



**ORIGINAL RESEARCH PAPER**

**General Medicine**

**STUDY OF CLINICAL PROFILE ELECTROCARDIOGRAPHIC AND ECHOCARDIOGRAPHIC CHANGES IN PATIENTS WITH CEREBROVASCULAR ACCIDENTS'**

**KEY WORDS:** CVA, 2D ECHO, ECG, DM, HHD, Hypertension

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**ABSTRACT**

Cerebrovascular accident [CVA] or stroke is most common and devastating disorder. It is the second leading cause of death and third leading cause of disability. The study was a prospective study. Fifty patients with CVA admitted to a tertiary care center were enrolled in the study to examine the correlation between clinical profile, electrocardiographic and echocardiographic changes in patients with cerebrovascular accidents.

**INTRODUCTION**

Cerebrovascular accident [CVA] or stroke is most common and devastating disorder.<sup>1</sup> It is the second leading cause of death and third leading cause of disability.<sup>2</sup> The incidence of ischaemic stroke is much higher than hemorrhagic stroke. In India, studies reveal that ischemic stroke occurs in 68-80% and hemorrhagic stroke in 20-32%. Among ischaemic stroke the occurrence of subtypes of strokes is as follows - large vessel (41%), lacunar (18%), cardioembolic (10%), other determined (10%), and undetermined (20%).<sup>3</sup> Stroke not only has an effect of physical health but also has a major effect on economic, social and mental health as well. Hence, there is the necessity of more studies to be conducted in this field. Many studies have shown CVA associated with ECG and 2D ECHO changes. Changes occurring in ECG following stroke were QT prolongation, ischemic changes, U waves, tachycardia, and arrhythmias.<sup>4</sup> Patients with cerebral embolus had an increased frequency of atrial fibrillation. And patients with subarachnoid hemorrhage had an incidence QT prolongation and sinus arrhythmia.<sup>5,6</sup>

The current study was conducted to assess the various clinical parameters influencing the occurrence of cerebrovascular accidents. The clinical correlates of ECG patterns and echocardiographic patterns in cases of cerebrovascular accidents were studied. The prognostic significance of the changes in ECG and Echocardiography + study cerebrovascular accident (CVA) were also evaluated

**AIMS AND OBJECTIVES**

To study the correlation between clinical profile, electrocardiographic and echocardiographic changes in patients with cerebrovascular accidents.

**METHODOLOGY**

The study was a prospective study. Fifty patients with CVA admitted to a tertiary care center were enrolled in the study. The patients were followed-up was over a period of 22 months.

The patients enrolled in the study underwent detailed neurological examination including fundoscopy and cardiovascular examination including a 12 lead ECG and 2D echocardiography (Ultramark 6 2D echo with color Doppler) within 24 hours of admission. (Table 1) Serum biochemistry included complete blood count, erythrocyte sedimentation rate, renal function test, serum electrolytes, and lipid profile. The diagnosis of CVA was made on the basis of the following

criteria: temporal profile of clinical syndrome, clinical examination, CT scan of the brain. The in-hospital prognosis was considered under two categories namely: Alive or Dead. The outcomes were analyzed and correlated with age, sex and risk factors, and clinical examination findings abnormalities.

**Inclusion criteria:** The study included patients of CVA with symptoms lasting for more than 24 hours who were admitted within 72 hours after the onset of stroke. CVA patients without known underlying cardiac diseases, which produce ECG and echocardiographic changes were also enrolled in the study.

**Exclusion criteria:** Patients admitted beyond 72 hours after the onset of stroke, patients with traumatic injuries with neurological deficits, patients with infections or neoplasms causing CVAs, patients with vasculitis, hypercoagulable diseases, and cortical venous thrombosis, eclampsia, patients with established cardiovascular diseases and patients with neurological dysfunctions secondary to metabolic encephalopathy were excluded from the study. ECG and 2D ECHO Criteria

