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Study Of Electrocardiogram In Patients Of Acute Stroke In Tertiary Care Centre

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Abstract

Aim: To evaluate the role of electrocardiogram among patients with acute stroke in tertiary care centre.

Materials and Methods: The present study was conducted among 50 CT/MRI documented cases of acute stroke admitted with in MMDU Mullana Hospital. A detailed history regarding the clinical profile of stroke including risk factors like hypertension, diabetes mellitus, history of cardiac diseases and smoking was taken. Different ECG parameters were recorded using ECG analysis.

Results: It was seen that among subjects with no arrythmias (n=36), only 22 subjects had ECG changes. All the subjects with arrythmias (n=14) had ECG changes. Among subjects with hemorrhage, both CT and ECG changes were seen in 14 subjects, among ischemic subjects, both the changes were seen in 22 subjects out of 29 subjects. Amongst all the subjects, 88% were alive and only 12% subjects had expired. It was seen that ECG changes were present in 32 subjects out of 44 alive subjects, and ECG changes were present in 4 subjects out of 6 expired subjects.

Conclusion: Continuous ECG monitoring should be advisable to patients with acute stroke for detection of these changes and urgently management of life threatening arrhythmia if occur, may improve the survival outcomes of such patients.

Keywords: Stroke, ECG, Arrythmias

Introduction

Most cerebrovascular diseases are manifested by the abrupt onset of a neurological deficit. A stroke, or cerebrovascular accident, is defined as abrupt onset of a neurologic deficit that is due to vascular cause[1]. Stroke is sometimes called as brain attack. It can injure the brain like the heart attack injures the heart[2]. ECG changes are present in 60-90% of patients with intra-parenchymal or subarachnoid bleed and in about 5-20% of patients with acute ischemic stroke[3]. The underlying basis is disordered repolarization process[4]. The possible mechanism is through disturbances in autonomic regulation and massive stimulation of the sympathetic nervous system[5].

Most of the strokes or acute cerebrovascular episodes also it is called is of two types. The most common is ischemic stroke and the less common type is hemorrhagic stroke. Hemorrhagic stroke can be intra-cerebral or subarachnoid type. The death rate has been estimated to be around 20% of the total cases of acute stroke[6].

The prevalence of stroke in India was estimated as 203 per 100,000 populations above 20 years, amounting to a total of about 1 million cases. The male to female ratio was 1.7:1.

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Around 12% of all stroke occurred in population below 40 years[7]. It is estimated that stroke represent 1.2% of the total deaths in the country, when all ages are included. The proportion of stroke death increases with age, and in the oldest group (>70 years of age) stroke contributes to 2.4% of all deaths[8].

Heart attack and stroke are both caused by diseases of blood vessels. They share same risk factors and by modifying these risk factors may reduce the possibility of stroke. ECGs of patients with acute neurological syndromes (ANS) can mimic acute coronary syndromes (ACS) especially in elderly[9].

Almost of the patients with acute stroke can have abnormal ECG and ECG changes like T wave abnormalities, ST segment abnormalities, P wave changes, etc. these changes are seen immediately after an attack of acute stroke. This may be due to "poor neurologic grade on admission"[10].

Most of the patients with acute stroke can have disturbance of rhythm of heart in the initial few days of attack of acute stroke. The most common of these abnormalities are not dangerous and they include premature ventricular beats, sinus tachycardia, premature atrial beats, sinus bradycardia etc. Arrhythmia of clinical importance is not so common and can be seen in 1-4% of the patients with acute stroke[11].

Thus, physicians are confronted on having ECG in patients with acute stroke as it can mimic that of myocardial infarction/ischemia. They should be aware of these changes taking place in patients with acute stroke and not due to myocardial infarction. Hence present study was carried out to study the ECG changes in patients with acute stroke.

Materials and Methods

The present study was conducted among 50 CT/MRI documented cases of acute stroke admitted with in MMDU Mullana Hospital.

Inclusion Criteria

- Patients of and above 18 years of age
- Both gender
- HTN
- DM TYPE 2
- CT/MRI documented cases of acute stroke

Exclusion Criteria

- Stroke due to trauma
- Stroke due to dissecting aortic aneurysm
- Patients with previous documented cardiac disease/any congenital cardiac disease.
- Old stroke cases

Methodology

- A detailed history regarding the clinical profile of stroke including risk factors like hypertension, diabetes mellitus, history of cardiac diseases and smoking was taken. The following investigations were done-

✓ Fasting blood sugar levels
✓ Complete blood count
✓ Fasting lipid profile
✓ Serum Electrolytes
✓ CT scan of brain
✓ ECG recording during presentation of acute stroke.

