A Study on Pattern of ECG Changes in Acute Phase of Stroke Patients in Tertiary Care Medical College Hospital

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Abstract

Background: Physicians are confronted on having ECG in patients with acute stroke as it can mimic that of myocardial infarction or ischaemia. Repolarization and ischemic-like electrocardiographic (ECG) changes observed during acute phase of stroke may cause diagnostic and management dilemmas for the physicians.

Aim: The aim and objective of this study to identify the prevalence of ECG changes in acute stroke patients admitted to medicine units of President Abdul Hamid Medical College Hospital.

Method: This 12 month period observational study was carried out among 100 of acute stroke patients admitted in medicine wards of President Abdul Hamid Medical College Hospital. ECG was done in all patients after their admission to hospital within 48 hours of developing their symptoms. Association of various types of ECG changes were identified and observed.

Results: Among 100 patients, 55% had ischaemic stroke and 45% had haemorrhagic stroke. 43.63% aged between 61-70 years had ischaemic stroke and 28.28% aged between 61-80 years had haemorrhagic stroke. Female had higher frequency of ischaemic stroke 52.72% and male had higher frequency of haemorrhagic stroke75.56%. Abnormal ECG found 84.44% in haemorrhagic stroke and 54.54% in ischaemic stroke. Of all abnormal ECG, ST depression is most frequent and 42.22% in haemorrhagic stroke, T inversion is next 20% in ischaemic stroke, AF was present in 18.18% in ischaemic stroke and QT prolongation is found in 17.77% in hemorrhagic stroke. There considerable variation of ECG changes according to CT scan evidence of particular area of brain involvement like ST depression (28.88%) found in gangliothalamic bleed in haemorrhagic stroke, AF was found (16.36%) in insular area involvement in ischaemic stroke, T inversion is more (12.72%) in large MCA territory infarctive stroke and QT prolongation (11.11%) was found in intracerebralhaemorrhage including SAH. Predictable early in hospital mortality is associated with AF 37.5% and with QT prolongation 31.25%.

Conclusion: In haemorrhagic stroke the ECG abnormalities were more frequent then in ischaemic stroke. The most common abnormalities were ST depression, T wave inversion, AF and QT prolongation. AF and QT prolongation has association of early in hospital mortality.

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Introduction

Stroke is a common medical emergency. It is the third most common cause of death in high income countries (11% of all death in UK) and the leading cause of adult disability world-wide. Stroke risk increases with age but one quarter of all strokes occur before the age of 65. Approximately two-thirds of the global burden of stroke is in the middle and low income countries. It is rising in association with less healthy life styles. Patient often has history of Hypertension, Diabetes Mellitus, Mitral or Aortic stenosis or Atherosclerosis.[1] The annual incidence of acute cerebrovascular disease in the over 45 age group in the U.K. is about 180-300 per 100000. Cerebrovascular diseases can cause death & disability by ischemia, from occlusion of blood vessel (producing cerebral ischemia & infarction) or hemorrhage through their rupture.[2] In India the prevalence rate of stroke was 250- 350/ 100000 in last decade.[3] In Bangladesh adequate and complete data on the incidence and mortality of stroke is not available. In one study in Dhaka Medical college Hospital, stroke is found to be the second commonest cause of emergency admission in the medicine ward and constituted about 10-12% of the total patient in this ward. Two studies in Chittagong Medical college Hospital and BIRDEM Hospital, Dhaka revealed respectively 2.58% and 5.8% of the admitted patients diagnosed as stroke.[4]

