

Original Research Article

Study of electrocardiographic changes in patients with acute cerebrovascular accidents

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ABSTRACT

Background: Stroke is “a focal (or at times global) neurological impairment of sudden onset, and lasting more than 24 hours (or leading to death), and of presumed vascular origin. A variety of cardiovascular events like cardiac arrest, arrhythmias, and severe hypotension can be seen in stroke victims. The purpose of this study is to investigate the prevalence and characterization of ECG abnormalities in patients of cerebrovascular accidents.

Methods: Study was carried out in Dr. PDMMC and tertiary care hospital Amravati, Maharashtra, India. All acute cerebrovascular accidents patients were the study subjects. The diagnosis of ischemic stroke was confirmed by CT scanning. Pre-validated questionnaire was used for data collection. At the end of the study all the ECG were compared to approach towards the result. Study was carried out over a period of three months from October to December 2020.

Results: We have recruited 90 stroke patients, most of them were males. Major type was ischemic stroke. In total 62 (68.89%) stroke patients had some form of ECG change. Majority i.e. 35 (38.89%) patients had QTc prolongation followed by 32 (35.56%) patients had T wave changes. QTc prolongation and Atrial fibrillation were significantly more among hemorrhagic stroke patients ($p < 0.05$) and T wave changes and ST changes (elevation or depression) were significantly more among ischemic stroke patients ($p < 0.05$).

Conclusions: Prevalence of ECG abnormalities among stroke patients was more i.e. 68.89%. QTc prolongation and T wave changes were the commonest ECG abnormalities.

Keywords:

INTRODUCTION

Hippocrates described the apoplexy in 400 B.C. It is impossible to cure a severe attack of apoplexy, and difficult to cure a mild one - Hippocratic Aphorism. According to W.H.O stroke is “A focal (or at times global) neurological impairment of sudden onset, and lasting more than 24 hours (or leading to death), and of presumed vascular origin”.¹ Globally around 15 million people will have stroke each year and responsible for around 9% of deaths.²⁷ From economic point of view stroke costs around US \$13 000 in the first 30 days of an acute illness.²

Cerebrovascular accidents (CVA) can be classified into two major categories; ischemic and hemorrhagic.³ There are many studies around the world who have pointed out that cerebrovascular accidents has posed as a major factor in cardiovascular morbidity and mortality.^{4,5,6} A variety of cardiovascular events like cardiac arrest, arrhythmias, and severe hypotension can be seen in stroke victims.⁷ Cardiac arrhythmias and electrocardiographic abnormalities are frequently observed after acute cerebrovascular events. The precise mechanism that leads to the development of these arrhythmias is still uncertain, though increasing evidence suggests that it is mainly due to autonomic nervous system dysregulation.⁸ Approximately 2 to 6% of

all stroke patients die from cardiac causes in the first 3 months after ischemic stroke.⁹

The purpose of this study is to investigate the prevalence and characterization of ECG abnormalities in patients of cerebrovascular accidents who had no history of heart disease.

Aim

To study the electrocardiographic changes in patients with acute cerebrovascular accidents.

Objective

To investigate the prevalence and characterization of ECG abnormalities in a patient of cerebrovascular accidents.

METHODS

The protocol of this cross-sectional study was approved by the Institutional Ethical Committee of the medical college. Written informed consent was taken from all study subjects before collection of data, and they were informed about complete right to withdraw from the study at any time without disadvantage. In case any participant who was not literate verbal consent was obtained after reading out the consent form to him and his verbal agreement was recorded by the interviewer in front of a witness.

Study was carried out in Dr. PDMMC and tertiary care hospital Amravati, Maharashtra, India. All acute cerebrovascular accidents patients were the study subjects and all patients fulfilling inclusion and exclusion criteria admitted in general medicine ward of Dr. PDMMC and tertiary care hospital were taken up for the study until fulfilling the required sample size. Study was carried out over a period of three months from October to December 2020.

Inclusion criteria

Patients >18 years of age. Patients with acute cerebrovascular accidents.

Exclusion criteria

Patients with previous cardiovascular pathology (Hypertension, CAD, IHD, RHD with valvular heart disease). Patients with dyselectrolytemia.

Sampling method

Simple random sampling method was used.

Sample size

Sample size was calculated using OPENEPI software version 3.

Considering prevalence of outcome in term of ECG changes in acute cerebrovascular accident patients 63% in the study carried out by Braga et al,¹⁰ confidence interval 95% and sampling error of 5% with absolute precision of 10% and using the formula

$$n = [DEF \times Np(1 - p)] \div [d^2 \div Z^2 1 - \alpha \div 2 \times (N - 1) + p \times (1 - p)]$$

Sample size came out to be 90.

Operational definition

Cerebrovascular accidents (CVA) can be classified into two major categories; ischemic and hemorrhagic.

Ischaemic strokes are caused by interruption of the blood supply to the brain, while hemorrhagic strokes result from the rupture of a blood vessel or an abnormal vascular structure.

