

ECG changes in patients of acute cerebrovascular diseases

Kamal Kumar Jain^{1*}, Yogesh Garg²

¹Assistant Professor, ²Sr. Resident, Department of Medicine, NIMS Medical College and Hospital, Jaipur, Rajasthan, INDIA.

Email: jaindrkamalkumar@gmail.com

Abstract

Introduction: Numerous studies have demonstrated the fact that primary neurologic abnormalities may produce ECG changes without any myocardial lesion. ECG changes affecting T wave, U wave, S-T segment, Q-T interval and arrhythmias have been reported. These changes may resemble those of myocardial ischemia and acute myocardial infarction, leading to misinterpretation and delay in operative management of sub-arachnoid haemorrhage. **Aims and Objectives:** to study the various ECG changes in patients of cerebrovascular diseases. **Material and Method:** In the present study we tried to study the electrocardiography findings in acute cerebrovascular diseases. For this purpose we selected 55 cases of acute cerebrovascular diseases. A 12 Lead Electrocardiogram was taken for all the cases within 24 hours of admission. A detailed analysis and interpretation of ECG changes like sinus arrhythmia, sinus bradycardia, sinus tachycardia, abnormal Q wave, U wave, T wave, right and left ventricular hypertrophy, S-T segment elevation/depression, T wave inversion and prolongation of Q-T interval was done. **Results:** Out of total 55 cases of cerebrovascular diseases majority were more than 60 years of age with M: F ratio of 1.89:1. In 65.45% patients, ischemic stroke was diagnosed followed by intra- cerebral hemorrhage (27.27%) and sub arachnoid hemorrhage (7.27%) was observed. The most common ECG change observed in the present study was abnormal T wave (40%), prolong QTc (27.27%) and interval arrhythmia (21.82%). The most common abnormal ECG pattern in ischemic stroke was Abnormal T wave (33.33%) followed by prolong QTc interval (38.89%) and arrhythmia (22.22%). In sub arachnoid hemorrhage patients prolong QTc interval and pathologic Q wave was observed in 50% cases each whereas ST Segment elevation and abnormal T wave was observed in 25% cases each. It was seen that in abnormal T wave (40%) was the most common abnormal ECG pattern in intracerebral hemorrhage patients. It was followed by prolong QTc interval (27.27%) and arrhythmia (21.82%). **Conclusion:** Thus we conclude that abnormal T wave, prolong QTc interval and arrhythmia were the common ECH+G findings in patients of cerebrovascular accident.

Keywords: cerebrovascular diseases, electrocardiography, ischemic stroke.

*Address for Correspondence:

Dr. Kamal Kumar Jain, Assistant Professor, Department of Medicine, NIMS Medical College and Hospital, Jaipur, Rajasthan, INDIA.

Email: jaindrkamalkumar@gmail.com

Received Date: 11/04/2015 Revised Date: 20/04/2015 Accepted Date: 23/04/2015

Access this article online

Quick Response Code:	Website: www.statperson.com
	DOI: 26 April 2015

INTRODUCTION

Cerebrovascular accident (CVA) also known as, Stroke or cerebrovascular insult (CVI). The World Health Organization defined stroke as a "neurological deficit of cerebrovascular cause that persists beyond 24 hours or is interrupted by death within 24 hours".¹ cerebrovascular

accidents (CVA) can be classified into two major categories; ischemic and hemorrhagic.² Ischemic 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. About 87% of strokes are ischemic, the rest being hemorrhagic. Bleeding can develop inside areas of ischemia, a condition known as "hemorrhagic transformation." It is unknown how many hemorrhagic strokes actually start as ischemic strokes.³ Numerous studies have demonstrated the fact that primary neurologic abnormalities may produce ECG changes without any myocardial lesion. ECG changes affecting T wave, U wave, S-T segment, Q-T interval and arrhythmias have been reported. These changes may resemble those of myocardial ischemia and acute myocardial infarction, leading to misinterpretation and delay in operative management of sub-arachnoid

haemorrhage⁴. There are evidences suggesting, that patients who had ECG changes following cerebrovascular accidents had poor prognosis compared to those who did not show any ECG changes. Approximately 2-6% of all stroke patients die from cardiac causes in first three months after ischemic stroke⁵.

