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Original Research Article.

Study of ECG Changes in Acute Cerebrovascular Accidents at a Tertiary Care Teaching Hospital

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ABSTRACT

Background: Electrical stimulation experiments suggest a posteriorly located area of cardiovascular sympathetic control and anterior parasympathetic control region. ECG abnormalities occurred in 60-90% of patients with intra-parenchymal or subarachnoid bleed and in about 5-20% of patients with acute ischaemic stroke. The aim of this study to evaluated the incidence and pattern of ECG changes in patients with cerebrovascular accidents.

Material & Methods: The present observational, non-interventional, retrospective study done on 50 patients was conducted at Department of General Medicine, KPC Medical College & Hospital, Jadavpur, West Bengal (India). All patients with acute cerebrovascular accidents were studied. They were evaluated with X-ray, serum electrolyte, and sugar and blood urea. 12 lead ECG was taken and monitored on the day of admission. CT scan was taken within 24-48 hrs.

Results: In our study showed that the majority of cases (84%) were seen in 51-70 years of age groups. Out of 22, 12 (57%) of patients with hemorrhages, 9 (34%) of patients with infarct had changes and 1 (33.33%) patient with SAH had changes. ST segment changes were most commonly noted after cerebral hemorrhage. 31% of patients with infarction had ST depression. ST elevation was found in 33.33% of patients with ICH. T wave changes were present in 52.38% of patients with ICH. 27% of patient with infarct had T wave changes.

Conclusion: We concluded that understanding that these ECG changes which are occurring in patients with CVA is important because it may lead to erroneous judgment of assigning these patients as CAD. These patients should be evaluated for cardiac injury and treated only if necessary.

Keywords: ECG, Cerebral Hemorrhage, Cerebral Infarction, Subarachnoid Hemorrhage.

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INTRODUCTION

Cardiac abnormalities were described with various CNS diseases including seizures, trauma, ischemic stroke, ICH and less commonly tumors, electroconvulsive therapy and meningitis. More recently emotion and stress induced cardiomyopathy has been described.[1-3] Electrical stimulation experiments suggests a posteriorly located area of cardiovascular sympathetic control and anterior parasympathetic control region.[4]

Asehenbrenner and Bodeehte[5] is reported that intracranial lesions may be responsible for electrocardiograph changes, but the first report of ECG abnormalities in patients with cerebrovascular accidents was given by Byer, Ashman and Toth.[6] Burch, Myers, and Abildskov[7] stated a pattern of QT prolongation, abnormal T waves, and U waves which they considered unique of acute cerebrovascular stroke.

The physiological & anatomical pathways involved in brain-heart interaction have been explained in both animal and human studies. ‘‘Ability to propagate the arrhythmia by activation of the sympathetic nervous system represented a neurogenic mechanism’’.[8] The medulla oblongata has been described as the principal site of vagal sympathetic and parasympathetic region involved in cardiac control.[9] In addition both anatomical and physiological evidences implicate the hypothalamus in cardiac control.[4] The prevalence of all types of stroke was 12%, among 0.2% cerebrovascular stroke was occurred in younger age group in Indian population.[10] It is estimated that1.2% to 2.4% of mortality occurred in younger age to older age in the country.[11]

ECG abnormalities occurred in 60-90% of patients with intra-parenchymal or subarachnoid bleed and in about 5-20% of patients with acute ischaemic stroke.[12]

The underlying basis is disordered repolarization process.[13] The possible mechanism is through disruption in autonomic regulation and massive stimulation of the sympathetic nervous system.[14]

An observational study of stroke patients indicated an increased incidence of sudden death among patients with right insular

strokes. In view of the varied explanation for the ECG abnormalities in acute CVA, the present study was undertaken to review the pattern of ECG changes associated to pathophysiologic categories of acute stroke among patients without cardiovascular disease and to determine if specific ECG changes are related to the location of lesions.

MATERIALS & METHODS

The present observational, non-interventional, retrospective study done on 50 patients was conducted at Department of General Medicine, KPC Medical College & Hospital, Jadavpur, West Bengal (India). All patients with acute cerebrovascular accidents were studied. They were evaluated with X-ray, serum electrolyte, and sugar and blood urea. 12 lead ECG was taken and monitored on the day of admission. CT scan was taken within 24-48 hrs.

Inclusion Criteria

All patients with acute cerebrovascular accidents.

Exlusion Criteria

- Patients with underlying heart diseases.
- Patients on drugs.
- Previously diagnosed patients with electrolyte abnormalities.
- Patients with hepatic or renal diseases.

Table 1: Age wise distribution of cases

Age group (yrs)	Number	Percentage
40-50 yrs	6	12%
51-60 yrs	19	38%
61-70 yrs	23	46%
>70 yrs	2	4%
Total	50	100%

Table 2: Incidence Of Abnormal ECG's In The Study Group

Study group	No. of cases	Abnormal cases	Percentage
Cerebral Infarction	26	9	34.61%
Cerebral Hemorrhage	21	12	57.14%
Subarachnoid hemorrhage	3	1	33.33%
Total	50	22	44%

Table 3: The Incidence of ST Segment Changes In The Study Group

Study group	Total no. of cases	ST Segment Elevation	ST Depression Segment	Percentage With ST Segment Changes
Cerebral Infarction	26	1 (3.84%)	8 (30.76%)	9(34.61%)
Cerebral Hemorrhage	21	9 (42.85%)	3 (14.28%)	12 (57.14%)
Subarachnoid hemorrhage	3	1 (33.33%)	0 (0%)	1(33.33%)

