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Original research article: Electrocardiographic changes in patients with stroke

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Abstract
Background: Stroke, also known as cerebrovascular accident (CVA), is the 3rd most common cause of death worldwide, after ischemic heart disease and cancer.
Stroke is defined as damage to the brain due to interruption of its blood supply leading to focal neurological manifestations.
It has been observed that there are many electrocardiographic (ECG) changes develop in the patients after onset of stroke. These patients were not known to have cardiac illness previously.
The possible mechanism is disturbance in the autonomic regulation of the heart after the onset of stroke.
Objectives: The objectives of this study is to determine the frequency and character of the ECG changes in the patients presenting with stroke.
Materials and Methods: The study was conducted at Narayan Medical College and Hospital, from 15th May 2017 to 15th November 2017(06 months). 109 patients presenting with different types of stoke were taken for study after considering the exclusion and inclusion criteria. ECG was taken of all the patients. The diagnosis of stroke was confirmed by CT scan of head. Parameters used were clinical profile, ECG and CT head.
Result: The present study shows that cerebrovascular accident and ECG finding are independent variables except ST depression.
Conclusion: There was statistically significant (P value = 0.04) association between ST depression in ECG and Stoke. However, no association was established between other ECG changes and Stroke.

Keywords: ECG, stoke, CT scan

1. Introduction
Stroke, also known as cerebrovascular accident (CVA), is the 3rd most common cause of death worldwide, after ischemic heart disease and cancer. 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 more or leading to death, with no apparent cause other than of vascular origin".
For the first time in 1994, Byer et al, described the ECG changes in sufferers of subarachnoid haemorrhage.
There is no study of ECG changes and stroke in our centre, the present study is undertaken to determine the frequency, character and significance of ECG changes in patients with acute stoke.

2. AIMS & objectives
General
To correlate ECG changes in patients with stroke.

Specific
To describe the frequency and character of ECG changes in patients with stroke.
To describe the significance of ECG abnormalities in patients with stroke.

3. Materials and methods
Place of study: Narayan medical college and hospital, Jamuhar, Sasaram.

Duration of study: The study was done for a period of 6 months from 15 May 2017 to 15 Nov 2017 after clearance from the institutional ethical committee.

Nature of study: Cross- sectional, observational study.

Study Material: All patients presenting to outpatient department and emergency with acute stoke which was confirmed by CT scan of head.

Inclusion criteria: All patients presenting with acute stroke which was confirmed by CT scan of head.
The patients and attendants who were willing to participate in the study.

Exclusion criteria: Stoke more than 2 weeks' duration.
Stoke developing after trauma and road traffic accidents.
Patients with history of cardiac illness.

Study design: After considering the inclusion and exclusion criteria all patients with suspected stroke, determined by through clinical examination, was included in study. ECG was taken of all such patients. The diagnosis of stroke was confirmed by CT scan of head. Parameters used was clinical profile, ECG and CT scan of head.

Documentation: Data was illustrated using graphs, pictures and tables.

Statistical analysis-was done by percentage, Proportion and Chi-square.

4. Observation and results

A trial of 109 patients were included in the study that arrived at emergency and out patient's department of Narayan Medical College and Hospital with the symptoms of stroke, diagnosed on the basis of clinical symptoms and CT Scan findings, were included in the study. After confirmation of diagnosis of stroke, ECG was taken of all patients.

The result obtained in this study are as follows.

In this study normal ECG was observed in 44 patients and 56 patients had significant ECG changes. Among the abnormal ECG changes ST segment changes were the most common. ST segment depression accounted for 35 cases and ST segment elevation accounted for 12 cases.

In P wave changes (Table. 1), Atrial Flutter and non-specific changes were seen in 3 patients each. Prolonged PR interval (Table. 2) was the most common changes among PR changes accounting 4 patients. There were no significant changes seen in Q wave (Table.3), all 9 changes were non-specific. Out of 3 QRS complex changes (Table.4), 2cases have ectopic changes and 1 case had non-specific changes. 7 cases had QT interval changes (Table.5), where 4 cases showed prolonged QT interval and 3 cases had non-specific changes. ST segment changes was the most common (Table 6), where 3 cases had non-specific changes, 12 cases showed ST elevation and in 35 cases there was ST depression. 13 cases had T inversion, 5 cases had Tall T, 1 case had flat T and 8 cases showed non-specific T wave changes (Table.7).

Table 1: Distribution of Patient by P wave

P Wave	Frequency
Bifid	1
Tall	1
Atrial Flutter	2
Non-Specific	3

Table 2: Distribution of Patient by PR interval

PR interval	Frequency
Prolonged	4
Short	2
Non-Specific	1

Table 3: Distribution of Patient by Q Wave

Q Wave	Frequency
Pathological	0
Non-Specific	7

Table 4: Distribution of Patient by QRS Complex

QRS Complex	Frequency
Wide	0
Narrow	0
Ectopic	2
Non-Specific	0

Table 5: Distribution of Patient by QT interval

QT interval	Frequency
Prolonged	4
Short	0
Non-Specific	3

Table 6: Distribution of Patient by ST Segment

ST Segment	Frequency
Elevation	12
Depression	35
Non-Specific	3

Table 7: Distribution of Patient by T Wave changes

T wave	Frequency
Inversion	13
Tall	5
Flat	1
Non-specific	8

Among the ECG changes, most of the changes were seen in ST segment where 47cases showed abnormal changes and 3 showed non-specific changes, followed by T wave changes where abnormal change was seen in 19 cases and non-specific change seen in 8 cases. Out of 7, ECG changes in Q wave, we did not observe any abnormal change, all were non-specific change. (Table 8)

Table 8: Distribution of Patient by T Wave changes

ECG Changes	Abnormal	%	Non-specific	%
P Wave	5	4.58	3	2.75
PR interval	6	5.5	1	0.91
Q Wave	0	0	7	6.42
QRS Complex	2	1.83	1	0.91
QT interval	4	3.66	3	2.75
ST segment	47	43.11	3	2.75
T Wave	19	17.43	8	7.33

5. Discussion

A significant number of stroke patients demonstrate ECG changes in the current study (76%). This finding is similar to previous studies of Goldstein et al and Bozluoclay *et al.* where ECG changes were demonstrated by 92% and 62% of the patients respectively.

ST segment depression is the most common ECG finding, seen in 32% of patients in the present study, which is inconcordance with study of Familoni et al where it was seen in 30% of patients.

T wave inversion was seen in 15% patients by Goldstein which is similar to the present study where it in seen in 16% patients.

Statistically significant association was seen between ST changes, especially ST depression, in patients with stroke.

6. Conclusion

In the present study carried out at Narayan Medical College and Hospital, we observed that cerebrovascular accident/ stroke (Confirmed by CT Scan of Head) and ECG findings are independent variables except ST depression which is statically significant (P value= 0.04).

There were ECG changes seen in the most of the patients with stroke that is accounted for 76% of cases. The most common ECG finding was ST depression.

Further studies to clarify the association and its significance between the ECG changes and stroke should be done for better understanding of the association between cerebrovascular accident and cardiac problems that will help for early and appropriate therapy.

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