FREQUENCY OF VARIOUS ELECTROCARDIOGRAPHIC CHANGES IN PATIENTS WITH ACUTE STROKE

Muhammad Rehan[1], Syed Azhar Sherazi[1], Habibullah[2]

ABSTRACT

Objective: To determine the frequency of electrocardiographic changes in patients with acute stroke and comparing the ischemic and hemorrhagic stroke in this perspective.

Study design: Observational.

Place and duration of study: Department of Medicine, District Headquarter, DIKhan from June 2012 to May 2013.

Patients and methods: One hundred and eighty two patients of acute stroke, who presented within 48 hours of the onset of neurological symptoms, were included in the study. Patients who had TIA, electrolyte imbalances and brain-stem stroke were excluded from the study.

Results: Patients with ischemic stroke were relatively older (mean age 62 + 12 years) than those with hemorrhagic stroke (55 + 14 years). ST depression was noted in 46.65% who presented with ischemic stroke and 39% with hemorrhagic stroke. Characteristic T-wave inversions were seen commonly in hemorrhagic stroke 46% as compared to 21 % in Ischemic stroke. Atrial fibrillation was more frequent in ischemic stroke than in hemorrhagic stroke (34% vs. 13% patients. Individually, other ECG abnormalities were not different in both groups.

Conclusion: Repolarization and ischemic-like electrocardiographic (ECG) changes observed during acute phase of stroke may cause diagnostic and management dilemmas for the clinician. Ischemia-like ECG changes and arrhythmias are frequently seen in stroke patients, even in those with no history or signs of primary heart disease, which support a central nervous system origin of these ECG abnormalities. Further study is necessary to better define the brain-heart interaction.

Keywords: Electrocardiography, CT scan, QTc interval, Left ventricular hypertrophy. Atrial fibrillation

INTRODUCTION

In epidemiological studies, stroke is defined by clinical findings and symptoms: rapidly developed signs of focal (or global) disturbance of cerebral function lasting more than 24 hours (unless interrupted by surgery or death), with no apparent cause other than a vascular origin.[1] Stroke is the second leading cause of death worldwide in the adult population. Of note, stroke is an increasing problem in developing countries, 87% of stroke deaths occurring in low- and middle-income countries.[2,3,4]

ECG abnormalities are present in up to 90% of patients presenting with acute stroke.[7]Typical ECG demonstrates large upright T-waves and prolonged QT intervals. Such ECG changes are also seen in the setting of subarachnoid hemorrhage, transient ischemic attacks, and nonvascular cerebral lesions.[5,6] The ECG changes have been postulated to arise from subendocardial ischemia as a result of increased centrally mediated catecholamine release in the setting of hypothalamic hypoperfusion.[8] The underlying basis is disordered repolarization process[9]. There is a relation between these changes and sudden death in sufferers of stroke [10].

ST segment changes are seen in over 20% of patients presenting with acute stroke and commonly include ST segment depression[14], a feature more frequently seen with left middle cerebral artery strokes. [11,12,13] Dynamic ST segment changes may also be indicative of true myocardial ischemia[15,16]

ECG repolarization abnormality manifesting as QT prolongation is seen in about 38% of stroke patients.[18] QT prolongation increases the vulnerable period of the cardiac cycle for arrhythmias and sudden death. AF is a common arrhythmia and its prevalence increases with age up to 9% at age 80–89 years. Approximately 85% of the individuals with AF are between 65 and 85 years of age[20]. Among all ischemic strokes 17–31% occur because of embolic complications of AF.[21, 22, 23]

Rationale of this study is to recognize electrocardiographic (ECG) changes observed during acute phase of stroke which causes diagnostic and management dilemmas for the clinician. Ischemia-like ECG changes and arrhythmias are frequently seen in

[1,2] Department of Cardiology, DHQ Teaching Hospital, DIK
[3] Department of Medicine DHQ Teaching Hospital DIK
....
Address for correspondence:
Dr Muhammad Rehan
Cardiology Department, DHQ Teaching Hospital, DIK
E-mail: qadirullah@yahoo.com

stroke patients, even in those with no history or signs of primary heart disease, which support a central nervous system origin of these ECG abnormalities. Further study is necessary to better define the brain-heart interaction.

Objective of our study is to determine the frequency of various electrocardiographic changes observed in patients with acute stroke and comparing these changes in ischemic and hemorrhagic stroke.

PATIENTS AND METHODS

This observational study was conducted from June 2012 to May 2013 in Department of Medicine, District Headquarter Hospital, DIKhan. It included 182 patients with acute stroke, admitted within 48 hours of the onset of neurological symptoms. A non-contrast CT scan of brain was used to define the stroke type. A 12 lead ECG was recorded at the time of admission. The first ECG was analyzed by a cardiologist who was blinded to the clinical data.

