Original Article

Study of various modalities for detecting left ventricular hypertrophy in hypertensive patients

Gajanan Gondhali[*], Anil Rathi[**], Pruthu Dhekane[***], Arun Daithankar[****]

[*]Assistant Professor, [**]Professor and HOD, [***]Junior Resident, [****]Associate Professor, Department of Medicine, MIMSR Medical College Latur, Maharashtra, INDIA.

Email: shitalbhattadgondhali@gmail.com

Abstract

Introduction: Hypertension is one of the leading causes of global burden of disease. About 7.6 million deaths worldwide and 92 million disability adjusted life years were attributed to high blood pressure. **Material and Methods:** The study was conducted at MIMSR, Yeshwantrao Chavan Rural Hospital, Latur from January 2014 to December 2015. Out of the patients attending the Out Patient Department (OPD) and admitted to the hospital, 100 patients were taken into the study who were having hypertension. **Results:** 100 patients of hypertension were studied out of which 59 (59%) patients had normal LVMI and 41(41%) patients had increased LVMI. Sensitivity of clinical examination, chest X-Ray and ECG by Sokolov-Lyon voltage criteria and Romhilt Estes score in detecting LVH was 17.07%, 24.39%, 58.54% and 73.17% respectively. Specificity of the same were 96.61%, 94.92%, 94.92% and 93.22% respectively.

Key Word: forensic osteology, human remains, identification, anthropology.

[*]**Address for Correspondence:**
Dr. Gajanan Gondhali, Assistant Professor, Department of Medicine, MIMSR Medical College Latur, Maharashtra, INDIA.
Email: shitalbhattadgondhali@gmail.com

Received Date: 19/05/2016 Revised Date: 10/06/2016 Accepted Date: 13/07/2016

Access this article online	
Quick Response Code:	Website: www.statperson.com
	DOI: 16 July 2016

INTRODUCTION

Hypertension is one of the leading causes of global burden of disease. About 7.6 million deaths worldwide and 92 million disability adjusted life years were attributed to high blood pressure. Hypertension doubles the risk of cardiovascular diseases, including coronary artery disease (CAD), congestive cardiac failure (CCF), ischemic and hemorrhagic stroke, renal failure, retinopathy(leading to reduction of vision) and peripheral arterial diseases.[1] Early detection, regular monitoring and appropriate compliant treatment reduces the risk of developing these complications significantly. Along with detection and monitoring of blood pressure, screening for target organ damage or dysfunction is also of paramount importance. Target organ damage screening helps in checking the impact of hypertension and monitoring the efficacy of anti-hypertensive treatment. Prolonged uncontrolled hypertension leads to left ventricular remodeling and hypertrophy. Detection of this hypertrophy is suggestive of effect of hypertension on the heart and effective control of hypertension.[2]

Traditionally clinical examination, Chest X-Ray (CXR) and Electrocardiography (ECG) were used in determining left ventricular hypertrophy. Position of apex beat, cardiac borders on percussion, audible third or fourth heart sounds, presence of cardiomegaly (LV type of apex) on CXR and presence of left ventricular hypertrophy on ECG by various criteria were used as markers for detection of left ventricular hypertrophy. But with the advent of Echocardiography the detection of LVH has become more easy, sensitive and accurate, especially with the use of M-mode Echocardiography. The presence of increased left ventricular mass index (LVMI) indicates the presence of left ventricular hypertrophy. Also presence of dilated left atrium and altered color Doppler flow velocities across the mitral valve along with filling patterns of the left ventricle could be detected. These all parameters pointed out to the presence or absence of diastolic dysfunction and its grading. These can thus detect diastolic heart failure. This diastolic dysfunction and diastolic heart failure is also a parameter for the presence or absence of hypertension and effect of hypertension on the cardiac status.[3] This study has been attempted to focus upon the usage of Echocardiography in diagnosing the effect of hypertension upon the heart itself and its sensitivity over other modalities in

How to site this article: Gajanan Gondhali, Anil Rathi, Pruthu Dhekane, Arun Daithankar. Study of various modalities for detecting left ventricular hypertrophy in hypertensive patients. *International Journal of Recent Trends in Science and Technology*. July 2016; 19(3): 443-446. http://www.statperson.com (accessed 18 July 2016).

diagnosing left ventricular hypertrophy and early detection of present and impending target organ dysfunction in rural Indian population. No such well coordinated Indian studies have been conducted so far in Indian population for assessing such aspects of hypertension. Aim of our study is to compare different modalities for detecting left ventricular hypertrophy with reference to left ventricular mass index by ECHO in Patients with hypertension

METHODOLOGY

The study was conducted at MIMSR, Yeshwantrao Chavan Rural Hospital, Latur from January 2014 to December 2015.