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The following ECG criteria was applied for analysis:[12]

- ✓ Heart rate: Sinus bradycardia <60beats/min Sinus tachycardia >100beats/min
- ✓ PR interval >0.2second: was considered as prolonged
- ✓ QRS width >0.1second: was considered as wide
- ✓ ST segment depression of 0.5mm or elevation of 1mm: was considered abnormal Rate
- ✓ corrected QT (QTc) >0.44second: was considered as prolonged
- ✓ T wave negative in lead II and V4-V6: was considered as abnormal Presence of very deep, widely splayed T wave inversions.
- ✓ Exaggeration of U wave voltage. Right ventricular hypertrophy (RVH):
- ✓ A tall R wave in lead V_1, equal to or larger than the S wave in that lead Right axis deviation
- ✓ T wave inversion in V_1-V_4 chest leads Left ventricular hypertrophy (LVH):
- ✓ The voltage of the S wave in lead V_1 plus the voltage of the R wave in lead V_5 or V_6 often exceeds 35mm
- ✓ Inverted T waves in leads with tall R waves Left axis deviation.

Data was collected and subjected to statistical analysis using SPSS software version 24.

Results

Only 2% were in age group of 21-30 years and 31-40 years, 24% were in age group of 41-50 and 51-60 years, and 48% were in age group of > 60 years. Hence maximum subjects were from elderly age group. Amongst all the subjects 64% were males and 36% were females.

Table 1: Age and gender distribution among the study subjects

Age Group (in years)	N=50	%
21-30	1	2
31-40	1	2
41-50	12	24
51-60	12	24
>60	24	48
Gender		
Male	32	64
Female	18	36

Graph 1 depicted the risk factors among the study subjects. Most of the subjects had hypertension (88%), followed by diabetes (78%), smoking in 26%, hyperlipidemia in 20% and alcohol in 7% subjects. It was found that 88% of subjects had hemiplegia, 24% had headache, 16% had vomiting, 24% had loss of consciousness, 28% had drowsiness, and 8% had neck stiffness. None of the subjects had seizures.

Graph 1: Risk factors among the study subjects

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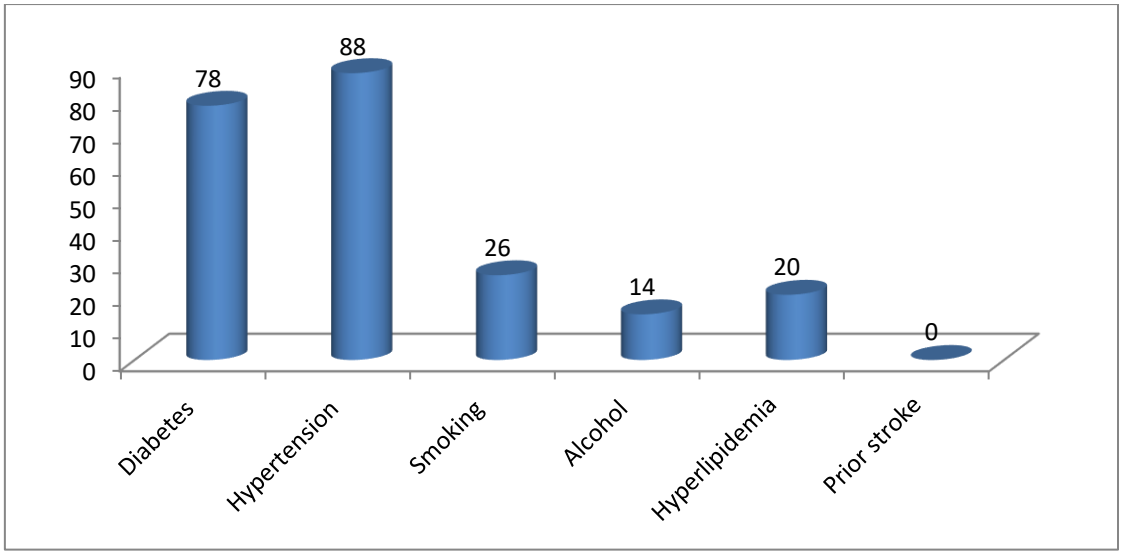

P wave was normal in most of the subjects (86%), it was wide base in 2% subjects and absent in 12% subjects. QTC prolongation <0.45 was seen in 80% subjects and >0.45 seen in 20% subjects. Among all the subjects, 44% had normal T waves, 48% had inverted T waves, and 8% had tall T waves. Among 66% subjects U waves were absent and only among 34% subjects U waves were present (table 2).

