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Electrocardiographic Changes in Stroke Patients in a Medical College Hospital – A Case Control Observational Study

Authors
Dr Md Niaz Mostafa[1], Dr AKM Aminul Haque[2], Dr Israt Jahan[3], Dr Mohammed Kamal Uddin[4]
[1]Medicine specialist, Combined Military Hospital, Cumilla & Assistant Professor Army Medical College, Cumilla
[2]Visiting Professor Anwer Khan Modern Medical College
[3]Specialist Radiation Oncology, Combined Military Hospital, Dhaka
[4]Medical Officer, Gastroenterology Dept. Sir Salimullah Medical College Mitford Hospital
Corresponding Author
Dr Md Niaz Mostafa

Abstract
Background: *A stroke is a sudden loss of brain function caused by a disruption in the brain's blood supply. It's the world's second leading killer. 80% of strokes are ischemic. The most prevalent mechanism of hemorrhagic stroke is hypertension small-vessel rupture. The ECG alterations seen during the acute phase of stroke can present diagnostic and treatment problems. The purpose of this study was to investigate electrocardiographic alterations in stroke patients at a Medical College Hospital.*
Method: *In this study, 50 patients from each group were chosen as cases and controls. The study took place from September 2014 to February 2015 at Dhaka Medical College Hospital. Cases and controls had different electrocardiographic changes.*
Result: *The study comprised 100 patients aged 30 to 87 in the case group and 13 to 100 in the control group. The majority of 16 patients in the case group were 51-60 years old, while the control group was 41-50 years old. 32 cases (64.0%) were male, while 22 controls (44.0%) were. 96% hemiparesis and 46% aphasia. Controls do not have such displays. Among the cases, 30 (60%) had HTN, 16 (32%) had DM, and 10 (20%) had CVD. 11 (22%) had DM and 10 (20%) had HTN. An abnormal ECG was found in 34 cases (68%) and 8 (16%) of controls. T wave inversion and ST segment depression were seen in 12 patients (24%). Pathologic Q wave was seen in 6 (12%) instances.*
Conclusion: *In this case control study suggested that the ECG findings abnormality in patients with acute stroke were common. Cardiac evaluation could have prognostic importance.*
Keywords: *Ichemic stroke, Electrocardiographic changes, stroke patients.*

Introduction

Cerebrovascular accident (CVA) is a term used to describe the sudden loss of brain function that occurs as a result of a disruption in the blood flow to the brain. An ischemic event (loss of blood flow) induced by a blockage (thrombosis, arterial embolism) or a hemorrhagic event might result in this situation. The occurrence of a stroke is a medical emergency that has the potential to inflict lifelong brain damage or death. Old age, high

blood pressure, a history of stroke or transient ischemic attack (TIA), diabetes, high cholesterol, tobacco use, and atrial fibrillation are all risk factors for ischemic attack and stroke. Heart disease and stroke are both caused by high blood pressure, which can be reduced or eliminated via lifestyle changes. Among all causes of death, it is the second most common in the world.[2][3] Ischemic strokes account for approximately 80% of all cases.[4] During the blockage of a major artery in the brain, various cellular changes occur. These changes are dependent in part on the degree of the ischemia that is induced as well as whether the occlusion is temporary or permanent in nature. In part because of the limited overlap in the perfusion regions of cerebral arteries, acute ischemia develops in the tissue immediately surrounding the occlusion of the blood vessel.[1] The most prevalent cause of hemorrhagic stroke (intracerebral bleeding) is hypertensive small-vessel disease, which results in the formation of tiny lipohyalinotic aneurysms, which rupture later on. In the acute phase of a stroke, repolarization and ischemic-like electrocardiographic (ECG) abnormalities are noticed. These changes might present diagnostic and therapeutic challenges for the clinician. The ECG and QT prolongation were discovered to be altered during the acute phase of stroke, and the alterations were found to be associated with other aberrant cardiac findings, according to a review. It did not matter whether or not the participants had previous heart illness; abnormalities such as ischemic-like ECG alterations and/or QT prolongation were detected in 76 percent (95 percent confidence interval: 73–90) of the participants. In almost half of all stroke patients who do not have underlying cardiac disease, minor variations in T inversion and ST segment modifications are found, and these changes do not follow the typical pattern of acute myocardial ischemia, according to the researchers.[7] The inversion of the T wave and ST segment alterations were detected in 37.4 percent of the patients in another investigation, with a pathologic Q wave being observed in 12.6 percent of the patients in that study. There was no laboratory or other evidence for 41.3 percent of the research patients, despite the fact that they had clinically diagnosed heart illness. When compared to the control group, ECG alterations were observed to be greater.[8-10]

