

Original Article

Electrocardiographic Changes in Different Grades of Hypertensive Patients: Experience of 400 Cases in Bangladesh

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Abstract

Background: Determination of the electrocardiographic changes among the hypertensive patients can reveal the early cardiac abnormalities. **Objectives:** The purpose of the present study was to find out the common electrocardiographic (ECG) changes in different grades of hypertensive patients. **Methodology:** This cross sectional study was conducted among mild to severe grade hypertensive patients attended in the Department of Medicine at Rajshahi Medical College and Hospital, Rajshahi during the period of July 2009 to June 2010 for a period of one year. 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:** A total number of 400 mild to severe grade hypertensive patients were recruited for this study of which male was 300 cases and female were 100 cases. The age ranges was 30 to 60 years, Among 400 hypertensive patients, abnormal electrocardiographic changes were found in 212(53%) patients. Among the mild, moderate and severe cases, the changes were 38.8%, 65% and 100% respectively. **Conclusions:** There is an association between hypertension and ECG changes which is more pronounced in severe hypertension. [*Journal of Science Foundation, January 2016;14(1):26-29*]

Keywords: Electrocardiographic Changes, Hypertension

Introduction

Hypertension is defined as the persistent rise of arterial blood pressure above the upper normal limit. Clinically, it is characterized by an elevation of blood pressure to 140/90 mmHg or more. The modern concept of hypertension has been somewhat changed. Now, hypertension is defined as the level of blood pressure at which the benefits of treatment outweigh its cost and hazards (Dada et al., 2006).

The electrocardiogram (ECG) is the graphical display of the various electrical changes of the heart. It plays an important role in the diagnosis of various heart diseases. It is one of the methods of assessing the effects of hypertension on one of its target organ heart. It remains one of the most sensitive methods for establishing left ventricular hypertrophy (LVH) and is often abnormal even when there is no left ventricular heave and chest x-ray shows no classical or obvious left ventricular enlargement (Agomuoh and Odia, 2007). An ECG does not determine whether one has hypertension or not but it can reveal the effects of long standing hypertension. So in a sense, the findings of ECG may be a reflection of hypertension. There had been found

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a linear correlation between the electrocardiographic changes with the severity and duration of the hypertension (Edhouse et al., 2002).

Electrocardiographic evidences of left ventricular hypertrophy are highly predictive of cardiovascular complications in patient with hypertension and therefore particularly useful in risk assessment (Verdecchia et al., 1998). LVH has been reported to be the first and commonest manifestation of heart disease in hypertensive patients and frequently present after the age of forty (Bacharova et al., 2007). Several studies have shown that left ventricular hypertrophy (LVH) is an important risk factor in patients with hypertension, leading to a 5-10 fold increase in cardiovascular risk (Sundstrom et al., 2001). 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 purpose (Dada et al., 2005).

In Bangladesh, so far we concern, such type of study relating ECG changes in hypertensive patients has not been conducted. The present study has been designed to find out the common electrocardiographic changes in hypertensive patients through ECG analysis by the 12-Lead surface electrocardiogram.

Methodology

This was a descriptive type of cross-sectional study was carried out in the Department of Physiology at Rajshahi Medical College (RMC), Rajshahi from July 2009 to June 2010 for a period of 1(one) year. Hypertensive patients attending Medicine Department of Rajshahi Medical College and Hospital (RMCH), Rajshahi were selected as study population. Hypertensive patients both male and female and their age range from 30 to 60 year 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 anti-hypertensive treatment. Hypertensive patients with pre-existing 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. Ethical clearance was approved by Institutional Review Board (IRB), Rajshahi Medical College, Rajshahi prior of the starting of the study. The study populations were categorized into 3 different grades according to their severity. Grade I or mild hypertension was defined when systolic blood pressure (SBP) was 140-159 mm Hg and diastolic blood pressure (DBP) was 90-99 mm Hg. Grade II or moderate hypertension was defined when SBP was 160-179 mm Hg and DBP was 100-109 mm Hg. Grade III or severe was defined when SBP was ≥ 180 mm Hg and DBP ≥ 110 mm Hg. 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. Measurement of blood pressure ;BP machine (Sphygmomanometer, Arenoid, Alr K2; made in Japan and Stethoscope, Littman; made in Japan)] and the 12-lead surface electrocardiogram [ECG machine (Matura ELI-100 EKG; made in China)]; were done in a resting state of the patient. All the findings were carefully preserved in the data collection form. Finally data were processed and analyzed with the help of a computer based on SPSS software programme, version-16. After entry into computer, results were analyzed according to objectives and variables of the study.