Bleeding can develop inside areas of ischemia, a condition known as "hemorrhagic transformation."

Method of assessment

Patients were assessed within the first 24 hours of admission to the hospital. The diagnosis of ischemic stroke was confirmed by computed tomography (CT) scanning. Prevalidated, pretested, semistructured questionnaire was used as data collection tool. Hematological examination was done to rule out dyselectrolytemia. ECG was taken of the same patients. At the end of the study all the ECG were compared to approach towards the result. The QT interval was measured manually. QTc was calculated. ST-T changes included ST segment (elevation and depression) and T-wave changes (example, inversion and flat). Malignant arrhythmia included ventricular tachycardia, ventricular fibrillation, or very severe sinus arrest and third degree atrioventricular block. Sinus bradycardia was defined as a heart rate that was lower than 60 beats/minute. Severe sinus arrest referred to pauses longer than 3 seconds. A detailed clinical history was taken from the patients or their accompanying relatives.

Data entered in Microsoft Excel and analyzed by using Statistical package for social sciences (SPSS) Software.

RESULTS

In the present study, majority of the patients i.e. 31 (31.44%) were from the age group of 65-74 years age group followed by 28 (31.11%) from 55-64 years of age group. Mean age of the stroke patients was 65.4±12.6 years with the range being 52-78 years. In this study, 65 (72.22%) patients were males and 25 (27.78%) patients were females. Major type of stroke was ischemic i.e. among 52 (57.78%) patients and 38(42.22%) patients were having hemorrhagic type. In this study, 27 (30%) patients were addicted to smoking and 24 (26.67%) to alcohol.

Amongst comorbidity, we have found that 22 (24.44%) were having hypertension, 12 (13.33%) were having diabetes and 6 (6.67%) were having DM with hypertension. (Table 1)

Table 1: Distribution of stroke patients according to baseline characteristics.

| Baseline characteristic | Subcategories | Frequency (no.) | % |
|-------------------------|----------------------|-----------------|-------|
| Age | 45-54 | 11 | 12.23 |
| | 55-64 | 28 | 31.11 |
| | 65-74 | 31 | 31.44 |
| | ≥75 | 20 | 22.22 |
| Sex | Male | 65 | 72.22 |
| | Female | 25 | 27.78 |
| Type of stroke | Ischemic | 52 | 57.78 |
| | Hemorrhagic | 38 | 42.22 |
| Smoking | Yes | 27 | 30.00 |
| | No | 63 | 70.00 |
| Alcohol addiction | Yes | 24 | 26.67 |
| | No | 66 | 73.33 |
| Comorbidity | DM | 12 | 13.33 |
| | Hypertension | 22 | 24.44 |
| | DM with hypertension | 06 | 06.67 |
| | None | 50 | 55.56 |

In the current study, most common complaint was weakness of right side of body among 52 patients, 47 patients complained of altered consciousness, 41 complained of headache and 22, aphasia. Other least

common complaints were slurred speech, blurring of vision, paraplegia, giddiness and coma. (Figure 1)

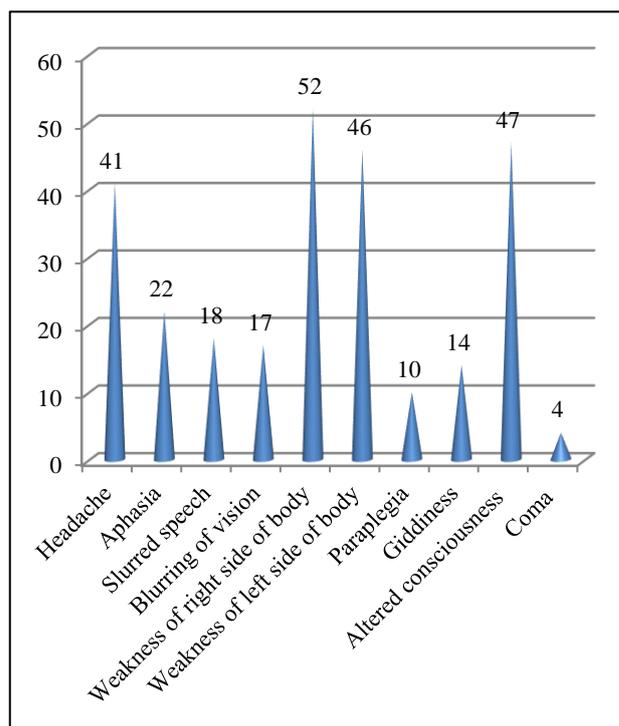


Figure 1: Presenting complaints in stroke patients.

In the current study, total 62 (68.89%) stroke patients had some form of ECG change. Majority i.e. 35 (38.89%) patients had QTc prolongation followed by 32 (35.56%) patients had T wave changes.