Out of the patients attending the Out Patient Department (OPD) and admitted to the hospital, 100 patients were taken into the study who were having hypertension. All newly diagnosed patients and old known cases of hypertension were included. Patients of both the sexes and above the age of 18 years were included in the study. Patients with blood pressure of systolic more than 139 mmHg and diastolic more than 89 mmHg, irrespective of taking anti-hypertensive treatment or not, were taken into the study.

Patients with pre-existing structural heart diseases (valvular heart diseases, cardiomyopathies) ischemic heart diseases, congenital heart diseases and diabetes were excluded from the study.

RESULTS

Table 1: Age of patient and LVMI

Sr. No.	LVMI	Age group (in years)			Total
		18-40	40-65	>65	
1.	Normal	4 (100%)	38 (64.41%)	17 (45.95%)	59
2.	Increased	0 (0%)	21 (35.59%)	20 (54.05%)	41
Total		**4**	**59**	**37**	**100***

χ^2 = 6.0992 'p' Value = 0.047379 **Significant**

Table 2: Correlation number of cases showing LVMI in males and females

Sr. No.	LVMI	Sex Distribution		Total
		Males	Females	
1.	Normal	31 (63.17%)	28 (54.90 %)	41(41%)
2.	Increased	18 (36.73%)	23 (45.10%)	59 (59%)
Total		**49**	**51**	**100**

χ^2= 0.72, p = 0.40, df = 1, **Not Significant**.

Table 3: Correlation between Heaving apex beat and LVMI

Sr. No.	LVMI	Apex beat		Total
		Normal	Heaving/Shifted	
1.	Normal	57(96.61%)	2(3.39%)	59
2.	Increased	34(77.78%)	7(22.22%)	41
Total		**91**	**9**	**100**

p = 0.03 by Fisher's Exact test, df = 1 **Significant**

Table 4: Correlation between X-ray findings [Cardiomegaly] and LVMI

Sr. No.	LVMI	X-ray findings – Cardiomegaly		Total
		Normal	Cardiomegaly	
1.	Normal	56 (94.92%)	3 (5.08%)	59
2.	Increased	31 (75.61%)	10 (24.39%)	41
Total		**87**	**13**	**100**

χ^2= 7.97, p = 0.005 df = 1 **Significant**

Table 5: Correlation between ECG: Sokolov- Lyon Criteria and LVMI

Sr. No.	LVMI	ECG : Sokolov- Lyon Criteria		Total
		Normal	LVH	
1.	Normal	56 (94.92%)	3 (5.08%)	59
2.	Increased	17(41.46%)	24(58.54%)	41
Total		**73**	**27**	**100**

χ^2= 35.07, p = 0.001, df = 1, **Significant**

Table 6: Correlation and Comparison of ECG (Rohmilt-Estes Criteria) and LVMI

Sr. No.	LVMI	ECG : Romhilt-Estes Criteria		Total
		Normal	LVH	
1.	Normal	55 (93.22%)	4 (6.78%)	59
2.	Increased	11(26.83%)	30(73.17%)	41
Total		66	34	100

$\chi^2 = 47.52$ 'p' value = 0.001 df =1 **Significant**

Table 7: Sensitivity and specificity of different modalities for LVH/increased LVMI

Sr. No.	LVH	Comparable LVH criteria			
		Heaving/Shif-ted apex beat	X-Ray Cardiomegaly	ECG-Sokolov-Lyon Criteria	ECG –Romhilt Estes criteria
1.	Sensitivity	17.07%	24.39%	58.54%	73.17%
2.	Specificity	96.61%	94.92%	94.92%	93.22%
Number of cases		9	13	27	34

DISCUSSION

In this study we found that Echocardiography was better than other methods for detection of LVH. Amongst the other methods compared ECG was having more sensitivity in detecting LVH than chest X-Ray and clinical methods.

In this study 9 (9%) patients had shifted or heaving apex beat. Presence of shifted or heaving apex beat was 3.39% in patients with normal LVMI and 22.22% patients with increased LVMI. Few other studies like by Edward G *et al*[4] showed presence of clinical factors to variable extent in hypertensive patients. Also Shoichi E *et al*[5] showed presence of shifted apex beat in 31% of hypertensive patients. Ehara S *et al*[6] also showed 31% of hypertensive patients having shifted apex beat. So in this study less proportion of patients showed presence of shifted/heaving apex beat as compared to previous other studies.

