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Original Article

Association between duration of hypertension, level of systolic blood pressure and ECG

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Abstract

Background: The electrocardiography (ECG) is an important tool to find out cardiac disorders. ECG changes among the hypertensive patients can reveal the early cardiac abnormalities, which can lessen the incidence of morbidity and mortality. **Objectives:** The purpose of the study was to find out the association between ECG changes and the duration of hypertension and level of Systolic Blood Pressure (SBP) in hypertensive patients. **Materials & Methods:** This cross sectional study was conducted among the hypertensive patients attended in the Department of Cardiology at TMSS Medical College and Rafatullah Community Hospital, Bogura during the period of January 2017 to January 2018. Data were collected by face-to-face interview with a pre-designed structured questionnaire. Measurement of the blood pressure and the 12-lead surface electrocardiogram were done among the study group in a resting state. **Results:** There were significant association between hypertension and ECG changes which is more pronounced with the duration of hypertension and level of systolic blood pressure. And also there was significant association between the Left Ventricular Hypertrophy and duration of hypertension.

Key words : LVH, ECG, SBP, HTN

Introduction

Hypertension is defined as the persistent rise of arterial blood pressure (systolic or diastolic) above the upper normal limit and clinically it is characterized by an elevation of blood pressure to 140/90 mm of Hg or more. However the modern perception of hypertension has been slightly changed. According to the recent perception hypertension is “the level of blood pressure at which the benefits of treatment outweigh its cost and hazards¹. One of primary and well recognized tool to screen and monitor cardiovascular diseases is electrocardiogram (ECG). Which is the graphical display of the various electrical changes of the heart. It plays an important role in the diagnosis of and monitoring various cardiac diseases. It is one of the major methods of assessing the effects of hypertension on one of its target organ heart and as well as effectiveness of the treatment of it. It remains one of the most sensitive methods for establishing left

ventricular hypertrophy (LVH) due to hypertension². An ECG does not determine whether one has hypertension or not but it can reveal the effects of long standing hypertension.

Electrocardiographic evidences of LVH are highly predictive of cardiovascular complications in patient with hypertension and therefore particularly useful in risk assessment . LVH has been reported to be the first and commonest complications of hypertensive patients and frequently present after the age of forty. Several studies have shown that LVH is an important risk factor in patients with hypertension, leading to a 5-10 fold increase in cardiovascular risk. So detection of LVH has become an important part of the cardiovascular risk assessment in hypertensive patients. The 12-lead surface electrocardiogram has long been used as the major means for this purpose¹.

The aim of the present study is to find out the

association between electrocardiographic changes in hypertensive patients through ECG analysis by the 12-Lead surface electrocardiogram.

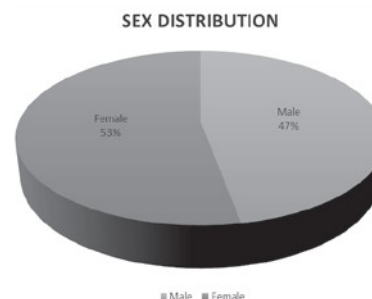
Materials & Methods

A descriptive cross-sectional study was carried out in the Department of Cardiology at TMSS Medical College and Rafatullah Community Hospital (TMC & RCH), Bogura from January 2017 to June 2018 for a period of 1½(one & half) year. Hypertensive patients attending Cardiology Department of TMC & RCH, Bogura were selected as study population. Hypertensive patients both male and female and their age range from 25 to 80 years were included in this study. The subject was considered to be hypertensive if s/he had a systolic blood pressure ≥ 140 mm of Hg and diastolic blood pressure ≥ 90 mm of Hg with or without antihypertensive treatment. Hypertensive patients with associated valvular diseases, ischemic heart diseases, heart block, strokes, chronic systemic diseases, pregnancy and diabetes mellitus were excluded from this study. Institutional approval was taken from the concern Department and Authorities. For determining the association between the ECG abnormalities and duration of hypertension, the study populations were categorized into four (4) different groups,. **Group-I:** those patients' hypertensive for 2 years of less, **Group-II:** are those patients' hypertensive for 3-5 years, **Group-III:** those patients' hypertensive for 6-10 years and **Group-IV:** those patients' hypertensive for 10-15 years or more. And for determining the association between LVH and duration of hypertension, the study population were divided into two groups. Group-1, those were hypertensive less than 5 years and Group-2 those were hypertensive for more than 5 years. Before data collection, the written informed consent of the patient was taken. Data were collected by face to face interview. Blood pressure was measured by auscultatory method. The 12-lead surface electrocardiogram (ECG) was done in a resting state of the patient. All the findings were encoded carefully. And finally, Data were processed and analyzed used SPSS Version-23 according to objectives and variables of the study. Chi Square (X^2) test was to find the association.