In this context, the current study will examine the ECG changes of stroke patients in the Department of Medicine at Dhaka Medical College and compare them to those of a control group of patients.

Objective

To determine the frequency of ECG changes in patients with stroke (both ischemic and hemorrhagic) in the Department of Medicine in Dhaka Medical College.

Methodology

In this case control study, a total number of 100 patients were selected along inclusion criteria as cases and controls, 50 in each group. The study period was from September 2014 to February 2015 at the Department of Medicine, Dhaka Medical College Hospital. Electrocardiographic changes were observed and compared among cases and controls. Purposive sampling was done according to availability of patients with strictly considering the inclusion and exclusion criteria. All the patients, fulfilling the inclusion and exclusion criteria, were enrolled for cases. Those patient's or patient's attendants refusing to attend the study were enrolled in control group.

Inclusion Criteria

Case Group

1) Patients presenting with stroke irrespective of type of stroke.
2) Patients attending Department of Medicine, Dhaka Medical College Hospital irrespective of age and sex with stroke.
3) Patients who attend the study.

Control Group

1) Patients admitted in Department of Medicine, Dhaka Medical College Hospital suffering from other diseases than stroke and primary cardiac disease.
2) Patients attending Department of Medicine, Dhaka Medical College Hospital irrespective of age and sex without stroke.
3) Patients who give consent to the study.

Exclusion Criteria

1) Patients who refused interview.
2) Patients who cannot communicate properly with the interviewer.

Results

This study includes 100 patients separated into 8 age groups. Both groups had a range of ages from 30 to 87. The majority of 16 patients in the case group were 51-60 years old, while the control group was 41-50 years old. Cases had a mean age of 60.2812.13 and controls of 49.4016.18. The table also shows age distributions. The two groups had a statistically significant age difference (p>0.05).

Table 1: Age distribution of the study patients (n=100)

Age in years	Types of treatment		Total
	Case	Control	
≥20	0	3	3
21-30	1	5	6
31-40	3	5	8
41-50	7	15	22
51-60	16	12	28
61-70	14	6	20
71-80	7	2	9
>80	2	2	4
Total	50	50	100
Mean± SD	60.28±12.13	49.40±16.18	p>0.05
Min-Max	(30-87)	(13-100)	

Table 2 shows sex distribution of the study patients. Among the 100 patients in the study it was observed that majority, 32 (64.0%) patients were male in cases and 22(44.0%) patients were male in control group. The sex difference was not statistically significant (p>0.05) in fisher exact t-test, between the two groups.

Table 2: Distribution of the study patients by sex (n=100)

Sex	Case (n=50)		Control (n=50)		*P* value
	n	%	n	%	
Male	32	64.0	22	44.0	0.070
Female	18	36.0	28	66.0	

Table 2 shown distribution of clinical presentation in the study patients. Out of 50 cases, 48 (96%) had hemiparesis at the time of presentation. It was also observed among cases that 32 (64%) patients had aphasia. It was also observed that 2(4%) patients were unconscious and disoriented. Among control group there were no hemiparesis, aphasia. Only 3 (6%) patients were unconscious and had generalized weakness.

