



Original Research Article

Electrocardiographic changes in acute cerebrovascular accidents-a tertiary centre experience in South India

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ABSTRACT

Introduction: Cerebrovascular accident plays an important role in the morbidity and mortality of adults posing serious medical, socio-economic and rehabilitation problems. Electrocardiographic abnormalities have been known to occur in the context of neurological disease. The current study is an observational study aimed at elucidating the relation between cerebrovascular accident and ECG.

Objectives: To determine the frequency of ECG changes in cerebrovascular accident and to determine the variations in ECG manifestations and mortality in different types of stroke.

Materials and Methods: 100 patients of acute stroke were considered. ECG was recorded in these patients within 24 hours of admission. Follow up of admitted patients was done to know the prognosis.

Results: ECG abnormalities noted among cerebral ischemic patients were presence of T Wave inversion (34.48%) and ST segment depression (32.76%) followed by QTc Prolongation (29.31%) and presence of U waves (27.59%). In cases of haemorrhagic Stroke, T wave inversion (33.33%) and arrhythmias (33.33%) were followed by U waves (30.95%) and ST segment depression (23.81%). Mortality was higher in patients with ST-T changes in ischemic group (66.66%) and in patients with positive U waves (60%) in haemorrhagic group. Studying ECG changes will provide insight in prognosis and management of stroke patients and may alter their management in coming future.

Conclusion: ECG changes occurred very commonly in acute stroke. The changes are thought to be independent of the nature of stroke. It was noted that ST and T inversion being common in ischemic while T inversions and arrhythmias common in haemorrhagic CVA. It was also noted that the mortality was higher in patients with abnormal ECG following an acute Cerebrovascular event.

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1. Introduction

Worldwide, stroke is the third most common cause of death after coronary heart disease and all cancer deaths.¹ It is the single most important cause of disability in the western world.² According to WHO, stroke is defined as “rapidly developing clinical signs of focal or global disturbance of cerebral function, with symptoms lasting 24 hours or longer or leading to death, with no apparent cause other than of vascular origin”. This definition includes subarachnoid haemorrhage (SAH) but excludes transient

ischemic attacks, subdural haematoma and haemorrhage or infarction caused by infection or tumor.³ It is also called apoplexy or cerebrovascular accident (CVA), but however stroke is the currently preferred term. CVA accounts for 10-12 % of all deaths in the western society. Incidence rates of CVA rise exponentially with advancing age. Every year, more than half a million people in the world suffer from acute cerebrovascular events, including ischemic stroke, intracerebral and subarachnoid haemorrhage, giving a mortality of nearly 20%.⁴ Acute strokes, especially subarachnoid haemorrhage is frequently accompanied by a variety of electrocardiographic (ECG) abnormalities,⁵⁻¹⁰ some of which may be indistinguishable from those seen

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in association with an episode of Ischemic heart disease or myo-pericarditis. In addition, patients often have associated co morbidities of Diabetes, Systemic hypertension, Dyslipidemia or coronary atherosclerosis, leading to some ECG changes. In addition, many primary cardiac disorders, like cardiac neoplasms, valvular lesions, septal and chamber or conducting system abnormalities have a directly or indirectly linked to associated ECG abnormalities and risk of CVA. Then, healthcare professionals presented with this clinical/electrocardiographic picture are confronted with special challenges, and it is crucial to distinguish stroke-induced ECG changes from ECG changes due to concomitant ischemic heart disease.

There is a very considerable variations in how ECG changes in stroke patients are presented in the literature.^{5–10} This electrocardiographic spectrum seems to be related to the type of CVA and its localization. The autonomic and cardiovascular effects of stroke; however, are modulated by concomitant factors such as pre-existent cardiac diseases, electrolyte disorder and other related factors. Although many subsequent reports have described ECG abnormalities and rhythm disturbances in stroke, especially subarachnoid haemorrhage, few have included an adequate number of patients to statistically assess the relative frequencies of these abnormalities among the pathophysiologic categories of stroke. Furthermore, few previous studies have evaluated ECG changes and rhythm disturbances in ischemic stroke patients without primary heart disease to distinguish abnormalities specifically associated with acute stroke. The study was done as an observational study aimed to elude the relation between CVA and ECG changes and attempt to throw some light on a still perplexing issue.

