

# Electrocardiographic Changes in Hypertensive Crisis in a Tertiary Care Hospital

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## ABSTRACT

### BACKGROUND

Cardiovascular disorders are the leading causes of disability and death worldwide, and a great majority of Cardiovascular Disorders are associated with dyslipidemia. Worldwide, there is broad variation in serum lipid profile levels among different population groups. Increased serum levels of total cholesterol, triglycerides, low density lipoproteins and decreased high density lipoproteins are known to be major risk factors for cardiovascular disorders. The present study was conducted to assess the lipid levels among cases of accelerated hypertension presenting to a tertiary healthcare institute.

### METHODS

The present study was a cross sectional observational study done on 96 patients who presented with hypertensive emergencies. They were admitted under Department of Medicine, KIMS, Karad, from August 2018 to December 2018. On admission, detailed history was taken, and complete clinical examination was done. It was a hospital based cross sectional study.

### RESULTS

Serum levels of TC, TG, HDL and LDL in hypertensives were  $182\pm 3.4$ ,  $143.62\pm 6.3$ ,  $49.68$  and  $95.83\pm 7.8$  mg/dL, respectively.

### CONCLUSIONS

Our results suggest that elevated BP may predict certain disturbances in lipoprotein metabolism.

### KEYWORDS

Accelerated Hypertension, Hypertensive Crisis, Lipid Profile, Blood Pressure, Total Cholesterol, Triglycerides, HDL, LDL

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## BACKGROUND

Raised blood pressure and deranged lipid levels are the major risk factors for development of non communicable diseases like cardiovascular disease. Hypertensive disorders are responsible for nearly mortality of 80% and loss of DALY among SEAR countries, the prevalence is reported to be increased in developing countries.<sup>1,2</sup> In developing countries, with communicable disease, non-communicable diseases causes double burden of diseases. Previous researches have described the relationship between development of hypertension and deranged lipid levels. Its pathophysiology have already been studied.

### Epidemiology

The first large study<sup>3</sup> of the natural history of hypertensive emergencies was published in 1939. The results of this seminal article revealed that untreated hypertensive emergencies had a 1-year mortality rate of 79%, with a median survival of 10.5 months. Before the introduction of antihypertensive medications, approximately 7% of hypertensive patients had a hypertensive emergency<sup>4</sup>. Currently, with the improvement in the drugs available for the treatment of hypertension, it is estimated that 1 to 2% of patients with hypertension will have a hypertensive emergency at some time in their life.<sup>5,6</sup> Despite the development of increasingly effective antihypertensive treatments over the past 4 decades, the incidence of hypertensive emergencies has increased.<sup>7</sup> The vast majority of patients who present with a hypertensive emergency to an emergency department have been previously diagnosed with hypertension and have been prescribed antihypertensive agents.<sup>8,9</sup> However, in many of these patients BP control prior to presentation was inadequate. In some studies,<sup>10</sup> up to 50% of patients who presented to an emergency department with hypertensive emergency were not adherent with their regimen in the preceding week. Illicit drug use has been reported<sup>11</sup> to be a major risk factor for the development of hypertensive emergency.

### Aetiology

Ninety-five per cent of patients have essential hypertension with no underlying cause. The remaining 5% of patients have an underlying cause for their elevated blood pressures, of which certain groups have higher chances of presenting with a hypertensive crisis. Use of recreational drugs is a frequent cause of hypertensive crisis. Cocaine amphetamines, phencyclidine hydrochloride, and diet pills are sympathomimetic and thus may cause severe acute hypertension. Patients taking monoamine oxidase inhibitors along with tricyclic antidepressants, antihistamines, or food with tyramine are prone to hypertensive crises. Withdrawal syndromes from drugs such as clonidine or beta-blockers may also precipitate hypertensive crises.<sup>12</sup> Pheochromocytoma is a rare cause of hypertensive crises. Patients with spinal cord disorders, such as Guillain Barre' syndrome, are also at a higher risk for hypertensive crises. Rapid industrialization, increased access to improved health care is responsible for increased life expectancy. However sedentary lifestyle, consumption of unhealthy diet, and increased prevalence of addiction among people is observed among the developing countries and it reflected as a risk

factor for augmentation of the disease process.<sup>13</sup> It is well known that raised low density lipoproteins, very low density lipoproteins, cholesterol, and triglycerides is associated with adverse outcomes in cardiovascular disorders, however high density lipoproteins is associated with favourable outcomes.<sup>14</sup> Various studies have demonstrated and proved the causal relationship between lipid levels and development of hypertension and coronary artery disease.<sup>15</sup>