Table 3: Distribution of the study patients by clinical presentation (n=100)

Clinical presentation	Case (n=50)		Control (n=50)	
	n	%	n	%
Hemiparesis	48	96.0	0	0.0
Aphasia	32	64.0	0	0.0
Unconsciousness	2	4.0	3	6.0
Disorientation	2	4.0	0	0.0
Generalized weakness	0	0.0	3	6.0
Headache	0	0.0	2	4.0
Increased frequency of Micturition	0	0.0	1	2.0
Abdominal pain	0	0.0	1	2.0

Table 4 shows past illness distribution of the study patients. It was observed that 30 (60%) patients had HTN, 16 (32%) had DM, 10 (20%) had CVD among cases. Among control 11 (22%) had DM and 10 (20%) had HTN.

Table 4: Distribution of the past illness of the study patients (n=100)

H/O past illness	Case (n=50)		Control (n=50)	
	n	%	n	%
DM	16	32.0	11	22.0
HTN	30	60.0	10	20.0
IHD	0	0.0	0	0.0
CVD	10	20.0	0	0.0

Table 5 shown personal history of the study patients. Among 50 cases it was observed 16 (32%) patients had smoking history and 10 (20%) had family history of stroke. Among control 14 (28%) smoking history and 12 (24%) had family history of stroke.

Table 5: Distribution of the personal history of study patients (n=100)

Personal history	Case (n=50)		Control (n=50)	
	n	%	n	%
H/O smoking	16	32.0	14	28.0
H/O alcohol intake	0	0.0	0	0.0
Family history of stroke	10	20.0	12	24.0

Table 5 shown distribution of clinical presentation in the study patients. Out of 50 cases, average pulse rate was 82/min in cases and 78/min in controls. Average systolic BP was 150 mm of Hg among cases and 120mm of Hg among control. Again diastolic BP was 90 mm of Hg among cases and 70 mm of Hg among controls. No patients had cyanosis, dehydration and oedema. Normal Hb% was found in 17 cases and 11 controls. Severe anemia was present in 3 cases and 2 controls.

Table 6: Distribution of physical findings of the study patients (n=100)

Physical findings	Case (n=50)	Control (n=50)
Pulse	82/ min	78/ min
Blood Pressure Systolic Diastolic	 150 mm of Hg 90 mm of Hg	 120 mm of Hg 70 mm of Hg
Anemia Normal Hb % Mild Moderate Severe	 17 21 9 3	 11 30 7 2
Cyanosis	0	0
Dehydration	0	0
Oedema	0	0

Table 7 shown distribution of electrocardiographic findings of the study patients (n=100) in the study patients. Abnormal ECG were present in 34 (68%) cases and 8 (16%) in controls. T wave inversion and ST segment depression was observed in 12 (24%) cases. Pathologic Q ave was present 6 (12%) cases.

Table 7: Distribution of electrocardiographic findings of the study patients (n=100)

Abnormality	Acute stroke	control	p- value
Abnormal ECG	34 (68%)	8 (16%)	<0.001
Pathologic Q wave	6 (12%)	3 (6%)	<0.1
Atrial fibrillation	2 (4%)	1 (2%)	<0.2
LVH	2 (4%)	6 (12%)	<0.3
T wave inversion	12 (24%)	5 (10%)	<0.1
ST segment elevation/ depression	12 (24%)	5 (10%)	<0.01
LBBB	6 (12%)	1 (2%)	<0.0001
AV block	0	0	-