Patients who had TIA, preexisting cardiac disease or drug intoxication and electrolyte disturbances that were thought to influence the QT-interval and ST/T changes (class-1 antiarrhythmic drugs, phenothiazine, tricyclic antidepressants, hypocalcaemia, hypokalemia, congenital long QT-syndromes) were excluded from the study. Stroke due to trauma, meningitis / encephalitis were also excluded from the study.

Statistical analysis was computed using SPSS-10 software and Chi-square test was applied to various qualitative variables of ECG, predictive of in hospital mortality due to stroke. While assessing the ECG abnormalities, pathologies like hypertension, coronary artery disease, valvular abnormalities and cardiomyopathies were not considered. Similarly, prestrike ECG changes were also not taken into account.

RESULTS

Total one hundred eighty two patients were included in this study, 106 cases (58%) with ischemic stroke and 76 (42%) with hemorrhagic stroke. Patients with ischemic stroke were relatively older (mean age 62 + 12 years) than those with hemorrhagic stroke (55 + 14 years). In ischemic stroke 106 patients were included, 75(71%) were males and 31(29%) were females. The mean age in ischemic group was 62 ± 12. In hemorrhagic stroke out of 76 pts, 50(67%) were males and 26(33%) were females. The mean age was 55 ± 14 was noted in hemorrhagic stroke as shown in table-I.

ST depression was noted in 49 pts (46.65%) who presented with ischemic stroke and 30 pts (39%) with hemorrhagic stroke. Characteristic T-wave inversions were seen commonly in hemorrhagic stroke 35 (46%) as compared to 22 pts (21 %) in Ischemic stroke. Prolonged QT interval and was found in 49 pts (64%) of the patients with hemorrhagic stroke and 38 (36%) with ischemic stroke. (Table-II). Atrial fibrillation was more frequent in ischemic stroke than in hemorrhagic stroke (34% vs. 13% patients as clear from Table-II.

Most of the patients of hemorrhagic stroke had ECG evidence of left ventricular hypertrophy. Their proportion was quite large when compared with sufferers of ischemic stroke. (69% vs. 15.51%). Bundle branch block and premature ventricular complexes, although less frequently detected changes, were similar in ischemic & hemorrhagic stroke.

In hospital mortality was higher in cases having hemorrhagic stroke 15 out of 76 pts(20.5%) as compared to ischemic stroke 6/106 (6.5%) giving on overall mortality figure of 27%. Median stay in the hospital was 6.0 days. (Table III).

Table 1: Demographic Data of Stroke patients

Stroke type	No of pts (182)	Mean age (Yrs)	Male	Female
Ischemic stroke	106(58%)	62±12	75(71%)	31(29%)
Hemorrhagic stroke	76(42%)	55±14	50(67%)	26(33%)

Table 2: Comparison of ECG changes in Stroke

Stroke type	No. of patients	ST Depression	T wave inversion	Atrial fibrillation	QT prolongation	Premature ventricular contraction	LVH
Ischemic Stroke	106(58%)	49(46.6%)	22(21%)	36(34%)	38(36%)	5(5%)	16(15%)
Hemorrhagic Stroke	76 (42%)	30(39%)	35(46%)	10(13%)	49(64%)	2(2%)	52(69%)

Table 3: Hospital mortality in stroke patients

Stroke type	No of pts: 182	Hospital mortality	Overall mortality
Ischemic stroke	106	6 (6.5%)	27%
Hemorrhagic stroke	76	15 (20.5%)	

DISCUSSION

In our study the most common ECG stroke related abnormalities were ST depression, T wave inversion and prolonged QTc interval found respectively in 46.6%,21%,and 36% of ischemic stroke patients and 39%,46% and 64% of hemorrhagic stroke patients.

The frequency of ischemic change given in our study (46.6%) is close to the result calculated by Goldstein (35%)[37] and Bozloucly (37.9%)[30]. ST-depression observed more frequently in sufferers of ischemic stroke than hemorrhagic stroke (46.6% vs 39%), which also seen in other study[38]. The high frequency of ECG abnormalities in our study population is in line with the frequency reported in the literature.[31,32,33,34] According to the results of these studies, the ischemia-like ECG abnormalities and QT interval prolongation can occur in more than 50% of the patients with ischemic or hemorrhagic stroke. In an early study of 150 patients with acute stroke, Golstein[37] detected QT prolongation in 45%, ischemic changes in 39%, and arrhythmias in 27% of their patients. In a study on patients with ischemic stroke but without history of primary heart disease, Dogan et al.[38] 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., transient ST-T changes were found in 54% of patients with ischemic stroke with no primary heart disease. Prominent U-wave, QT interval prolongation, and arrhythmia were observed in 17%, 13%, and 4% of them, respectively. Compared with our study, however, that study included only 24 patients with cerebral infarction.