AIMS AND OBJECTIVES

To study the various ECG changes in patients of cerebrovascular diseases.

MATERIAL AND METHOD

The present study was conducted in the department of medicine of NIMS Medical Hospital. The study was conducted from August 2012 to July 2013. For the purpose of study following inclusion and exclusion criteria was used to select the study patients.

- **Inclusion Criteria:** cases of ‘cerebrovascular accident and admitted within 72 hours and patients having ECG changes.
- **Exclusion Criteria:** Stroke cases which came after 72 hours, the individuals with head injury and known cardiac, hepatic and renal diseases.

Thus total 55 cases of cerebrovascular accident were enrolled in the study by using the above mentioned inclusion and exclusion criteria. The The diagnosis of CVA was confirmed by using following criteria⁶

- temporal profile of the clinical syndrome
- evidence of focal brain damage/disease
- clinical setting

A 12 Lead Electrocardiogram was taken for all the cases within 24 hours of admission and subsequently repeated on 3rd day, 7th day and 30th day for follow up. CT scan brain was taken and all patients were subjected to investigations like Trop-i or Trop-t, 2d echocardiogram, serum electrolytes, urine analysis, blood sugar, blood urea, lipid profile and relevant serological tests. A detailed analysis and interpretation of ECG changes like sinus arrhythmia, sinus bradycardia, sinus tachycardia, abnormal Q wave, U wave, T wave, right and left ventricular hypertrophy, S-T segment elevation/depression, T wave inversion and prolongation of Q-T interval was done.

RESULTS

Table 1: Distribution according to age, sex and type of CVA

Variable	No. of patients	Percentage
Age	<40	3 5.45%
	40-59	13 23.64%
	≥60	29 52.73%
Sex	Male	36 65.45%
	Female	19 34.55%
	Ischemic	36 65.45%
Type of CVA	Sub arachnoid hemorrhage	4 7.27%
	Intracerebral hemorrhage	15 27.27%

It was observed that out of total 55 cases of cerebrovascular diseases majority were more than 60 years of age (52.73%). Majority of the patients were male (65.45%) with M: F ratio of 1.89:1. It was seen that 65.45% patients were of ischemic stroke followed by intra- cerebral hemorrhage (27.27%) and sub arachnoid hemorrhage (7.27%) was observed.

Table 2: Distribution according to ECG changes

ECG changes	No. of patients*	Percentage
Prolong QTc interval	15	27.27%
ST Segment depression	7	12.73%
ST Segment elevation	5	9.09%
Abnormal U wave	4	7.27%
Pathologic Q wave	9	16.36%
Abnormal T wave	22	40.00%
overall arrhythmia	12	21.82%

* Multiple responses were recorded.

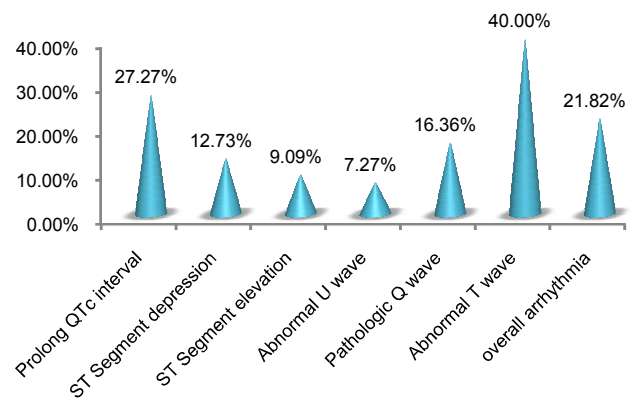


Figure 1: Distribution according to ECG changes

The most common ECG change observed in the present study was abnormal T wave (40%), prolong QTc (27.27%) and interval arrhythmia (21.82%).