Results

Total of 102 hypertensive patients of different grades were included in this study. A 12-lead surface electrocardiogram was done in all cases to find out the selective ECG changes among them. Among the 102 patient youngest patient was 25 years of age and oldest patients was 80 years of age with mean age of the patients was 56.82 ± 12.22 . There was total 48 (47.1%) male patients and 54 (52.9%) female patients. Figure I showed the male-female ratio in percentage.

Figure 01: Distribution of Male-Female among the patients.



ECG Abnormalities among the patients showed majority have Left Ventricular Hypertrophy with Ischaemia (29%), next was Ischaemia (28%), only Left Ventricular Hypertrophy was 8% and normal ECG findings was 23%. Table 01, showed the ECG Abnormalities.

Table I: ECG Abnormalities (n=102)

ECG Abnormalities	Frequency	Percent
Atrial Fibrillation (AF)	1	1
Ischaemia	29	28
LVH	8	8
LVH and Ischaemia	30	29
LVH Ischaemia, and AF	1	1
Normal	23	23
OMI(inf)	1	1
RBBB	1	1
Sinus brady, 1st degre A.V. Block, LVH	1	1
Sinus bradycardia	3	3
Sinus Bradycardia	1	1
Sinus rhythm, Atrial ectopic beats	1	1
Sinus rhythm, PVC	1	1
Ventricular Bigemini with sinus bradycardia	1	1

Statistical analysis revealed there was a significant association between the duration of hypertension and positive ECG changes ($p = 0.014$). And also there was a significant association between the level of Systolic Blood pressure and ECG changes ($p = 0.027$). Another significant analysis, there was very significant association between Left Ventricular Hypertrophy (LVH) and duration of hypertension. (p value 0.029).

Table II: Distribution of duration of Hypertension by ECG findings and their Association (n=102)

ECG Findings	Duration of Hypertension				χ^2	p -value
	<3 Years	3-5 Years	6-10 Years	>10 Years		
Normal	9	6	0	1		
Abnormal	25	29	22	10	10.553	0.014
Total	34	35	22	11		

Table III: Distribution of Hypertension by ECG findings and their Association (n=102)

ECG Findings	Systolic Blood Pressure			χ^2	p -value
	Hypertensive	Normal	Hypertensive		
Normal	9	10	6		
Abnormal	2	24	60	7.218	0.027
Total	2	34	66		

Table III: Distribution of Left Ventricular Hypertrophy by ECG findings and their Association (n=102)

	Duration of Hypertension		χ^2	p -value
	<5 yrs	>5 yrs		
Normal	22	18		
Abnormal	47	15	4.758	0.029
Total	69	33		

Discussion

Hypertension is an important non-communicable disease, which has significant public health concern due to its morbidity and mortality through-out the world³. As there is increased left ventricular workload

against the pressure gradient in hypertension, left ventricular hypertrophy (LVH) is a common complication⁴ and it's also easily revealed in ECG. Second common complication is Ischaemia of heart which also identifiable through ECG. Level of Systolic Blood Pressure and duration of hypertension effects on the development of LVH and Ischaemia and the present study also revealed there is significant association between the level of SBP and duration of hypertension. It is also known that LVH is associated with an increased incidence of ventricular arrhythmia and sudden cardiac death⁵. If the blood pressure remains consistently at a higher level, gradually there is chance of the development of biventricular hypertrophy⁶. There was cross sectional study done on 2016 among 400 hypertensive patients to find out the ECG changes in different grades of hypertension⁷. In that, study hypertensive patients were categorized into mild, moderate and severe hypertensive groups. And revealed 53% ECG abnormalities in hypertensive patients. Among the mild, moderate and severe hypertension, the changes were 38.8%, 65% and 100% respectively⁷. The present study revealed 84.31% (N=86) of the patients had ECG abnormalities. However, the present study didn't categorize the hypertensive patients according to severity of hypertension. Another difference with that study and the present is that, the researcher only tried to find out the association between the ECG abnormalities and severity of hypertension and its was significant ($p < 0.001$)⁷, however the present study revealed significant association between ECG abnormalities and level of Systolic Blood Pressure and also duration of hypertension. Another important finding of the present study was that significant association between LVH and duration of hypertension.

Another study was done on 2014 to find out the association between ECG abnormalities and incidence of heart failure (HF), another common complication of long-standing hypertension⁸. HF risk was 0.11 (95% CI 0.03–0.19) among the patients with long history of hypertension. Present study also showed there is association between LVH and duration of hypertension. And it is known that LVH leads to HF.

So it is very important that the hypertensive patients should be regularly monitored for ECG changes.

Conclusions

This study revealed a significant association between hypertension and ECG changes, which was more pronounced in duration of the disease and with level of SBP and also with LVH.

Conflict of interest

The authors have no conflict of interest to declare.

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