2. Materials and Methods

2.1. Study design and setting

The study was conducted in the neurology unit of a tertiary care facility in south India in patients with history and clinical features suggestive of cerebrovascular accidents. The study period was from January 2012 to January 2015 during which we were able to include a patient population of 100. Patient or patient's attendant consent was taken and ethical clearance was obtained from Institute's Ethical Committee. The Subject selected were of and above 45 years of age with CT documented cases of cerebrovascular accidents admitted within 24 hours. Those excluded were subjects in whom admission to the hospital was delayed for more than 24 hours after the appearance of acute stroke, Stroke due to trauma, due to dissecting aortic aneurysm and with previous documented cardiac diseases. For all the patients who fulfilled the criteria a detailed history regarding the clinical profile of stroke including risk factors like hypertension, diabetes mellitus, Dyslipidemia, history of cardiac diseases and smoking was

taken. Detailed neurological examination was done. The following investigations were done including a Complete blood count, fasting blood sugar levels, fasting lipid profile, Serum Electrolytes, CT scan of brain: It was done within 24 hours of admission. In all a 12 lead ECG recording was done within 24 hours of admission as per standard settings and a rhythm strip of lead II was taken in all. Standardisations were followed as per protocol. The data thus obtained from the study was statistically analyzed. The statistical operations were done through SPSS for Windows, version 17. Significance was taken at 5% level. Electrocardiographic abnormalities have been known to occur in the context of neurological disease. The current study is an observational study aimed at elucidating the relation between cerebrovascular accident and ECG.

The incidence of stroke is higher in India in multiple studies done possibly attributed due to increased prevalence of risk factors like hypertension and diabetes mellitus. The male: female ratio was 2.4:1 which is comparable to other studies done by Anand et al¹⁰ (1.7:1) and Nagaraja et al¹¹ (2:1). The lower incidence of stroke in women may be attributed to genetic factors, positive effects of estrogen on the cerebral circulation or to lower blood pressure values compared to men. Moreover ischemic heart disease, peripheral artery disease and cigarette smoking are more prevalent among men. The mean age in the study group was 62.5 ± 11 years. It is comparable to other studies done by Truelsen et al¹² (64.2 years), Sridharan et al¹³ (67 years) and Kim et al¹⁴ (65.2 years). Incidence of stroke was highest in the age group of 45-54 years accounting for 33% out of 100 patients followed by 55-64 years (27%). Indians develop stroke at a younger age compared to western population due to high prevalence of risk factors for stroke like hypertension, diabetes mellitus, hyperlipidemia. In the present study, hypertension was present in majority of the cases i.e., 78%. Next commonest risk factors were smoking (31%) and diabetes mellitus (30%), which are comparable with that found in Pandiyan et al¹⁵ being, 23.6% and 49.8%. Hyperlipidemia followed which was present in 15% of the cases. Prospective studies in Framingham have shown that hypertension is the most common risk factor for stroke. The risk increases with elevated systolic and diastolic values, the relationship being almost linear and independent of age and sex. Control of hypertension with anti-hypertensive drugs reduces the risk of stroke. In this study, 58% of the patients had ischemic stroke, which is comparable with that found in the studies. The most common cause for ischemic stroke is atherosclerosis of the arteries, large and small that supply the brain. 42% had haemorrhagic stroke in the present study that is comparable with 37.9% and 44% in the Kuruvilla et al.¹⁶ A vast majority of stroke patients demonstrated ECG changes in the current study (78%). Increased QTc in our study was seen in 25% of cases. This is similar to observation in a large scale study done

by Goldstein⁸ where it was seen in 32% of cases. T-wave inversion was seen in 15% by Goldstein et al where as in this study it is 34%. ST-segment depression was seen in 13% in Goldstein while in the present study it is 29%. U-wave was seen in 28% in Goldstein et al, while in our study it is seen in 29%. Tachycardia was seen in 2% in Goldstein et al while in this study it is 26%. Bradycardia was seen in 8% in Goldstein et al, while in the present study it is 10%. Various other studies showed highly variable values and this may be due to the fact that ECG changes occurring in stroke are highly variable over time and cannot be standardized unless continuous ECG monitoring is done. Ischemic-like and repolarisation ECG changes that occur in patients with acute stroke have been thought to be due to neural myocardial stunning, changes in autonomic nervous system and catecholamine-mediated injuries. Some have attributed these to lesions in the insular cortex, which can lead to cardiac abnormalities such as ischemic-like changes, arrhythmias and even myocytolysis. This sometimes makes it difficult to make a diagnosis of heart disease in the presence of acute stroke.

3. Conclusion

Cerebrovascular accident is a major cause of morbidity and mortality. The ECG changes occur independent of the nature of stroke. The major ECG abnormalities were ST-T changes, QTc prolongation and positive U waves. The incidence of mortality is higher in stroke patients with ECG abnormalities hence early attempt to prognosticate high risk and low risk patients based on ECG changes. This may reduce the morbidity and mortality in patients of. ECG abnormalities should be identified and specific pathology like Ischemia and Haemorrhage should be treated. 24 hours Holter monitoring is advisable to be all patients admitted with stroke to look for any ECG abnormalities.

4. Conflicts of Interest

All contributing authors declare no conflicts of interest.

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None.

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