



ORIGINAL RESEARCH PAPER

Medicine

LEFT VENTRICULAR HYPERTROPHY – ADAPTIVE RESPONSE TO CHRONIC SYSTEMIC HYPERTENSION

KEY WORDS: Left Ventricular Hypertrophy, Elderly, Hypertension

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ABSTRACT

Left Ventricular Hypertrophy (LVH) often reflects as a physiological adaptation to chronic blood pressure (BP). It indicates a grave prognosis and should be diagnosed early by using the accurate methods. **Objective:** To estimate prevalence of LVH and ascertain correlation between electrocardiographic and radiographic (chest x-ray) evidence of LVH. **Materials and methods:** 100 elderly hypertensive subjects were included in study & LVH was assessed by using chest x-ray and different ECG criteria. **Results:** Chest x-ray detected LVH in 29% subjects. ECG detected LVH in 32%, 15%, 34% and 44% subjects as observed by Sokolow Lyon criteria, Cornell voltage criteria, Romhilt Estes score system and Total QRS voltage criteria respectively. 37% subjects had ST-T wave's abnormalities and 19% had ECG with strain pattern. **Conclusion:** In low resource setups chest x-ray and ECG are the useful tools for detection of LVH, where standard diagnostic tests are unavailable.

INTRODUCTION

Hypertension (HTN) is one of the leading risk factors of global burden of disease affecting 1.13 billion people (World Health Organization, 2018). HTN, if untreated or poorly controlled leads to stress on several target organs, causing them to deteriorate over time, of which hypertensive heart disease is a constellation of abnormalities that includes LVH, systolic and diastolic dysfunction and their clinical manifestations. Hence, it is important to know the BP status before target organ damage (TOD) occurs. LVH is, to a great extent, a reversible risk factor and its detection leads to a more aggressive therapeutic approach and improves CV outcome and long-term prognosis (Chobanian, 2004).

LVH can be diagnosed by Chest X-ray, ECG, Echo and CMR imaging etc. CMR and Echo are the more sensitive and gold standard techniques to identify LVH at early stage (Ravikeerthy, 2015). Chest X-ray and ECG are affordable, readily available, easy to use and portable examination tool but relatively insensitive and can't accurately quantitate the severity of LVH (Bryan Williams et al., 2018). But in developing countries, Chest x-ray and ECG are the useful tools for screening and detection of LVH where the facilities of CMR and Echo are still unavailable. Present study was done with the objectives to determine the Prevalence of LVH and to ascertain correlation between the electrocardiographic and radiographic (chest x-ray) evidence of LVH in elderly hypertensive subjects.

MATERIAL AND METHOD

The Institution based cross-sectional study was conducted among elderly (≥ 60 years) hypertensive subjects in the Department of General Medicine, Deben Mahato Sadar Hospital, Purulia, West Bengal, for a period of one and half year (1st July 2018 to 31st Dec 2019). Sample size was calculated by using, 63.6% prevalence of LVH by ECG Sokolov-Lyon criteria among subjects with essential HTN, with 95% confidence interval, 5% absolute precision (Shashidharan, 2016).

Study included the subjects of either sex, aged ≥ 60 years, who have been diagnosed with essential HTN, irrespective of

duration of HTN and type of treatment receiving and those who have given consent. All cases of secondary HTN with previous ischemic heart disease, congenital heart disease, valvular heart disease, primary lung disease and those who have not given consent were excluded.

Total 100 elderly hypertensive subjects were recruited after taking informed written consent. Data was collected by using a pretested and interviewer administered questionnaire. Then they were subjected to detailed history taking, through examinations and investigations.

Chest X-ray postero-anterior view was performed on each subject. A cardiothoracic ratio (CTR) is >0.5, was considered as LVH. Subjects having CTR >0.5 due to causes other than essential HTN were excluded from the study. X-ray findings were interpreted with the help of radiologist.

Since the gold standard examinations were not available in present study setting; ECG had been taken as reference for comparison. The diagnosis of LVH was assessed electrocardiographically by using- **1) Sokolow-Lyon index**- SV1 + RV5 or V6 ≥ 35mm was considered as LVH irrespective of sex. **2) Cornell's voltage criteria** - SV3 + R aVL > 20 mm in women or > 28 mm in men was considered as LVH. **3) Total QRS voltage criteria** - Any value ≥ 175 mm of total QRS voltage was considered as LVH. **4) Romhilt-Estes point Score system (Total Score=12)** - [(R or S wave in limb leads ≥ 20 mm OR SV1, V2 or V3 ≥ 25 mm OR RV4, V5 or V6 ≥ 25 mm = 3 points), (ST-T changes = 3 points), (Left atrial involvement- "P" terminal force in V1 > 0.04 sec OR > 1mm = 3 points), (Left axis deviation of ≥ 15° = 2 points), (Intrinsicoid deflection in V5 or V6 ≥ 0.04 sec = 1 point)]. Any value ≥ 5 was considered as definite LVH, 4 – Probable LVH and <4 - No LVH.

Collected data was tabulated, analyzed and interpret by SPSS 20.0. Data was displayed with the help of tables and charts. Categorical variables were presented as percentages. Appropriate statistical tests were applied accordingly. 95% confidence intervals (CI) and p-value (<0.05) were considered significant. Ethical approval was obtained from the Institutional Ethical Committee of Bankura Sammilani

Medical College and hospital, Bankura, West Bengal.

Operational definitions

Elderly- Government of India adopted 'National Policy on Older Persons' in January, 1999. The policy defines 'senior citizen' or 'elderly' as a person who is of age 60 years or above (Central Statistics Office, 2016).