The Electrocardiogram is considered as one of the tools used in the diagnostic workup of hypertensive crisis to diagnose myocardial ischemia or infarction, typically T-wave inversion and in more severe cases, ST segment displacement. These changes mirror cardiac injury and indicate a hypertensive emergency situation and therefore necessitate prompt medical intervention.<sup>16</sup> Existing Previously conducted researches have concluded that the diastolic left ventricular dysfunction may be the earliest detectable pathology that may be seen before left ventricular hypertrophy voltage criteria which is usually seen in a standard 12-lead ECG (Electrocardiogram). Ventricular activation time can be used to predict the diastolic dysfunction and left ventricular stiffness, representing a new marker for early diagnosis of cardiovascular disorders.<sup>7-19</sup>

The present study was conducted to assess the electrocardiographic changes among cases of accelerated hypertension presenting to a tertiary healthcare institute.

## METHODS

The present study was a cross sectional observational study conducted among all the cases fulfilling inclusion criteria and willing to participate in the present study (Universal sampling). 96 patients presented with hypertensive emergencies admitted under department of medicine, KIMS, Karad, from August 2018 to December 2018. On admission, detailed history was taken and complete clinical examination was done. The study was conducted among subjects after taking their consents. The present study was done after getting approval from the institutional ethical committee.

### Inclusion Criteria

1. Systolic blood pressure of 180 mmHg and above or diastolic blood pressure of 120 mmHg and above.
2. Evidence of end organ damage, either clinically or laboratory findings.

### Exclusion Criteria

1. Patients less than 18 yrs. and above 40 yrs. of age
2. Patients with valvular heart disease, pregnancy induced hypertension.

### Diagnostic Criteria

The diagnosis of hypertensive emergency will be established by the following 1. Systolic blood pressure  $\geq 180$  mmHg or diastolic blood pressure  $\geq 120$  mmHg. 2. Acute target organ damage. We obtained written informed consent in all cases to participate in the study.

### Data Collection Procedure

All the study subjects who fulfilled the inclusion criteria were included in the present study. The consent was taken from

the patients or attendants who were included in the study, for performing the necessary investigations or procedures. A semi-structured, pre-validated, standard case record proforma was used in the current study to collect the data. Detailed history was taken, clinical examination was performed, and necessary investigations were carried out. Relevant investigations like complete blood counts, urine examination, serum electrolytes. The results were analysed to assess the aetiology, risk factors, and the pattern of clinical and radiological profile.

**Statistical Analysis**

Data was recorded in the form of tables and graphs. The data was analyzed using SPSS program version 21 software. The data was summarized and tabulated accordingly to analyze frequencies.

**RESULTS**

In the present study, we observed that majority of the cases presented with accelerated hypertension were males (56.25%), followed by 43.75% female cases. We observed that majority of the cases of accelerated hypertension belonged to 56-65 years of age group (29.16%), followed by 46-55 years (26.16%), and 66-75 years (16.66%). The mean age of the study subjects was 57.41±14.12 years. We assessed their hypertensive status and diabetic status, we observed that majority of the cases were known cases of hypertension (67.70%), and 12.5% cases were known cases of diabetes mellitus and 4.16% cases were known cases of ischaemic heart disease.