Results of our study are similar to study done by Akbar et al, in which ST depression, T wave inversion and repolarization abnormalities (QT prolongation) were commonly observed in patients with stroke. A total of 200 patients were included in this study, patients with ischemic stroke were relatively older. LVH was common manifestation of hemorrhagic stroke in our and that study as well.

Results of our study are similar to study conducted by B. FURE et al[36], in that study the most frequent ECG changes were: prolonged QTc 36.0%, ST depression 24.5%, atrial fibrillation 19.9% and T wave inversion 17.8%. Our study demonstrates a frequency of 34% for atrial fibrillation detected in patients with stroke. This correlates with the results given by Bozluoclay, who detected the same ECG variable in19.5% sufferers of ischemic stroke[30].

CONCLUSION

Repolarization and ischemic-like electrocardiographic (ECG) changes observed during acute phase of stroke may cause diagnostic and management dilemmas for the clinician. Ischemia-like ECG changes and arrhythmias are frequently seen in stroke patients, even in those with no history or signs of primary heart disease, which support a central nervous system origin of these ECG abnormalities.Sufferers of acute stroke should receive continuous ECG monitoring for detection of these changes.

REFERENCES

1. Doğan A, Tunç E, Oztürk M, Erdemoğlu AK. Comparison of electrocardiographic abnormalities in patients with ischemic and hemorrhagic stroke. 2004; 4:135-40.

2. Lopez AD, Mathers CD, Ezzati M, Jamison DT, Murray JL. Global and regional burden of disease and risk factors: systematic analysis of population health data. Lancet 2006; 367:1747–57.

3. Strong K, Mathers C, Bonita R. Preventing stroke: saving lives around the world. Lancet Neurol 2007; 6:182–7.

4. Beaglehole R, Ebrahim S, Reddy S, Voute J, Leeder S. Prevention of chronic diseases: a call to action. Lancet 2007; 370:2152–7.

5. Adams HP, Bendixen BH, Kappelle LJ,Biller J,Love BB,Gordon DL et al. Classification of subtype of acute ischemic stroke. Definitions for use in a multicenter clinical trial. TOAST. Trial of Org 10172 in Acute Stroke Treatment. Stroke 1993; 24:35–41.

6. Ay H, Furie KL, Singhal A, Smith WS, Sorensen AG, Koroshettz WJ et al. An evidence-based causative classification system for acute ischemic stroke. Ann Neurol 2005; 58:688–97.

7. Oppenheimer SM, Hachinski VC. The cardiac consequences of stroke. Neurol Clin 1992; 10:167-76.

8. Melville KI, Blum B, Shister HE, Silver MD. Cardiac ischemic changes and arrhythmias induced by hypothalamic stimulation. Am J Cardiol 1963; 12:781-91.

9. McDermott MM, Lefevre F, Arron M, Martin GJ, Biller J. ST segment depression detected by continuous electrocardiography in patients with acute ischemic stroke or transient ischemic attack. Stroke. 1994; 25:1820-4.

10. Hachinski VC. The clinical problem of brain and heart .Stroke 1993; 24: 10-12.

11. Goldstein DS. The electrocardiogram in stroke: relationship to pathophysiological type and comparison with prior tracings. Stroke 1979; 10:253-9.

12. Connor RC. Myocardial damage secondary to brain lesions. Am Heart J 1969; 78:145-8.

13. Suffer J, Dreifus LS, Michelson EL. Polymorphous ventricular tachycardia associated with normal and long QT- intervals. Am J Cordiol 1982; 49: 2021-9.

14. Dogan A, Tunc E, Ozturk M, Kerman M, Akhan G. Electrocardiographic changes in patients with ischemic stroke and their prognostic importance. Int J Clin Pract 2004; 58:436-40.

15. Ohira T, Iso H, Imano H, Kitamura A, Sato S, Nakagawa Y et al. Prospective Study of major and minor ST-T abnormalities and risk of stroke among Japanese. Stroke 2003; 34:250-3.

16. Khechinashvili G, Asplund K. Electrocardiographic

changes in patients with acute stroke: a systematic review. Cerebrovasc Dis 2002; 14:67-76.

17. Bozluolcay M, Ince B, Celik Y, Harmanci H, Ilerigelen B, Pelin Z et al. Electrocardiographic findings and prognosis in ischemic stroke. Neurol India 2003; 51:500-2.

18. Ivanusa M, Ivanusa Z. Risk factors and in-hospital outcomes in stroke and myocardial infarction patients. BMC Public Health 2004; 4:26.