Discussion

Ischemic stroke patients' ECGs often change. The reported frequency of new ECG abnormalities in acute ischemic stroke patients was 15-30%.[11-12] There were no clinically diagnosed heart diseases in our study, and the rest were diagnosed by ECG results. These patients had no prior cardiac history or laboratory signs of illness. An abnormal ECG was found in 34 (68%) cases and 8 (16%) controls. The fact that the study group had more ECG abnormalities than the control group suggests that some of the changes may be related to acute cerebral infarction. Heart autopsy findings in patients who died from acute stroke included extensive myocardial necrosis and hemorrhagic lesions (myositolisis). These lesions were found near nerve terminals, indicating a neurogenic origin.[17] In another investigation, no coronary artery disease was found in 8 patients who had ECG alterations after an ischemic stroke.[12] Coronary artery disease and ischemic stroke are major killers. Coronary artery disorders frequently coexist with carotid artery atherosclerosis, MI, or stroke. Numerous studies have revealed that coronary artery disease is the main cause of ischemic cerebrovascular disease mortality. Thus, diagnosing coronary artery disease in individuals with cerebrovascular illness, especially those without clinical signs of heart disease, is becoming more important. T wave inversion and ST segment depression were found in 12 (24%) instances. Pathologic Q wave was seen in 6 (12%) instances. Among the 262 individuals investigated by Ebrahim et al., 112 were female (42.8 percent). The mean age was 67.5±11.9. The control group had 48 females

(47%) with a mean age of 64.511. 138 stroke patients had hypertension and 46 had diabetes. The frequency of abnormal ECG changes were observed in 179 (68.3%) cases. The ECG changes that observed in stroke patients were pathologic Q-wave in 10 cases and AV block was absent. The inversion T wave, ST segment elevation/ depression, and LBBB were detected in 50 (19.08%) patients, left ventricular hypertrophy in 11 (4.19%), and left arterial dilatation in 13 (4.96%). (12.2 percent). The findings are similar to the current study.[8] In McDermott's study of 51 patients with ischemic stroke or TIA, 15 (29%) had ST segment depression (95%) and 18 (35%) had ventricular arrhythmias (95 percent confidence interval, 21 percent to 49 percent). According to logistic regression, ST segment depression was predicted by age (P =.02) and a left-sided neurological incident (P =.01). Atherosclerotic risk factors, cardiac disease history, and mean arterial pressure did not predict ST segment depression.[18] In the first five days after a TIA, 29% of patients had ST segment depression. Compared to asymptomatic persons, ST depression occurs in 2.5% to 8% of those with symptomatic coronary artery disease.[18] With the help of a case-control study, the author assessed the relative frequencies of ECG abnormalities across the pathophysiologic categories of stroke and distinguished new abnormalities at the time of stroke from those identified on past tracings. 138 (92%) of 150 stroke patients had ECG abnormalities. The most common abnormalities were QT prolongation (68 patients, 45%), ischemia alterations (59, 35%), U waves (42, 28%), and arrhythmias (42, 28%). (41, 27 percent). There was an elevated frequency of atrial fibrillation (9 patients, 47%) and QT prolongation (20,71%) in patients with cerebral embolism and subarachnoid hemorrhage (5, 18 percent). QT prolongation and ischemia alterations were associated with admission systolic pressure but not death. Patients with stroke had higher frequency of pathologic Q waves (30%) and left ventricular hypertrophy (26%), although these were not novel findings at the time of the stroke. The ECG alterations are compatible with underlying hypertensive or atherosclerotic cardiovascular disease, sympathetic hyperactivity, and possibly myocardial necrosis.[19] Patients with frontal, insular, or amygdala lesions have a higher incidence of cardiac involvement.[20-23] Autonomic system activation may be a cause of cardiac arrhythmias in acute ischemic stroke patients. The connection of ECG alterations with CT infarct location was not examined in this study.

Conclusion

The high frequency of ischemic ECG changes found in the stroke patients was not significantly different from that in the control patients. After adjustment for ischemic heart disease, there emerged a trend of borderline significance to suggest that ischemic ECG changes were more strongly associated with elderly acute stroke patients than elderly control patients. Larger outcome study will be required to determine the significance of ischemic ECG changes following acute cerebrovascular events in older patients. This case control study suggested that the ECG findings abnormality in patients with acute ischemic stroke were common. Cardiac evaluation could have prognostic importance.

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