Hypertension- The presence of a persistent elevated SBP \geq 140 mmHg and/or diastolic DBP \geq 90mmHg, and/or the use of anti-hypertensive drugs and/or past medical history of hypertension (Chobanian, 2004).

RESULTS

Among 100 subjects, (59, 59%) were males and (41, 41%) were females. The mean age of the subjects was 66.10 (\pm 7.69) years. 31 (31%) subjects were hypertensive since >10 years.

Table-1 depicts that clinical finding of LVH were present in 23 (23%) subjects.

Table 1- Clinical findings of LVH

Clinical findings	(N)	(%)
Down, outward, Forceful and well sustained apical impulse	23	23
Down and outward shifted apex beat	23	23
S4 heart sound present	8	8
S3 heart sound present	6	6

Overall 29 (29%), 32 (32%), 15 (15%), 34 (34%) and 44 (44%) subjects had LVH by chest x-ray, Sokolow Lyon criteria, Cornell voltage criteria, Romhilt Estes score system and Total QRS voltage criteria respectively.

Table 2- Other ECG findings

ECG findings (Multiple response)		(N)	(%)
ST-T wave changes (n=37)	Early repolarisation	4	4.0
	T wave inversion	4	4.0
	ST depression + wave inversion (strain pattern)	19	19.0
	Tall T wave	6	6.0
	Biphasic T wave	4	4.0

Table-2 describes other ECG findings in the study subjects. ST-T wave changes were present in ECG of 37% subjects. Strain pattern was observed in 19, 19% subjects.

Figure-1; describes significant positive correlation between “CTR and Sokolow Lyon criteria” ($r=0.321$, $p=0.001$) and between “CTR and Romhilt Estes score system” ($r=0.298$, $p=0.003$). Non-significant positive correlation was present between “CTR and Cornell voltage criteria” ($r=0.152$, $p=0.132$) and between “CTR and total QRS voltage” ($r=0.181$, $p=0.072$).

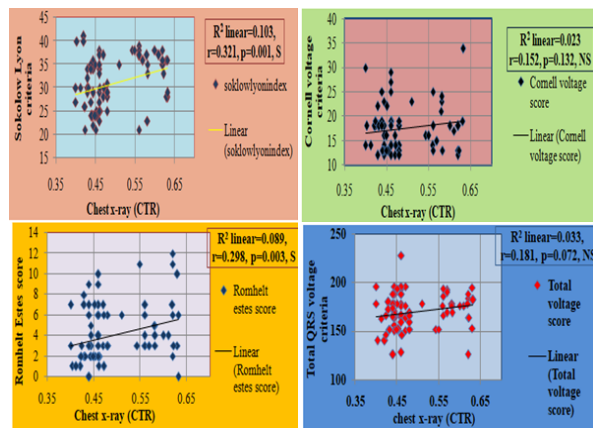


Fig.1- Correlation between “chest x-ray and various ECG criteria

DISCUSSION:

The prevalence of LVH varies from 29 to 44% among subjects in present study. These findings are consistent with many previous studies. Prakash (2019) reported that 31 (20.67%) subjects had LVH on ECG by Sokolow-Lyon voltage criteria. CTR \geq 0.50 was present in 19.9% subjects. 84% and 92% of cases have LVH by Sokolow-Lyon voltage criteria and Cornell voltage criteria respectively (Padaki & Dambal, 2017). Sokolow-Lyon criterion, Romhilt-Estes scoring system and Total QRS voltage criteria detected LVH in 28%, 36% and 39% subjects (Venugopal et al., 2016). Gondhali et al., (2016) found cardiomegaly in chest x-ray of 13% subjects. Thakur et al., (2016) observed that 32%, 31% and 43% of subjects had LVH by Cornell voltage criteria, Romhilt Estes score and Sokolow Lyon criteria respectively. 24.9% of subjects showed cardiomegaly on chest X-Ray in studies conducted by (Biharas Monfared et al., 2015). Ribeiro et al., (2012) observed that 11% subjects presented an elevated CTR.

In present study 23% subjects had palpating apex beat. Prisant, (2005) classic physical findings of outside displaced, sustained, enlarged (>3 cm diameter) apical impulse is characteristic of isolated LVH. Palpating (displaced or heaving) apex beat gives a clue about cardiomegaly or LVH with or without dilatation. Venugopal et al., (2016) reported clinical evaluated LVH in 18% subjects. Gondhali et al., (2016) found that 9 (9%) subjects had palpating apex beat. (Gondhali et al., 2016) Ehara et al., (2011) found shifted apex beat in 31% subjects.

Present study revealed S4 and S3 heart sound in 8% and 6% subject respectively. An abnormal S3 indicates thin, eccentric hypertrophy associated with systolic heart failure. An abnormal S4 sound denotes stiff, hypertrophic ventricles and is very specific to hypertensive heart disease as stated by (Prisant, 2005).

Present study revealed strain pattern in ECG of 19 (19%) subjects. Strain pattern is associated with adverse CV risk factors. Salles et al., (2006) reported strain pattern in 23% subjects. Emmanuel & Kofi, (2016) reported ST-T-wave changes in 30.1% subjects.

CONCLUSION

LVH is a common pre-clinical cardiac complication of HTN. There should be emphasis on controlling BP of hypertensive subjects by life style modifications, systematic screening of BP and detection followed by timely treatment so that further CV complications can be prevented. Liberal use of cost effective tools like **chest x-ray in conjunction with the ECG** in hypertensive subjects (with special emphasis on high risk subjects) could be useful in early diagnosis of LVH and guiding treatment decision in the low-resource settings where gold standard diagnostic tests are unavailable. The methods used in this study are simple and adaptable at the primary as well as secondary healthcare level for planning prevention and intervention programmes.

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