Table 2: ECG findings among the study subjects

P wave abnormality	**N=50**	**%**
Normal	43	86
Wide Base	1	2
Absent	6	12
QTC Prolongation		
<0.45	40	80
>0.45	10	20
ST segment		
Normal	26	52
Depression	16	32
Elevated	8	16
T Waves		
Normal	22	44
Inverted	24	48
Tall	4	8
PR interval abnormality		
Abnormality	8	16
Normal	42	84
U Wave		
Absent	33	66
Present	17	34

Most of the subjects had no Arrythmias (32%), 28% had Arrythmias, 6% had AF, 4% had AF, RBBB, APB, ectopic and irregular rhythm each, and 6% had RBBB. It was seen that among subjects with no arrythmias (n=36), only 22 subjects had ECG changes. All the subjects with arrythmias (n=14) had ECG changes. All these findings were not statistically significant. Overall ECG changes was found in all the different types of arrythmias, however

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it also revealed changes in 22 subjects which had no arrythmia. It was found that 42% subjects had hemorrhage and 58% subjects had ischemia in CT findings. Among subjects with hemorrhage, both CT and ECG changes were seen in 14 subjects, among ischemic subjects, both the changes were seen in 22 subjects out of 29 subjects. These findings were not significant statistically (table 3).

Table 3: Arrythmias and CT changes among the study subjects according to ECG changes

Arrythmias	ECG Changes		Total
	Absent	Present	
No	14	22	36
AF	0	3	3
AF, RBBB	0	2	2
APB	0	2	2
Ectopic	0	2	2
Irregular	0	2	2
RBBB	0	3	3
Total	14	36	50
Chi Square	7.56		
p value	0.37		
CT Changes			
Hemorrhage	7	14	21
Ischemia	7	22	29
Total	14	36	50
Chi Square	0.51		
p value	0.48		

Amongst all the subjects, 88% were alive and only 12% subjects had expired. It was seen that ECG changes were present in 32 subjects out of 44 alive subjects, and ECG changes were present in 4 subjects out of 6 expired subjects (table 4).

Table 4: Outcome among the study subjects according to ECG changes

Outcome	ECG Changes		Total
	Absent	Present	
Alive	12	32	44
Expired	2	4	6
Total	14	36	50
Chi Square	0.09		
p value	0.76		

Discussion

The present study was conducted among 50 CT/MRI documented cases of acute stroke admitted in MMDU Mullana Hospital. The aim of the study was to study the electrocardiographic changes observed in different types of cerebrovascular accident and to establish the prognostic significance of the ECG changes. The findings of the study with past literature are compared as below:

In the present study, maximum subjects were from elderly age group. It infers that with advancing age incidence of stroke increases, but stroke below the age of 45years (i.e. Young stroke) is also not so uncommon. According to Rambabu MV et al[13], majority of patients with acute stroke were above 60 years of age (38%) followed by age group of 51-60 years

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(32%). These findings are similar to our study. In a study by Kumar S et al[14], mean age calculated was 63.48 years with standard deviation of 14.162.

There was male dominancy in this study. Kumar S et al[14] in their study showed similar male dominance. Similar gender distribution was reported by Rambabu MV et al in their study[13].

Most of the subjects had hypertension (88%), followed by diabetes (78%), smoking in 26%, hyperlipidemia in 20% and alcohol in 7% subjects in this study. Kumar S et al[14] in their study reported that 51.6% of the patients had history of hypertension. Rambabu MV et al[13] in their study revealed that among addictions, alcoholics had the highest incidence of 68% followed by smokers at 43%.