Given the disease burden of stroke, prevention is an important public health concern. Some of the modifiable risk factors like hypertension, diabetes mellitus, hyperlipidaemia, cigarette smoking and heart disease play vital role in the formation of the atherosclerotic plaque leading to thrombosis and embolism followed by ischemic stroke. Identification and control of modifiable risk factors is thus a good strategy to reduce the burden of stroke.[5] Primary cardiac disorders can lead to stroke, but the idea that CNS disorder such as stroke may produce ECG changes and arrhythmia if fairly recent. For the first time in 1947 Byer and colleagues described the ECG changes in sufferers of subarachnoid hemorrhage.[6] ECG changes are present in anywhere from 60-90% of patients with intra-parenchymal or subarachnoid bleed and in about 5-20% of patients with acute ischemic stroke.[6] The underlying basis is disordered repolarization process, autonomic regulation and massive stimulation of the sympathetic nervous system. Moreover the studies have shown that the frontal lobe, insular cortex and amygdale play an important role in regulating the heart rate via autonomic nerves.[6,7] This study aims to identify different electrocardiographic changes after acute stroke patients, its frequency and its relation with particular type of stroke and any association of early in hospital mortality with particular ECG type.

Methods

This observational study was carried out among 100 randomly selected acute stroke indoor patients of , President Abdul Hamid Medical College Hospital from November 2019 to November 2020. Patient admitted within 24 hours of onset of symptoms with confirm CT scan showing cerebral infarct or haemorrhage were included in this study. ECG was done in every patient on admission. A semi-structural questionnaire was followed by face to face interview on the basis of objective of the study. All interviewed questionnaire were checked for its completeness, accuracy and consistency to exclude missing or inconsistent data. Data were checked, cleaned and edited properly before analysis. Statistical analysis was carried out by using SPSS vl6.0 Windows statistical software. All patients' legal guardian were briefed about the study. Informed and written consent obtained from all patients who could give the consent and those who were unable to respond, their

appropriate relatives/legal guardian gave the consent. Confidentiality and privacy was maintained throughout the study.

Result

Among 100 patients, maximum number of patients (43.63%) in this study were in between 61-70 years age group followed by (32.72%) between 51-60 years age group in ischaemic stroke. In haemorrhagic stroke maximum patients are between 61-70 and >70 years age group (28.88%, 28.88% respectively.) 55% had ischaemic stroke and 45% had haemorrhagic stroke. 43.63% aged between 61-70 years had ischaemic stroke and 28.28% aged between 61-80 years had haemorrhagic stroke. Female had higher frequency of ischaemic stroke 52.72% and male had higher frequency of haemorrhagic stroke 75.56%.

Abnormal ECG are found in 68% of stroke cases irrespective of their types.

Table I: Distribution of the respondents by ECG abnormality (n=100)

ECG changes	Stroke Type		Total	P Value
	Ischaemic Stroke(n=55)	Haemorrhagic Stroke (n=45)		
Abnormal	30 (54.54%)	38 (88.44%)	68	
Normal	25 (45.45%)	7 (15.55%)	32	**0.001[s]**
Total	**55**	**45**	**100**	

n= Number of the patients S= Significant P value reached from Chi square test

This table shows that, abnormal ECG found in both in ischaemic stroke (54.54%). And statistically significant hemorrhagic and ischaemic stroke and abnormality is difference (0.001) was found between acute stroke slightly higher in hemorrhagic stroke (84.44%) then (Ischaemic & haemorrhagic) & ECG changes.

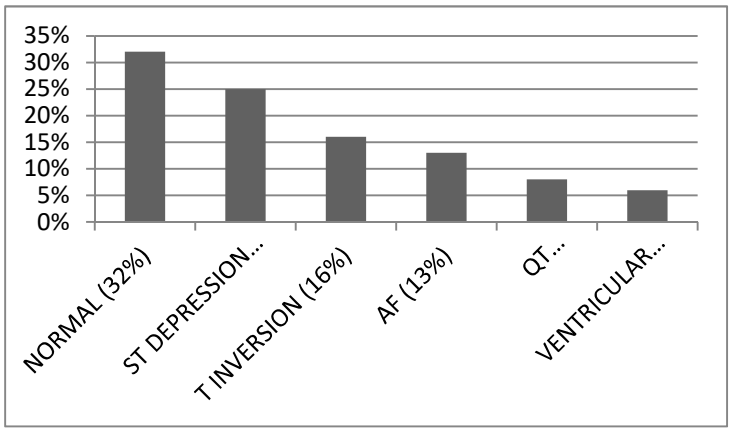

Figure 1. Frequency of normal and abnormal ECG in association with stroke

This chart shows that, ST depression was most common ECG abnormality (25%) then T inversion (16%). AF found at frequency of 13% and QT prolongation was 8% and ventricular ectopic was 6%.