Table 3: Distribution of ECG changes according types of CVA

ECG changes	Ischemic stroke*		SAH*		Intracerebral hemorrhage*	
	No. of patients	Percentage	No. of patients	Percentage	No. of patients	Percentage
Prolong QTc interval	12	33.33%	2	50.00%	1	6.67%
ST Segment depression	4	11.11%	0	0.00%	3	20.00%
ST Segment elevation	3	8.33%	1	25.00%	1	6.67%
Abnormal U wave	3	8.33%	0	0.00%	1	6.67%
Pathologic Q wave	5	13.89%	2	50.00%	2	13.33%
Abnormal T wave	14	38.89%	1	25.00%	7	46.67%
Overall arrhythmia	8	22.22%	0	0.00%	4	26.67%

* Multiple responses were recorded

The most common abnormal ECG pattern in ischemic stroke was Abnormal T wave (33.33%) followed by prolong QTc interval (38.89%) and arrhythmia (22.22%). In sub arachnoid hemorrhage patients prolong QTc interval and pathologic Q wave was observed in 50% cases each whereas ST Segment elevation and abnormal T wave was observed in 25% cases each. It was seen that in abnormal T wave (40%) was the most common abnormal ECG pattern in intracerebral hemorrhage patients. It was followed by prolong QTc interval (27.27%) and arrhythmia (21.82%).

DISCUSSION

In the present study we tried to study the electrocardiography findings in acute cerebrovascular diseases. For this purpose we selected 55 cases of acute cerebrovascular diseases. It was observed that majority of the cases were more than 60 years of age. Male predominance was also observed with male: female ratio of 1.89:1. It was seen that 65.45% patients were of ischemic stroke followed by intra- cerebral hemorrhage (27.27%) and sub arachnoid hemorrhage (7.27%) was observed. The most common ECG change observed in the present study was abnormal T wave (40%), prolong QTc interval (38.89%) and interval arrhythmia (21.82%). Similar findings were also reported by Goldstein DS *et al*, Sommargren CE *et al* and Villa A *et al*.^{7,8} The most common abnormal ECG pattern in ischemic stroke was Abnormal T wave (33.33%) followed by prolong QTc interval (38.89%) and arrhythmia (22.22%). The higher incidence of abnormal T wave in ischemic stroke patients with cardiovascular diseases implies the influences of other factors on the T wave than the intracranial disorder in this group. Dogan *et al*.⁹ found ischemia like ECG changes in 65% of patients, QTc interval prolongation in 26%, and arrhythmias in 44% of them. In the study of Lindgren *et al*¹⁰ transient STT changes were found in 54% of patients with ischemic stroke with no primary heart disease. In sub arachnoid hemorrhage patients prolong QTc interval and pathologic Q wave was observed in 50% cases each whereas ST Segment elevation and abnormal T wave was observed in 25%

cases each. Similar findings were also reported by Frontera JA *et al*¹¹, Liman T *et al*¹² and Mayer SA *et al*.¹³ It was seen that in abnormal T wave (40%) was the most common abnormal ECG pattern in intra cerebral hemorrhage patients. It was followed by prolong QTc interval (27.27%) and arrhythmia (21.82%). Various authors have made attempt to correlate the ECG abnormalities with the location of the brain lesion but the reported results were divergent. The direct stimulation of many areas of the CNS is known to result in abnormal ECG patterns; while no relationship of the ECG changes, to the site of the bleeding aneurysm, was found by Cropp and Shuster *et al*,¹⁴ Manning *et al*,¹⁵ and Hunt *et al*.¹⁶ In studies focused on the intracranial vascular spasm after SAH and the appearance of ECG abnormalities, Wilkins *et al*¹⁷ showed no relationship, while Stober and Kunze¹⁸ were able to find a correlation between cerebral arteries spasms of the left hemisphere, Twave inversion, and QT prolongation. A correlation between arrhythmias and Twave abnormalities and hemorrhages in the anterior cerebral circulation has been reported in patients with cerebral hemorrhages.¹⁹

CONCLUSION

Thus we conclude that abnormal T wave, prolong QTc interval and arrhythmia were the common ECH+G findings in patients of cerebrovascular accident.