Table 2: ECG changes and type of stroke.

| ECG change | Ischemic stroke (n=57) | | Hemorrhagic stroke (n=33) | | Total | |
|--|------------------------|----------------|---------------------------|----------------|-----------------|----------------|
| | Frequency (no.) | Percentage (%) | Frequency (no.) | Percentage (%) | Frequency (no.) | Percentage (%) |
| QTc prolongation | 15 | 26.32 | 20* | 60.61 | 35 | 38.89 |
| Sinus bradycardia | 16# | 28.07 | 08 | 24.24 | 24 | 26.67 |
| ST changes (elevation or depression) | 19* | 33.33 | 04 | 12.12 | 23 | 25.56 |
| T wave changes (inversion and flat T wave) | 25* | 43.86 | 07 | 21.21 | 32 | 35.56 |
| Atrial fibrillation | 09 | 15.79 | 12* | 36.36 | 21 | 23.33 |
| Ventricular tachycardia | 07# | 12.28 | 04 | 12.12 | 11 | 12.22 |
| Ventricular fibrillation | 07# | 12.28 | 03 | 09.09 | 10 | 11.11 |
| AV block | 02# | 03.51 | 01 | 03.03 | 03 | 03.33 |

*p<0.05 i.e. statistically significant value, #p>0.05 i.e. statistically insignificant value

Other ECG changes among stroke patients were sinus bradycardia (26.67%), ST changes (elevation or

depression=25.56%), Atrial fibrillation (23.33%), Ventricular tachycardia (12.22%), Ventricular fibrillation

(11.11%) and AV block (3.33%). Out of these ECG abnormalities, QTc prolongation and Atrial fibrillation were significantly more among hemorrhagic stroke patients ($p < 0.05$) and T wave changes and ST changes (elevation or depression) were significantly more among ischemic stroke patients ($p < 0.05$). Other ECG abnormalities did not show significant difference between the two groups ($p > 0.05$). (Table 2)

DISCUSSION

In the present study, we have enrolled 90 stroke patients by simple random sampling admitted under general medicine department in I.C.U. or ward. Majority of the patients were from the age group of 65-74 years age group followed by 55-64 years of age group. Mean age of the stroke patients was 65.4 ± 12.6 years with the range being 52-78 years and most of the patients were males. This finding is in line with Asadi et al who found that mean age of the stroke patients was 69.5 ± 12.7 (24-100) years.¹¹ Major type of stroke was ischemic. In this study, 30% patients were addicted to smoking and 26.67% to alcohol. Also we have found that 24.44% were having hypertension, 13.33% were having diabetes and 6.67% were having DM with hypertension. Similar findings are reported by Wu et al who in their study found that most (65.93%) patients were male and mean age was 61.59 ± 13.33 years, with hypertension as a most common morbidity followed by diabetes mellitus and Braga et al who reported in their study that the most common type of stroke was ischemic, most common morbidity hypertension followed by diabetes mellitus.^{10,12}

In the current study, common complaints were weakness of right side of body, altered consciousness, headache and aphasia. Other least common complaints were slurred speech, blurring of vision, paraplegia, giddiness and coma. Similar finding is reported by Scheef et al and Amin et al.^{13,14}

In the current study, prevalence of ECG abnormalities among stroke patients was 68.89%. Asadi et al also found ECG abnormalities among higher number i.e. 82.7% of patients and Braga et al reported ECG abnormalities in 72.4% patients.^{10,11} Majority patients had QTc prolongation followed by T wave changes. Other ECG changes among stroke patients were sinus bradycardia, ST changes (elevation or depression), atrial fibrillation, ventricular tachycardia, ventricular fibrillation and AV block. Out of these ECG abnormalities, QTc prolongation and Atrial fibrillation were significantly more among hemorrhagic stroke patients ($p < 0.05$) and T wave changes and ST changes (elevation or depression) were significantly more among ischemic stroke patients ($p < 0.05$). Other ECG abnormalities did not show significant difference between the two groups ($p > 0.05$). Similar findings reported by Asadi et al who found that the most common ECG findings included normal sinus rhythm (27.3%), inverted T wave (21.2%), sinus tachycardia (11.7%), atrial fibrillation (11.5%), and

pathologic Q wave (9.9%); Wu et al who had reported in their study that stroke patients significantly suffered from QTc prolongation, ST-T changes, sinus bradycardia and ventricular premature beats. Similar abnormalities also observed by Braga et al.¹⁰⁻¹² Mechanism of these ECG abnormalities is poorly understood but it is thought to be due to lesion in corresponding area of brain leading to autonomic dysregulation.

Limitations

This was a hospital-based study, it would have been better if it is done in community setting so as to get the correct prevalence of ECG changes amongst stroke patients.

CONCLUSION

Males particularly those were from older age group i.e. 65-74 years suffered more commonly from cerebrovascular accidents (CVA) and its complications. Prevalence of ECG abnormalities among stroke patients was more i.e. 68.89%. QTc prolongation and T wave changes were the commonest ECG abnormalities among stroke patients. QTc prolongation and Atrial fibrillation were significantly more among hemorrhagic stroke patients ($p < 0.05$) and T wave changes and ST changes (elevation or depression) were significantly more among ischemic stroke patients ($p < 0.05$).

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