Blood Pressure	Mean	Standard Deviation
Mean SBP	183	24.7
Mean DBP	99.68	18.03

**Table 1. Distribution of Study Subjects According to their Blood Pressure**

Clinical Presentation	Number of Cases	Percentage
Headache	78	81.25%
Giddiness	36	37.5%
Chest pain	34	35.42%
Dyspnoea	19	19.79%
Limb weakness	15	15.62%
Oedema	10	10.41%
Pallor	11	11.45%

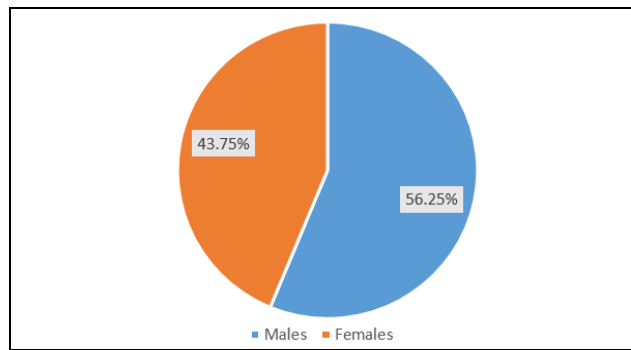
**Table 2. Distribution of Study Subjects According to their Clinical Presentation**

ECG Changes	Number of cases	Percentage
QT prolongation	22	22.91%
T wave inversion	18	18.75%
ST segment depression	15	15.62%
U waves	7	7.29%
Tachycardia	21	21.87%
Bradycardia	3	3.1%
Other arrhythmias	2	2.08%

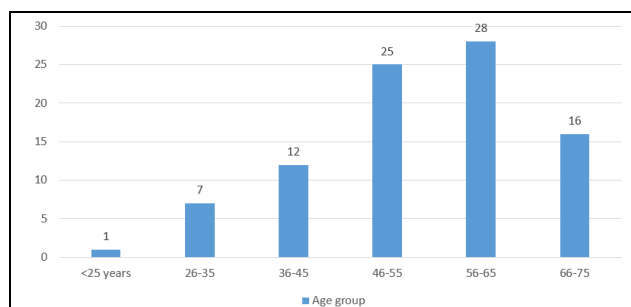
**Table 3. Distribution of Study Subjects According to their Electrocardiographic Changes**

In the present study, we observed that majority of the study subjects presented with headache as a presenting complaint (81.25%), followed by giddiness among 37.5% cases, 35.42% cases presented with chest pain, 19.79% cases presented with dyspnoea, weakness in limbs among 15.62% cases and oedema among 10.41% cases. We assessed the systolic and diastolic blood pressures of all the study subjects

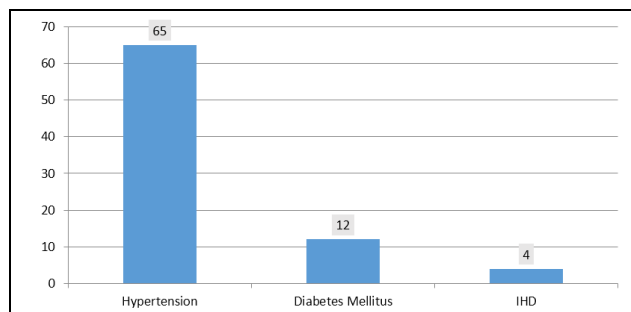
at presentation. We observed that the mean systolic blood pressure on admission was 183±24.7 mmHg, while mean diastolic blood pressure on admission was 99.68±18.03 mmHg. Serum levels of TC, TG, HDL and LDL were 182±3.4, 143.62±6.3, 49.68 and 95.83±7.8 mg/dL, respectively, in hypertensive subjects.



