therewas significant association between alcohol use and LVH (p=0.04) (table 2)andsignificant association between LVH and dyslipidemia (p< 0.001) (Table3).

Variables	Status Of LVH		Chi-Square	p- Value
	Present	Not present		
Smoking Smoker	41	21	1.573	0.21
Non smoker	87	66		
Smoking Duration				
Upto 5years	1	4		0.03*
5years and above	41	16		
Amount of Smoking Per day				
Upto 5 Sticks	5	7		0.09
6and above	36	14		
Alcohol intake Status Alcohol user	61	29	4.366	0.04*

Alcohol Non-User	67	58		
Activity				
Adequate	38	24	0.111	0.73
Inadequate	90	63		
Exercise Yes No	52 77	27 60	1.739	0.19
Amount of Exercise (per day) (n=79)				
Less than 30minutes	24	15	0.307	0.58
30minutes and more	27	13		

Table2: Association between LVH and lifestyle and behavior of respondents.

Variables	Status Of LVH			Chi – Square	p- Value
	Present	Not present			
Diabetes Mellitus					
Yes	21	8		2.308	0.13
No	107	79			
Dyslipidemia					
Present	53		10	22.37	<0.001*
Not present	75		77		
Duration of Hypertension					
Upto 10 years	103	74		0.75	0.39
More than 10 years	25	13			
Duration of Medication					
Upto 10 years	107	73		0.004	0.95
More than 10 years	21	14			

Table 3: Association between LVH and co-morbidities,investigation, treatment and medication of respondents.

The variables which significantly associated with LVH were age, sex, BMI, Duration of smoking and dyslipidemia. The finding shows that the respondents less than 50 yrs. of age had 0.556times less likely to have LVH than above 50 years of age (OR= 0.556, CI: 0.321-0.964). Male had 2.491 times more likely to have LVH than female (OR=2.491, CI: 1.415-4.387). (Table 4)

Regarding BMI, the findings shows that BMI less than 25 had 0.388 times less likely to have LVH than BMI 25 and above (OR=0.338, CI: 0.221-0.679).Regarding Alcohol consumption, the finding shows that Alcohol users have 1.821 more likely to have LVH than non- users (OR=1.821. CI: 1.035-3.203).Regarding dyslipidemia, the finding shows that respondents with dyslipidemia had 5.411 times more likely to have LVH than normal lipid levels (OR=5.411, CI: 2.578-11.483) (Table 4).

Variables	LVH		OR	95% CI
	Present	Not Present		
Age of the Respondents in years				
Upto 50	52 (52%)	48(48%)		
More than 50	76(66%)	39(34%)	0.556	0.321-0.964*
Sex				
Male	71(71%)	29(29%)		
Female	57(49.6%)	58(50.4%)	2.491	1.415-4.387*
BMI				
Less than 25	44(46.8%)	50(53.2%)		
25 and above	84(69.4%)	37(30.6%)	0.388	0.221-0.679*
Duration of Smoking (n=62)				
Upto 5 years	1(20%)	4(80%)		
More than 5 years	41(71.9%)	16(28.1%)	0.098	0.010-0.941*
Alcohol Consumption				
Alcohol User	61(67.8%)	29(32.2%)		
Alcohol Non user	67(53.6%)	58(46.4%)	1.821	1.035-3.203*
Dyslipidemia				

Yes	53(84.1%)	10(15.9%)		
No	75(49.3%)	77(50.7%)	5.411	2.578-11.483*

Table4: Bivariate logistic regression analysis for determinants of LVH.

Variables	Unadjusted OR	95% CI	Adjusted OR	95%CI	p-Value
Age of the respondents	0.556	0.321-0.964	0.658	0.175-2.477	0.54
Sex	2.491	1.415-4.387	2.103	0.530-8.341	0.29
BMI	0.388	0.221-0.679	0.171	0.042-0.702	0.01*
Duration of smoking	0.098	0.010-0.941	0.089	0.006-1.221	0.07
Alcohol Consumption	1.821	1.035-3.203	3.533	0.829-15.062	0.09
Dyslipidemia	5.411	2.578-11.483	2.335	0.548-9.938	0.25

Table 5: Multivariate binary logistic regression model for determinants of lvh among hypertensive clients.

The association of factors like as age,sex, BMI, alcohol consumption and dyslipidemia were found significantly associated with LVH among respondents during bi-variate analysis. The Variable that was significant during multivariate analysis was BMI. Respondents who had BMI less than 25 were 0.171 times less likely to have LVH (OR 0.171, CI: 042-0.702) (Table 5).