Chest X- Ray suggested cardiomegaly in 13 (13%) patients.5.08% patients with normal LVMI were having cardiomegaly on chest X-ray and 24.39% patients with increased LVMI showed cardiomegaly on chest X-Ray. 24.9% of patients showed cardiomegaly on chest X- Ray in studies conducted by Ali Biharas Monafred *et al*[7]. 77.8% of hypertensive patients showed cardiomegaly on chest X-Ray in studies done by Diaz Arieta G *et al*[8]. According to Riberio SM *et al*[9] presence of cardiomegaly was 11.29%. So the observations in this study were more or less similar to the observations seen in other previous studies.

More prominent cardiomegaly is seen on Chest X-Ray in eccentric type of cardiomegaly. In hypertensive patients there is more concentric type of hypertrophy. Also improper positioning of the patient during taking x-rays along with other disorders like scoliosis can cause improper diagnosis of presence or absence of cardiomegaly. Hyperdynamic circulatory conditions like chronic anemia, thyrotoxicosis, beri-beri can also cause cardiomegaly.

ECG showed by Sokolov-Lyon voltage criteria that 27 (27%) patients had LVH. 58.54% of patients with increased LVMI showed LVH by Sokolov – lyon voltage criteria on ECG. Other studies like by Kevin A *et al*[10] showed 29% presence of LVH in hypertensive patients on ECG with Sokolov – Lyon voltage criteria. By Romhilt-Estes score in this study 34% (34) patients showed LVH. 73.17% patients with increased LVMI and 6.78% patients with normal LVMI showed LVH by Romhilt – Estes score respectively. Study by Kevin A *et al*[10] showed presence of LVH by Romhilt Estes criteria to be 22%. Prakash O *et al*[11] showed presence of LVH by Sokolov Lyon criteria in 34% of patients and presence of LVH by Romhilt Estes score in 13% of patients. Owusy I *et al*[12] found out presence of LVH to be 49% by Sokolov Lyon criteria and 51% by Romhilt Estes criteria. Hence results obtained in this study were similar to results obtained in previous studies. It was seen from this study that sensitivity and specificity of apex beat in diagnosing LVH was 17.07% and 96.61% respectively. Shoichi *et al*[5] found 56% sensitivity and 91% specificity of apex beat in diagnosing LVH. According to studies conducted by O'Neill T.W *et al*[13], apex beat had 59% sensitivity and 76% specificity in diagnosing LVH. While sensitivity was 22% and specificity was 91% of apex beat in diagnosis of LVH in studies conducted by Rutten F *et al*[14]. Hence it was seen that sensitivity varied but specificity remained relatively same in between our study and other previously conducted studies. This could be due to varying built and nutritional status of patients in various studies. Also interpersonal and intrapersonal variation in assessment of apex beat (location and character) could cause variation in obtained results.

Chest X-Ray in this study showed 24.39% sensitivity and 94.92% specificity in diagnosing LVH. Chest X-Ray had 34% sensitivity and 84.5% specificity in diagnosing LVH in studies conducted by Ali Biharas Monfared *et al*[7]. Sensitivity and specificity were 16.7% and 88.3%

respectively in studies conducted by Riberio SM *et al*[9]. Meanwhile Adel Abdul –Hassan Kadhum *et al*[15] showed sensitivity of 17.24% and specificity of 90.47% in detecting LVH from Chest X-Ray. Thus relatively similar findings were obtained in our study and the studies done previously.

ECG showed by Sokolov-Lyon criteria, sensitivity of 58.54% and specificity of 94.92% in this study. Sensitivity was 17.0% and specificity was 90.8% by Sokolov- Lyon criteria in the studies conducted by Edoardo Casiglia *et al*.[16] Sensitivity was 45.5% and specificity was 94.4% according to studies conducted by Beyerbacht H. P *et al*[17]. Sensitivity and specificity was 21.0% and 95.0% respectively according to studies conducted by Reichek N *et al*[18]. Hence more or less varying results were obtained from studies conducted by us and previously as regards sensitivity and specificity of ECG-Sokolov-Lyon criteria for detecting LVH.

ECG showed by Romhilt Estes score criteria 73.17% sensitivity and 93.22% specificity in diagnosing LVH in this study. Edoardo Casiglia *et al*[16] showed 22.5% sensitivity and 90.8% specificity in diagnosing LVH by Romhilt Estes score. In studies conducted by Beyerbacht H. P *et al*[17]. the sensitivity and specificity of diagnosing LVH were 77.3% and 77.8% respectively. Sensitivity was 50% and specificity was 95% according to studies of Reichek N *et al*[18]. Hence more or less varying results were obtained from studies conducted by us and other previous studies in detecting sensitivity and specificity of ECG- Romhilt Estes criteria for detecting LVH.