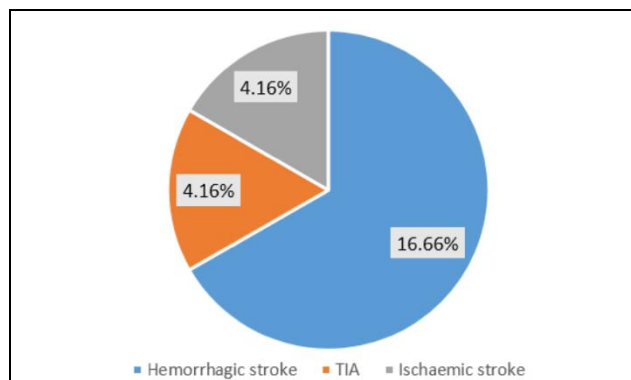
**Figure 1. Distribution of Study Subjects According to their Gender**



**Figure 2. Distribution of Study Subjects According to their Age Distribution**



**Figure 3. Past Medical History of Study Subjects**



**Figure 4. Distribution of Study Subjects According to their Brain Imaging Findings**

The most common ECG abnormality associated with stroke was prolonged QTc interval (22.91%) followed by T wave inversion (18.75%), ST segment changes (15.62%),

sinus tachycardia (21.87%), U-waves (7.29%), bradycardia (3.1%), and other arrhythmias (2.08%).

## DISCUSSION

In the present study, we observed that majority of the cases presented with accelerated hypertension were males (56.25%), followed by 43.75% female cases. The current cross-sectional analytical study was conducted at tertiary health care centre to assess cases presenting to outpatient department and emergency department with hypertensive emergencies. Majority of the study subjects reported in the present study were males (66%) as compared to proportion of female cases. Martin et al in their study among cases presented with hypertensive crises, reported that 55% of total patients were males, while Zampaglione et al.<sup>20</sup> in their study also reported similar kind of finding, they reported that majority of the study subjects were males. In the current study, we observed that majority of the cases of accelerated hypertension belonged to 56-65 years of age group (29.16%), followed by 46-55 years (26.16%), and 66-75 years (16.66%). The mean age of the study subjects was 57.41±14.12 years.

We assessed their hypertensive status and diabetic status, we observed that majority of the cases were known cases of hypertension (67.70%), and 12.5% cases were known cases of diabetes mellitus and 4.16% cases were known cases of ischaemic heart disease. Garcia GM in their study observed that 65.9% subjects were known cases of hypertension. While Zampaglione et al.<sup>21</sup> observed 92% of previously diagnosed hypertensive cases. Martin et al.<sup>20</sup> in their study observed the prevalence of diabetes mellitus among their cases as 26%. Martin et al.<sup>20</sup> in their study studied the clinical presentation of the study subjects. They reported that the commonest presenting symptoms were neurological deficits (48%), dyspnoea (25%) and chest pain (18%) as the most common clinical presentation. While Zampaglione et al.<sup>21</sup> observed chest pain among 27% cases, followed by dyspnoea among 22% cases and neurological deficits was observed among 21%. Neurological deficits in their study varied from

hemiparesis among 75% of the cases with neurological deficits, convulsion among 16.6% cases, and visual deficits among 8.3% cases. Hemiparesis accounted for the largest group of patients with neurological deficit

We assessed the systolic and diastolic blood pressures of all the study subjects at presentation. We observed that the mean systolic blood pressure on admission was 183±24.7 mmHg, while mean diastolic blood pressure on admission was 99.68±18.03 mmHg. Martin et al.<sup>23</sup> In their study reports a mean systolic blood pressure of 193± 26 mmHg in their patients and a mean diastolic blood pressure of 129±12 mmHg. The most common ECG abnormality associated with stroke was prolonged QTc interval (22.91%) followed by T wave inversion (18.75%), ST segment changes (15.62%), sinus tachycardia (21.87%), U-waves (7.29%), bradycardia (3.1%), and other arrhythmias (2.08%). In the study conducted by Srikanth Tandur et al,<sup>21</sup> observed QTc prolongation in their study as the most common finding (31.08%, i.e., 23 of 74 cases) which was followed by T wave

inversion (24.32% i.e., 18 cases), and ST segment changes were observed among (20.27%, i.e., 15 cases).

## CONCLUSIONS

From the present study, we observed that, cases presenting with cerebrovascular disorders (CVA) often have abnormal electrocardiography pattern with or without presence of any obvious known organic heart disease or electrolyte imbalance. The most common ECG changes observed in the current study were prolonged QTc interval, T wave inversion, ST segment depression and tachycardia.

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