Discussion

In present study, among the respondents, LVH was found in 59.6% of hypertensive clients. The finding of the study was somewhat similar to study in which the prevalence of LVH was 64% on echocardiographic measurement [10]. Whereas another study showed only 24% of hypertensive clients had fulfilled the criteria of LVH. A study done in Chinese population in primary care setting , the prevalence of LVH was 42.7%. Another study revealed prevalence of LVH 52.2% to 72.2 % using different threshold values for defining LVH. A meta-analysis including 22studies showed prevalence of echocardiographic ranging from 56% as assessed by updated criteria, of patients with Resistant hypertension [11].

Regarding the age of the respondents, the mean age was 51.88 ±12.43 years. There was significant association of age with LVH and was more likely to occur in more than 50 years of age (OR 0.556,CI :0.175- 2.447, p=0.04). In a study done, LVH was correlated with age and was more likely to be found in the age more than 55years of age(r2 = 0.077) [11]. Findings ofthis study was supported with a study where LVH prevalence was 29.4% in 18-40years of age, 48.2% in 41-64 years of age and 63.6% in above 64 years of age [12].Regarding the sex of the respondents, there was significant association between LVH and sex of the respondents (p<0.001). Male sex was 2.1 times more likely to have LVH. The findings of the study supports a study, LVH was more likely to occur in male and independently associated with male in a multivariate analysis(OR: 1.29, CI: 1.6-1.43, p<0.001) [13]. Findings was contradictory to the study which showed LVH was more prevalent with female gender (OR: 7.69, 95% CI 3.23-20.0,p< 0.001) [14].

Regarding the BMI of respondents, LVH was statistically associated in present study (p<0.001). In multivariate analysis, LVH was less likely to occur with normal BMIin comparison to obese (Adjusted OR 0.171,95% CI 0.042-0.702, p - value = 0.01). Findings of the study was somewhat similar to the study LVH was higher in obese hypertensive clients (OR 3.26, p<0.001) [15],. The finding supports another study donein theobese population; prevalence of LVH was 56.0% (range 20.0-85.0%). Data provided by 15 studies (n = 4999 obese individuals), including 6623 non-obese controls, showed that the probability of having LVH was much higher in cases than in non-obese counterparts (odds ratio 4.19, 95% confidence interval 2.67-6.53, p< 0.01). Another study showed people with increased BMI are more likely to have LVH (OR=2.18, 95% CI=1.05-3.42) [16] .In a study done in Malaysia , Hypertensive patients who were obese (Odds ratio 8.34, 95% confidence interval 3.14 - 22.22) and male gender (OR:1.96, 95%CI: 1.08 to 3.16) had significant positive association with LVH [17].

Regarding lifestyle and behavior, there was significant association of duration of smoking with LVH (p= 0.03) in present study .Another Study showed that LVH was significantly associated in male smokers (p< 0.001) [18]. Similarly, findings of present study revealed that alcohol consumption was significantly associated with LVH (p= 0.04). The findings were supported with Framingham Heart study that alcohol intake was positively associated with left ventricular mass in men (p< 0.01) .

Regarding co- morbidities, present study showed LVH was significantly associated with dyslipidemia (p-value<0.001), dyslipidemic clients were 5.411 times (CI 2.578-11.483) more likely to have LVH. There was a significant positive correlation between Left Ventricular Mass Index (LVMI) and triglycerides level (r =0. 535, p<0.001,) in a study[19].The findings of a study was supported with the study where high-density lipoprotein had a significant inverse association with Left ventricular mass and Left ventricular posterior wall thickness.

In the multivariate analysis,the determinant of LVH was BMI. LVH was 0.17 times less likely to occur with non-obese (Adjusted OR 0.171, 95% CI 0.042-0.702, p-value = 0.014). The finding supportsastudy,where the independent predictors of LVH were found to be sex, age, SBP, obesity and diabetes. A significant correlation was found between indexed left ventricular mass and body mass index (r2= 0.167), age (r2=0.077) and SBP (r2=. 055). Similarly, in a study done by China, the factors associated with LVH wereobesity (odds ratio (OR) 8.34, 95% CI: 3.14 to 22.22) and male gender.Another study done by Falkner et. al., (2013) concluded independent associations of obesity and High blood pressure (HBP) with LVH (obesity OR = 3.26, p< .001; HBP OR = 2.92, p<0.001).

Conclusions

Based on the findings of the study, LVH was found among More than half of the respondents. The remarkable associated factors such as presence of dyslipidemia,male sex,alcohol consumption, age more than fifty years and duration of smoking more than five years, contributed to LVH. Increased Body Mass Index was the alone determinant of LVH among hypertensive patients. Therefore timely management of hypertension and risk factors should be considered.

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