Results

A total of 400 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.

Table 1: Distribution of Hypertensive Patients into Different Grades

Grades of HTN	Frequency	Percent
Grade-I (mild)	250	62.5
Grade-II (moderate)	100	25.0
Grade-III (severe)	50	12.5
Total	400	100.0

Table 1 shows that out of 400 hypertensive patients, 250 were in grade-I category (mild), 100 were in grade-II category (moderate) and 50 were in grade-III (severe) category which were 62.5%, 25% and 12.5% respectively.

Table 2: ECG changes in different grades of hypertensive patients

Grades of HTN	ECG Change		Total
	Normal	Abnormal	
Grade-I (Mild)	153(61.2%)	97 (38.8%)	250(100.0%)
Grade-II (Moderate)	35 (35.0%)	65 (65.0%)	100(100.0%)
Grade-III (severe)	0 (0.00%)	50 (100.0%)	50(100.0%)
Total	188 (47.0%)	212 (53.0)	400(100.0%)

$\chi^2=70.36$, $df=2$, $p<0.001$

Table 2 shows abnormal ECG changes in 212(53%) out of 400 hypertensive patients and normal ECG findings in the remaining 188(47%) patients. In grade-I hypertension, the ECG changes were observed in 97(38.8%) out of 250 patients, in grade-II, 65(65%) out of 100 and in grade-III, 50(100%) out of 50 patients. There was an association between severity of hypertension and ECG changes. The association was statistically highly significant ($p<0.001$).

Discussion

Systemic hypertension is an important public health problem with significant morbidity and mortality through-out the world (Julian et al., 2005). Due to increase left ventricular work in hypertension, left ventricular hypertrophy (LVH) is a major complication of it (Bauml et al., 2010). It is well known that LVH is associated with an increased incidence of ventricular arrhythmia and sudden cardiac death (Dimopoulos et al., 2009). If the blood pressure remains consistently at a higher level, biventricular hypertrophy gradually develops, particularly after episodes of congestive cardiac failure (Dunn et al., 1977). So it is very important to detect LVH early in the course of hypertension to halt its progression.

In the present study, an attempt was made to find out the selective ECG changes in hypertensive patients to create increased awareness and improve life expectancy. A total of 400 hypertensive patients of both sexes, age range from 30-60 years without any systemic disorders were studied. Hypertensive patients were categorized into three different grades according to their severity.

The major ECG abnormalities which arise as a result of hypertension are high voltage QRS, widen P wave and changes in S-T segment and T waves (George et al., 1972). Persistent high voltage QRS is usually indicative of LVH, widening of P wave is suggestive of left atrial enlargement and changes in S-T segment and T wave is mostly due to myocardial ischemia and injury with or without LVH (Hampton, 2008). The majority of the untreated hypertensive patients showed increased QRS voltage on their electrocardiogram with subsequent changes in other waves (George et al., 1972).

The present study revealed 53% ECG abnormalities in hypertensive patients. Among the mild, moderate and severe hypertension, the changes were 38.8%, 65% and 100% respectively. These findings concurred to the findings of the Kwok et al (2008), Agomuoh and Odia (2007), George et al (1972), Evans (1962), Symons et al (1960) and differed to some extent from the study results of the Chi et al (1990), and Symons et al (1960).

In mild hypertension, Kwok et al (2008) noted ECG abnormalities in 30.7% cases. In moderate hypertension, Agomuoh and Odia (2007) observed ECG abnormalities in 62.1% cases, Chi et al (1990) in 49% cases and Symons et al (1960) in 75% cases. Their findings were not so far from the current study results. The small variations might be due to selection criteria of the sample population. In severe hypertension, the present study revealed 100% ECG changes which was consistent with the works done by George et al (1972); Evans (1962) and Symons et al (1960). All these investigators observed 100% ECG abnormalities in severe hypertension. It was noticed from this study that abnormal ECG changes were more

marked in more severe grade of hypertension and it was statistically highly significant ($p < 0.001$). Though there were many limitations during conducting this study, an honest and sincere effort had been made to find out the similarities and dissimilarities of these findings with other studies and also try to seek the reasons of the dissimilarities of the findings. From the present study, it was somewhat difficult to ascertain the exact cause of ECG changes in hypertensive patients; because there is lot of factors which influences ECG. Age, sex, race, body build, treatment habit, alcohol, drugs, smoking, physical and mental condition of the patient also affects ECG.

Conclusions

This study revealed an association between hypertension and ECG changes which was more pronounced in severe hypertension. ECG changes in hypertensive patients run parallel to the severity of hypertension and the changes were 100% in severe hypertension.

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