**ECG Criteria**

- Heart rate less than 60/ min was regarded as bradycardia and heart rate exceeding 100/ min was regarded as tachycardia.
- ST segment depression of 0.5 mm or elevation of more than 1 mm were taken abnormal.
- T-wave was considered abnormal when inversion of T-waves in which it should have been upright i.e., I, II, V3-V6 may be variable in III, aVL, V1 and V2.
- QTc prolongation: The QT interval is measured from the beginning of the QRS complex to the end of T-wave, the rate corrected QTc is obtained by dividing the actual QT by the square root of the RR-interval (both measured in seconds). QTc is taken as prolonged if it more than 0.44 m-seconds.
- U-wave was taken as significant when exaggeration of U-wave voltage was noted when appeared in more than 2-leads when appeared in leads in which it was not normally seen (other than V3-V4).
- RVH: R-waves in right chest leads and the R-wave may be taller than the S wave in lead V1, persistent S-wave seen in V5-V6
- LVH: If the sum of the depth of the S-wave in lead V1 and the height of the R wave in either lead V5 or V6 exceeds 35 mm, an R-wave of 11 to 13 mm or more in lead aVL is another criteria for LVH

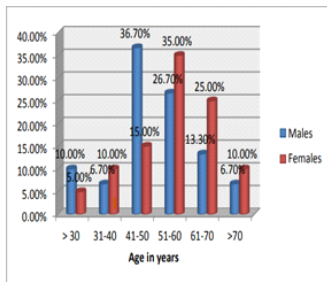
**2D Echo Criteria**

- LV ejection fraction was used to assess LV systolic function. Doppler indices (A>E across mitral valve) were used look for LV diastolic dysfunction.
- Mitral valve opening using planimetry was used to look for mitral stenosis apart from this valve thickening and doming of AML and paradoxical motion of PML were used.
- Flow across aortic valve was used to look for aortic stenosis including opening (severe AS if AVO < 8 mm).
- Color imaging and doppler were utilized for any regurgitation.
- 2-dimensional imaging was used to rule out left atrial thrombus.

**OBSERVATIONS**

A male preponderance in the incidence of stroke was observed in the study. The incidence of stroke was higher in 4th, 5<sup>th</sup>, and 6th decades .with a peak prevalence in the age range of 41 to 60 years.( Figure 1) . In patients with haemorrhagic stroke 8,% were males and 4% were females (p= 0.544)

**Figure 1 : Prevalence of stroke across different age groups**



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**Figure 1 : Prevalence of stroke across different age groups**

	Infarct	Hemorrhage
ECG changes		
T wave inversion	28%	2%
Tall T waves	2%	0%
ST depression	6%	0%
QT prolongation	40.9%	50% (p=0.686)
U wave	10%	2% (p=0.556)
Abnormal ECHO	26.0%	2% (P=0.663)
Abnormalities in Doppler		

**Table 3: CV Abnormalities in patients**

Abnormality	Infarct	Hemorrhage
Hypertensive heart disease	40.0%	8%
LV Dysfunction	32.0%	4%
Incidence of RWMA	16.0%	0%
Aortic stenosis	2%	0%
Aortic regurgitation	0%	2%

**Discussion**

The present study analyzed the clinical profile, electrocardiographic and echocardiographic changes in patients with cerebrovascular accidents. The majority of the patients in the study were between 51-60 years of age (30%) followed by 41-50years of age (28%). The study by Jeyaraj Durai Pandian et al,46 mean age of patients with stroke was 50 - 67 years corroborates the findings of this study.

In this study, the incidence of stroke was more common among males. Reeves MJ, et al,48 demonstrated age specific stroke rates are higher in men because of their longer life expectancy and much higher incidence at older ages. But, stroke has a greater impact on women than men because women have more events and are less likely to recover. The Stroke in India fact sheet also corroborated the male predominance of stroke and the male/female sex ratio for India is 7:1. Fiona C Taylor et al,49 This may be due to a higher prevalence of risk factors among men in India as compared with women (Das Banerjee 2008).

In the current study ,diabetes mellitus was the most common risk factor and was present in 76% of the cases, followed by alcohol in 58%patients , Hypertension was observed in 30% of patients, smoking in 48% patients. and many patients had a combination of risk factors. In the retrospective study by Blas Gil-Extremera et al,51 ( n=433 ) in patients with cerebrovascular disease, hypertension was the most common risk factor for CVA. In another recent cross-sectional investigation carried out in 243 patients admitted with ischemic stroke, the most common modifiable risk factors were hypertension (72.1%), followed by diabetes (51.7%), and dyslipidemia(28.5%), arrhythmia 22.1% tobacco use 20,3%, alcohol consumption 8.1%,obesity 5.8%.