Echocardiography was seen to have more sensitivity for detecting LVH. But clinical examination, chest X-Ray and ECG are also important for ruling out other associated conditions with LVH[19].

REFERENCES

1. Theodore A. Kotchen, Epidemiology, Hypertensive Vascular Disease. Harrison's Principles of Internal Medicine. Dennis L. Kasper , Anthony S. Fauci, Dan L. Longo, Eugene Braunwald, Stephen L. Hauser, J Larry Jameson, 18th edition, New York, Mc Graw- Hill Companies, 247:2042,2043,2012.
2. Edward D. Frohlich. The pathophysiology of systemic arterial hypertension. In Hurst's The Heart, by Wayne Alexander, Robert C Schlant, Vlentine Fuster, 8th edition, New York, McGraw Hill Companies; 1319,1994.
3. Nathaniel Reicheck, Richard B. Devereux. Left Ventricular Hypertrophy relationship of anatomic, echocardiographic ,electrocardiographic findings. Circulation 83;1391-1398,1981.
4. Edward D, Carl Apstein, Aram V, The heart in hypertension; N Eng J Med 2001.
5. Shoichi Ehara et al. The Clinical Value of Apex Beat and electrocardiography for detection of left ventricular hypertrophy from the standpoint of distance factors from the heart to chest wall: a multislice CT study. Hypertens Res 2011 Sep; 34 (9): 1004-1010.
6. Ehara S et al. Comprehensive evaluation of apex beat using 64 slice computed tomography: Impact of Left Ventricular mass and distance to chest wall. J Cardiol 2010;55: 256-265.
7. Ali Biharas Monfared et al. Iranian Red Cresent Med J. 2015 Jan; 17(1): e 18242
8. Areita G et al. Correlation between chest radiography and the electrocardiogram to evaluate cardiomegaly in patients with systemic arterial hypertension. Arch Cardiol Mex. 2006 Apr – Jun; 76(2):179-84.
9. Riberio SM et al. Accuracy of chest radiography plus electrocardiogram in diagnosis of hypertrophy in hypertension. Arq Bras Cardiol. 2012(online) ahead print PP.0-0.
10. Kevin A. Micheal Usama Boles, Andres Enriquez, Hoshiar Abdollah, Early changes on electrocardiogram in hypertension. An article from the e-journal of the ESC Council for Cardiology Practice. Vol. B, 2015 Sep; 30-08.
11. Prakash O et al. Left Ventricular hypertrophy in hypertension: correlation between electrocardiography and echocardiography. Kathmandu Univ Med J (KUMJ) 2009. Apr- Jun; 7(26): 97-103.
12. Owusi I et al. electrocardiographic Left Ventricular Hypertrophy in patients with Hypertensive Heart Failure. The Internet Journal of Third World Medicine-2006. Volume 6. Number -1.
13. O'Neill T. W et al. Diagnostic value of palpation of apex beat. Department of Cardiology. Mental Hospital, Dublin, Ireland. The Lancet 1989/03:1 (8635):410-1.
14. Rutten F et al. OP-094, Diagnostic Value of palpation of apex beat in detecting or excluding left ventricular hypertrophy in patients with hypertension. Wonca 2009-Basel.
15. Adel Abdullah-Ha Sasan Kodhum et al. Validity of chest X-Ray in determination of cardiac size in comparison for echocardiography. MIBU, 2007, Vol25: 48-50.
16. Edodardio Casiglia et al. electrocardiographic criteria of left ventricular hypertrophy in general population. Eur J Epidemol.10-1007/s 10654-008-9234-6
17. Beyerbacht H. P et al. Evaluation of ECG criteria for left ventricular hypertrophy before and after aortic valve replacement using magnetic resonance imaging. Journal of Cardiovascular Magnetic Resonance 2003, Vol. 2, 31, 465-474.
18. Reichek N et al. left ventricular relationship of anatomic, echocardiographic and electrocardiographic findings. Circulation.1981;63:1391-1398.
19. Blood Pressure Lowering Treatment Trialists Collaboration: Effects of different blood pressure lowering regimens on major cardiovascular events in individuals with and without diabetes mellitus. Arch Intern Med. 165:1410,2005.

Source of Support: None Declared
Conflict of Interest: None Declared