Table II: Distribution of particular ECG changes with type of stroke

ECG Changes	Type of Stroke		Total	P-Value
	Ischaemic Stroke (n=55)	Haemorrhagic Stroke (n=45)		
Normal	25 (45.45%)	7(15.55%)	32	0.001[s]
ST Depression	6(10.90%)	19(42.22%)	25	0.05[s]
T Inversion	11 (20%)	5 (11.11%)	15	0.05[s]
QT prolongation	0 (0%)	8(17.77%)	8	0.03[s]
AF	10(18.18%)	3 (6.66%)	13	0.02[s]
Ventricular ectopics	3 (0.01%)	3 (11.11%)	6	0.10[ns]
Total	**55**	**45**	**100**	

n= Number of the patients,S= SignificantP value reached from Chi square test

This table shows that here was significant statistical variation of normal and abnormal ECG between ischaemic and hemorrhagic stroke. Of all the abnormal ECGs, ST depression is the commonest and is found higher in hemorrhagic stroke (42.22%) then in ischaemic stroke (10.09%) and it is statically significant. Next is T wave inversion that is found more in ischaemic stroke (20%) then in hemorrhagic stroke (11.111%). AF that is found at higher frequency in ischaemic stroke (18.18%) then in haemorrhagic stroke (6.66%) and it was also statistically significant. QT prolongation is next that was found in haemorrhagic stroke (17.77%) and the finding is also statistically significant. Ventricular ectopic beat found not significant is higher in hemorrhagic stroke.

Table III: Distribution of particular ECG changes with involvement of particular site of brain evidence by CT Scan of brain (n=100)

ECG Changes	Type of stroke						
	Ischaemic Stroke (n=55)			Haemorrhagic Stroke (n=45)			
	Lacunar	Insular	MCA territ	GanglThal	1C Hge	ICHgeVE	SAH
Normal	9(16.36%)	4(7.27%)	12(21.81%)	3(6.66%)	2(4.44%)	2(4.44%)	0(0)
ST depression	0(0)	0(0)	6(10.90%)	13(28.88%)	2(4.44%)	3(6.66%)	1(2.22%)
T inversion	1(1.81%)	2(3.63%)	7(12.72%)	3(6.66%)	1(2.22%)	2(4.44%)	0(0)
QT prolongation	0(0)	0(0)	0(0)	0(0)	0(0)	5(11.11)	3(6.66)
AF	1(1.81%)	9(16.36%)	1(1.81%)	0(0)	0(0)	2(4.44%)	0(0)
Ventr. Ectopic	0(0)	1(1.81%)	2(3.63%)	2(4.44%)	0(0)	1(2.22%)	0(0)
Total (100)	11	16	28	21	5	15	4

n= Number of the patients, Lacunar Stroke, Insular Stroke, MCA (Middle Cerebral Arterial) territory, GangThal (Gangliothalamic) stroke, IC(Intracerebral) haemorrhage, ICHgeVE(IntracerebralHaemorrhage with ventricular extension.

This table shows that there was considerable variation of ECG changes according to area of involvement in CT Scan. ST depression is more at gangliothalamic bleed (28.88%) then in large MCA territory ischaemic stroke (10.90%). T inversion is more in ischaemic stroke and more found in large MCA territory infarctive stroke (12.72%). QT prolongation almost exclusively occurs in hemorrhagic stroke and more in large intracerebral hematoma with ventricular extension (11.11%) and in SAH (6.66%). AF where more marked in ischaemic stroke and found more in insular area involvement (16.36%). Ventricular ectopic where found relatively less frequently and was more marked in gangliothalamic bleed then large MCA territory infarctive stroke.