In the present study, the incidence of ischemic stroke was 88% (n=44 patients) which was higher than the incidence of hemorrhage 12% (n= patients).The incidence of ischemic stroke was more common than hemorrhage in the study population. The global burden of cerebrovascular disease by Thomas Truelsen,et al also observed in Caucasian populations , that 80% of all strokes are ischemic, 10%- 15% intracerebral hemorrhage (ICH), al 5 % subarachnoid hemorrhage (SAH), and the rest is due to other causes of stroke. 50According to stroke in India factsheet49 , ischemic stroke , account for 50%-85% of all strokes worldwide and hemorrhagic stroke accounts for7%-27% corroborating the current findings.

In the current study, ECG changes i.e. T wave inversion was seen in 15 patients (30%). There was no association observed for ST depression (p= 0.676) , QT prolongation (p= 0.686 w), U wave (p=0.556 and stroke. Experimental animal studies as well as clinical data indicate a gradient of neurogenic stress cardiomyopathy (NSC), where ECG abnormalities are found in 40-100% of cerebral hemorrhage patients and 5% of those patients have serious cardiac arrhythmia. stroke patients. Bujt , Chen et al,53 The study conducted by FeiWu et al,54 demonstrated that T-wave changes (p = 0.030) were significantly associated with worse functional outcomes. He concluded that T-wave changes could be useful markers to predict the outcome in stroke patients According to Stroke in India factsheet49 study both QTD and QTcD on the first hospitalization day were significantly higher in the stroke

group than in the control group. In the current study, no association was observed between 2D ECHO abnormality and stroke ( $p=0.663$ ). No significant association was found between HHD, LV dysfunction, RWMA, mitral valve abnormality and aortic valve abnormality and stroke. According to study by Zhili Chen et al,<sup>53</sup> the ischemic stroke can cause cardiac dysfunction even in the absence of risk factors and preexisting heart disease. He concluded that stroke induced heart problems occur in up to 70% of patients, with clinical manifestations such as ECG changes, reduced LVEF, ventricular wall motion abnormalities, and increases in serum cardiac enzyme. In the current study, none of the ECG changes observed correlated with stroke. Hong-Jie Yang et al,<sup>57</sup> observed in 625 patients with Ischemic stroke, the prevalence of upright T in aVR was 32.2% and was independently associated with all-cause death [hazard ratio (HR): 2.88, 95% confidence intervals (CI): 1.07e7.73], cardiovascular death (HR: 3.04, 95% CI:1.07e8.64), and IS recurrence (HR: 1.86, 95% CI: 1.08e3.20). Upright T in aVR in patients with Ischemic stroke was associated with increased mortality and recurrence of ischemic stroke. The mortality in stroke patients and its relation to the presence or absence of U wave changes in ECG was not significant. Current studies indicate that QT prolongation is observed in about 25% of the stroke patients. Villa et al<sup>[.16]</sup> have demonstrated the effect of QT prolongation on early mortality in acute ischemic stroke. Familoni et al<sup>[.18]</sup> have also shown the association between the QT prolongation and mortality. On the other hand, although the current study was not designed to determine mortality, no association between the cQT interval and mortality was observed.

In the current study, among 7 patients who died, 6 (33.33%) of them had LV dysfunction in 2D ECHO and the remaining 1 patient (3.13%) had no LV dysfunction. ( $p < 0.05$ ). significant. The study conducted by Gujarat et al,<sup>52</sup> that in spontaneous and traumatic brain hemorrhage patients, 7.2% patients had acute cardiac dysfunction and 43% had LV hypertrophy.

### CONCLUSIONS

QTc prolongation, T wave inversion and the presence of U waves are the common ECG abnormalities in ischemic strokes. QTc prolongation is the common ECG abnormality in hemorrhagic stroke. Hypertensive heart disease and LV dysfunction are the most common 2D echocardiographic abnormality in stroke patients. QTc prolongation in ECG and LV dysfunction in stroke patients has prognostic significance in predicting mortality in cerebrovascular patients.

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