Table 4: The Incidence of T Wave Changes In The Study Group

Study group	Total no. of cases	Tall T Wave	T Wave Inversion	Percentage With T Wave Changes
Cerebral Infarction	26	2 (7.69%)	5 (19.23%)	7(26.92%)
Cerebral Hemorrhage	21	8 (42.85%)	3 (14.28%)	11 (52.38%)
Subarachnoid hemorrhage	3	1 (33.33%)	0 (0%)	1(33.33%)

Table 5: The mean value of QT & QT complex in study group

Study group	QT (Mean±SD)	QTC (Mean±SD)
Cerebral Infarction	0.3719±0.04	0.4370±0.06
Cerebral Hemorrhage	0.4205±0.08	0.456±0.054
Subarachnoid hemorrhage	0.3367±0.045	0.4567±0.1343

Table 6: Incidence Of Rhythm Disturbances In The Study Group

Study group	Total no. of cases	Sinus Tachycardia	Sinus Bradycardia	Percentage With T Wave Changes
Cerebral Infarction	26	3 (11.53%)	0 (0%)	3(11.53%)
Cerebral Hemorrhage	21	3 (14.28%)	5 (23.80%)	8 (38.09%)
Subarachnoid hemorrhage	3	1 (33.33%)	0 (0%)	1(33.33%)

RESULTS

In our study showed that the majority of cases (84%) were seen in 51-70 years of age groups (table 1). Out of 22, 12 (57%) of patients with hemorrhages, 9 (34%) of patients with infarct had changes and 1 (33.33%) patient with SAH had changes (table 2).

ST segment changes were most commonly noted after cerebral hemorrhage. 31% of patients with infarction had ST depression. ST elevation was found in 33.33% of patients with ICH (table 3).

T wave changes were present in 52.38% of patients with ICH. 27% of patient with infarct had T wave changes (table 4).

The mean value of QT and QTC interval in infarction was 0.3719±0.04 & 0.4370±0.06 respectively and in hemorrhage was 0.4205±0.08 & 0.456±0.054 respectively (table 5).

Rhythm disturbance were present in 11.53% of patients with infarct. 38% of patients with ICH have changes of which 14.28% had sinus tachycardia and 24% had sinus bradycardia. 33.33% of patients with SAH have ECG changes (table 6).

DISCUSSION

Our study observed that mostly cases (84%) were seen in 51-70 years of age groups, because CVA patients admitted in hospital more than 40 years of age group during study period. The proportion of stroke death increases with age, 2.4% of all deaths in old age (>70 years of age).[15] Our study compared with Bozluolcay M et al. (2003)[16] mean age was 65.5 ± 11.9 (range 31–91 yrs).

T wave inversion was observed in 14% of patients with intracerebral hemorrhage and 29% patients with cerebral infarction in our study. The mean value of QT and Q-Tc interval in infarction was 0.3719±0.04 & 0.4370±0.06 respectively and in hemorrhage was 0.4205±0.08 & 0.456±0.054 respectively.

A study done by Ashman and Toth, in 1947.[6] In 1954, Burch, Myers, and Abildskov[7] stated a pattern of QT prolongation, abnormal T waves, and U waves which they considered unique of acute cerebrovascular stroke. Mansoureh Togha et al (2013)[17] reported ‘‘ECG abnormalities associated with stroke were T-wave abnormalities, prolonged Q-Tc interval and arrhythmia, which were respectively found in 39.9%, 32.4%, and 27.1% of the stroke patients’’. Dr. Abhilash Somasundaran et al (2015)[18] reported ECG changes included T inversions (22.3%) and ST depressions (17.2%) predominantly.

The next common abnormality noted was tall T waves, which was observed in 43% of patients with intracerebral hemorrhage. Our findings consisted with Byer and colleagues (1947) reported marked QT prolongation with large T and U waves on the ECG of four patients with stroke.[6]

The most common abnormality noted was ST segment changes (57%) in patient with cerebral hemorrhage. Of which 43% had ST segment elevation and 14% had ST segment depression.

The findings were conflict with Dimant J, Grob D (1977)[19] who found that CVA had a 7- to 10-fold higher incidence of ST segment depression.

Kono and colleagues performed detailed cardiac evaluation of patients with acute SAH and reported that ST elevation in the ECG may be due to apical wall motion abnormalities on the echo-cardiogram, but there was no evidence of coronary artery stenosis or coronary artery vasospasm on angiography.[20]

Rhythm disturbance were present in 11.53% of patients with infarct. 38 % of patients with ICH have changes of which 14.28% had sinus tachycardia and 24% had sinus bradycardia. 33.33% of patients with SAH have ECG changes.

Our comparison with study done by Goldstein's observed bradycardia in 8% and tachycardia in 2% of patients with acute stroke.[21] Stober et al described sinus bradycardia in 23%.[22]

Regarding the relationship between the locations of CVA lesions and ECG abnormalities, Frentz and Gormsen (1962)[23] ‘‘ECG changes appeared to bear no relationship to arteriographic findings’’.

CONCLUSION

We concluded that understanding that these ECG changes which are occurring in patients with CVA is important because it may lead to erroneous judgment of assigning these patients as CAD. These patients should be evaluated for cardiac injury and treated only if necessary.

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