Discussion

A total of 100 patients with acute stroke (Ischemic = 55 & Hemorrhagic = 45) were included in the study, during the study period, as per clinical criteria of acute stroke which were also CT scan proven. Among the study patients mean age was 61.04 (±10.32) in ischaemic stroke and 52.71 (± 9.23) in haemorrhagic stroke, this was consistent with the study conducted by Tarun, Rezaul ,Anwarullah, Anisul.[8] In this study 72% were male and 28% were female i.e., male incidence is 30% higher than female which coincide with other international study. The present study coincides with the study of Chowdhury et al,[9] and Kurtzke,[10] where showed that frequency of stroke is 30% higher in men than women. In this series abnormal ECG found in both hemorrhagic and ischaemic stroke and abnormality is slightly higher in hemorrhagic stroke (84.44%) then in ischamic stroke (54.54%). Khechinashvili G, Asplund K et al showed this similar result in their study where prevalence of ECG changes were higher in haemorrhagic stroke.[11,12] Of all the abnormal ECGs, ST depression is the commonest and is found higher in hemorrhagic stroke (42.22%) then inischaemic stroke (10.09%) and it is statically significant. This is consistent with study done by Byer E, Ashman R, Toth LA et al.[13] Next where T wave inversion that is found more in ischaemic stroke (20%) then in hemorrhagic stroke (11.111%) Burch GE, Meyers R, Abildskov JA showed smiliar result in their study.[11,14] Levine HD and Kreus KE, Kemila SJ, Takala JK et al showed in their study that T wave inversion was more marked in acute ischaemic stroke.[15,16] AF that is found at higher frequency in ischaemic stroke (18.18%) then in haemorrhagic stroke (6.66%) and it is also statistically significant and similar result observed by Burch GE, Meyers R, Abildskov JA et al.[14] QT prolongation was next that was found in haemorrhagic stroke (17.77%) and the finding is also statistically significant. Levine HD and Dimant J, Grob D showed in their study that QT prolongation was more in haemorrhagic stroke.[15,17]

There were considerable variation of ECG changes according to area of involvement in CT Scan of Brain.[18] ST depression were more at gangliothalamicbleed (28.88%) then in large MCA territory ischaemic stroke (10.90%) S. Oppenheimer showed similar result in his study. T inversion was more in ischaemic stroke and more found in large MCA territory ischaemic stroke (12.72%) this is consistent with study done by H Christensen, G Boysen, A F Christensen, et al [18]. QT prolongation almost exclusively occur in hemorrhagic stroke and more in large intracerebral hematoma with ventricular extension (11.11%) and in SAH (6.66%) and Nazire, Ali S.Fak, Jacques T. Metzger, Guy Van Melle et al, showed that SAH has about 85% association of QT prolongation.[19] AF is more marked in ischaemic stroke and is found more in insular area involvement (16.36%). Ventricular ectopics are found relatively less frequently and is more marked in

gangliothalamic bleed then large MCA territory stroke.[19,20] The results found on this study coincided with other study as mentioned .

Conclusion

In our country, there are many studies on stroke, its associated conditions and their effect on stroke patient's outcome, but no study done previously about the ECG changes which is a one of the interesting concern of many countries. In this study, I attempted to find out the common ECG abnormalities in acute stroke patients. The results of this study demonstrates that, in haemorrhagic stroke, the incidence of ECG changes were more than ischaemic stroke and which were mostly ST depression and QT prolongation.It was also observed that in ischaemic stroke the common changes were T inversion and AF. There where considerable variation of ECG changes according to area of involvement in CTscan. ST depression was more at gangliothalamic bleed then in large MCA territory ischaemic stroke. T inversion was more in ischaemic stroke and more found in large MCA territory ischaemic stroke. QT prolongation almost exclusively occur in hemorrhagic stroke and more in large intracerebral hematoma with ventricular extension and in SAH. AF was more marked in ischaemic stroke and was found more in insular area involvement.

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