19. Wong KY, Mac Walter RS, Douglas D, Fraser HW, Ogston SA, Struthers AD et al. Long QTc predicts future cardiac death in stroke survivors. Heart 2003; 89: 377-81.

20. Marini C, De Santis F, Sacco S, Russo T, Olivieri L, Torato R et al. Contribution of atrial fibrillation to incidence and outcome of ischemic stroke: results from a population-based study. Stroke 2005; 36:1115–9.

21. Steger C, Pratter A, Martinek-Bregel M, Avanzini M, Valentin A, Slany J et al. Stroke patients with atrial fibrillation have a worse prognosis than patients without: data from the Austrian Stroke registry. Eur Heart J 2004; 25: 1734–40.

22. Liao J, Khalid Z, Scallan C, Morillo C, O Donnell M. Noninvasive cardiac monitoring for detecting paroxysmal atrial fibrillation or flutter after acute ischemic stroke: a systematic review. Stroke 2007; 38:2935–40.

23. Chesebro JH, Fuster V, Halperin JL. Atrial fibrillation—risk marker for stroke. N Engl J Med 1990; 323: 1156-8.

24. Douen AG, Pageau N, Medic S. Serial electrocardiographic assessments significantly improve detection of atrial fibrillation 2.6-fold in patients with acute stroke. Stroke 2008; 39:480–2.

25. Spring M, Dorian P, Fry B. A 30-day cardiac event monitor belt for recording paroxysmal atrial fibrillation after a cerebral ischemic event. The EMBRACE Pilot Study. Stroke; 2008; 39:571–2.

26. Tatschl C, Stöllberger C, Matz K, Wilmaz N, Eckhardt R, Nowotny M et al. Insular involvement is associated with QT prolongation:ECG abnormalities in patients with acute stroke. Cerebrovasc Dis 2006; 21:47–53.

27. Colivicchi F, Bassi A, Santini M, Caltagirone C. Prognostic implications of right sided insular damage, cardiac autonomic derangement and arrhythmias after acute ischemic stroke. Stroke 2005; 36: 1710-5.

28. Klingelhofer J, Sander D. Cardiovascular consequences of clinical stroke. Baillieres Clin Neurol 1997; 6: 309-35.

29. Christensen H, Boysen G, Chirstensen AF, Josannesen HH. Insular lesions, ECG abnormalities and outcome in acute stroke. J Neurol Neurosurg Psychiatry 2005; 76:269-71.

30. Bozluoclay M, Ince B, Celik Y, Harmanci H, Llerigelen B,Pelin Z et al. Electrocardiographic findings and prognosis in ischemic stroke. Neurol India 2003; 51: 500-2.

31. Christensen H, Fogh CA, Boysen G. Abnormalities on ECG and telemetry predict stroke outcome at 3 months. J Neurol Sci 2005; 234:99–103.

32. Maramattom BV, Manno EM, Fulgham JR, Jaffe AS, Wijdicks EF. Clinical importance of cardiac troponin release and cardiac abnormalities in patients with supratentorial cerebral hemorrhages. Mayo Clin Proc 2006; 81:192–6.

33. Arruda WO, Lacerda FS. Electrocardiographic findings in acute cerebrovascular hemorrhage. A prospective study of 70 patients. Arq Neuropsiquiatr 1992; 50:269–74.

34. Yamour BJ, Sridharan MR, Rice JF, Flowers NC. Electrocardiographic changes in cerebrovascular hemorrhage. Am Heart J.1980; 99:294–300.

35. Soffer J, Dreifus LS, Michelson EL. Polymorphous ventricular tachycardia associated with normal and long QT intervals. Am J Cardiol 1982; 49: 2021- 9.

36. Fure B, Bruun T, Thommessen B. Electrocardiographic and troponin T changes in acute ischemic stroke. J Intern Med 2006; 259:592–7.

37. Goldstein DS. The electrocardiogram in stroke: relationship to pathophysiological type and comparison with prior tracings. Stroke 1979; 10: 253-9.

38. Dogan A, Tune E, Ozturk M, Erdemglu AK. Comparison of electrocardiographic abnormalities in patients with ischemic and hemorrhagic stroke. Anat J Cardiol 2004; 4: 135-40.

39. Dogan A, Tune E, Ozturk M, Kerman M. Electrocardiographic changes in patients with ischemic stroke and their prognostic importance. Inter J Clin Pract 2004; 58: 436-40.

ONLINE SUBMISSION OF MANUSCRIPT

It is mandatory to submit the manuscripts at the following website of KJMS. It is quick, convenient, cheap, requirement of HEC and Paperless.

Website: **www.kjms.com.pk**

The intending writers are expected to first register themselves on the website and follow the instructions on the website. Author agreement can be easily downloaded from our website. A duly signed author agreement must accompany initial submission of the manuscript.