REFERENCES

1. Donnan GA, Fisher M, Macleod M, Davis SM (May 2008). "Stroke". *Lancet* 371 (9624): 1612–23.
2. "Brain Basics: Preventing Stroke". National Institute of Neurological Disorders and Stroke. Retrieved 2009-10-24.
3. World Health Organisation (1978). *Cerebrovascular Disorders (Offset Publications)*. Geneva: World Health Organization.
4. Cropp GJ, Manning GW, Electrocardiographic changes stimulating myocardial ischemia and interactions associated with spontaneous intracranial haemorrhage, *Circulation*, 22, 1960, 25-38.
5. Prosser J, Mac Gregor L, R Kennedy, D Hans- Christoph, Predictors of early cardiac morbidity and mortality after ischemic stroke, *Stroke*, 38, 2007, 2295-2302.

6. Adams RD, Victor M, Ropper AH. Cerebrovascular diseases in principles of Neurology, USA, Me Grow Hill Health Professions Divisions, 8th Ed, 2005,660- 746.
7. Goldstein DS. The electrocardiogram in stroke. Relationship to pathophysiological type and comparison with prior tracings. *Stroke*. 1979;10:253–9.
8. Villa A, Bacchetta A, Milani O, Omboni E. QT interval prolongation as a predictor of early mortality in acute ischemic stroke patients. *Am J Emerg Med*. 2001;19:332–3.
9. Dogan A, Tunc E, Ozturk M, Kerman M, Akhan G. Electrocardiographic changes in patients with ischaemic stroke and their prognostic importance. *Int J Clin Pract*. 2004;58:436–40.
10. Lindgren A, Wohlfart A, Pahlm O, Johansson BB. Electrocardiographic changes in stroke patients without primary heart disease. *Clin Physiol*. 1994;14:223–31.
11. Frontera JA, Parra A, Shimbo D, Fernandez A, Schmidt JM, Peter P, et al. Cardiac Arrhythmias after Subarachnoid Hemorrhage: Risk Factors and Impact on Outcome. *Cerebrovasc Dis*. 2008;26:71–8.
12. Liman T, Endres M. Elevated troponin and ECG alterations in acute ischemic stroke and subarachnoid hemorrhage. *Nervenarzt*. 2008;79:1388–90.
13. Mayer SA, Lin J, Homma S, Solomon RA, Lennihan L, Sherman D, et al. Myocardial injury and left ventricular performance after subarachnoid hemorrhage. *Stroke*. 1999;30:780–6.
14. Shuster S. The electrocardiogram in subarachnoid haemorrhage. *Br Heart J*. 1960;22:316–20.
15. Cropp GJ, Manning GW. Electrocardiographic changes simulating myocardial ischemia and infarction associated with spontaneous intracranial hemorrhage. *Circulation*. 1960;22:25–38.
16. Hunt D, McRae C, Zapf P. Electrocardiographic and serum enzyme changes in subarachnoid hemorrhage. *Am Heart J*. 1969;77:479–88.
17. Wilkins RH, Alexander JA, Odom GL. Intracranial arterial spasm: A clinical analysis. *J Neurosurg*. 1968;29:121–34.
18. Stober T, Kunze K. Electrocardiographic alterations in subarachnoid haemorrhage. *J Neurol*. 1982;227:99–113.
19. Yamour BJ, Sridharan MR, Rice JF, Flowers NC. Electrocardiographic changes in cerebrovascular hemorrhage. *Am Heart J*. 1980;99:294–300.

Source of Support: None Declared
Conflict of Interest: None Declared