Overall ECG changes were present in 72% of the study subjects. P wave was normal in most of the subjects (86%), it was wide base in 2% subjects and absent in 12% of the subjects. QTC prolongation <0.45 was seen in 80% subjects and >0.45 seen in 20% subjects. 52% of the subjects had a normal ST segment, 32% had depression in the ST segment and 16% had an elevated ST segment. Among all the subjects, 44% had normal T waves, 48% had inverted T waves, and 8% had tall T waves. Most of the subjects had normal (84%) PR interval, only 16% had PR interval abnormality. Among 66% subjects U waves were absent and only among 34% subjects U waves were present. PR interval appear to be related to more in hemorrhagic group and findings are reversible with in few days, most likely related to raised ICT in case of hemorrhagic stroke.

Rambabu MV et al[13] in their study reported that overall 79% of patients with acute stroke had ECG changes. ECG was totally normal in 21% of the cases. In a study by David S. Goldstein et al[15], of the 150 patients with stroke, 138 (92%) showed ECG abnormalities. The most common abnormalities were also changes from prior tracings: QT prolongation (68 patients, 45%), ischemic changes (59, 35%), U waves (42, 28%). Kumar S et al[14] in their study found that prolonged PR interval was found in 10 patients (9.2%), LAD in 32 patients (26.2%), RAD in 7 patients (5.7%), prolonged QRS interval in 31 patients (25.4%), LVH in 19 patients (15.6%), prolonged QTc interval in 53 patients (43.4%), p wave abnormalities in 30 patients (24.6%), pathological q wave in 11 patients (9.6%), ST segment elevation in 14 patients (11.4%), ST segment depression in 20 patients (16.4%), T wave inversion in 44 patients (36.1%) and presence of U wave in 9 patients (7.1%). Arruda WO[16] in 1992 observed 67.2% patients with acute cerebrovascular hemorrhage had prolonged QTc. Akbar MA et al[17] observed QTc prolongation in limb lead III in 52.27 % in ischemic group and 63.4 % in hemorrhagic group, and QTc prolongation in lead V6 in 63.63 % in ischemic group and 68.29 % in hemorrhagic group. Liu Q et al[18], studied 304 patients, out of which 67.1% had ECG changes.

Most of the subjects had no Arrythmias (32%), 28% had Arrythmias, 6% had AF, 4% had AF, RBBB, APB, ectopic and irregular rhythm each, and 6% had RBBB. David S. Goldstein et al[15] in their study showed that arrhythmias of any type occurred in 41/150 (27%) patients with acute stroke which is in concordant with the present study. Atrial fibrillation was the most common arrhythmia. According to Kumar S et al[14], arrhythmias of any type occurred in 41/150 (27%) patients with acute stroke. Atrial fibrillation was the most common arrhythmia, occurring in 21/150 (14%) patients. These findings are similar to our study.

In this study, 42% of the subjects had hemorrhage and 58% of the subjects had ischemia in CT findings. It was found that among subjects with hemorrhage, both CT and ECG changes were seen in 14 subjects, among ischemic subjects, both the changes were seen in 22 subjects out of 29 subjects. These findings were not significant statistically.

Khechinashvili GR et al[19], noted that ECG changes similar to that seen in ischemic heart disease were present in patients with acute stroke. In their review they stressed that these findings for the physicians can lead to confusion in the diagnosis and management of such cases. Authors also found that the ECG changes were similar to that seen in ischemic heart

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disease in patients of the present study. In their review the authors found that overall 76% of the cases of stroke due to subarachnoid hemorrhage had ECG changes and 90% in patients with ischemic stroke. Most of these cases had heart disease prior to episode of stroke. They cautioned that these ECG changes occurring during the attack of acute stroke were not specific for the diagnosis of AMI. They concluded that ECG abnormalities and cardiac arrhythmias are common in patients with acute stroke, but the pathophysiology of these changes is still not clear.

Dogan A et al[20], found that the prevalence of "Ischemia-like ECG changes" was 65% in patients with ischemic stroke compared to 57% in patients with hemorrhagic stroke. Atrial fibrillation was significantly more i.e. 34% in patients with ischemic stroke compared to only 13% in patients with hemorrhagic stroke. But other types of ECG changes were comparable in the two groups.

Limitations

1. Small Sample size, Holter monitoring to look for beat to beat variation of ECG, echocardiography can also be considered to rule out any structural cardiac disease & follow up patient after 2-4 weeks can also be considered to look for reversal of ECG changes.
2. Since we did not routinely perform thoracic echocardiography and other investigations such as stress echocardiography, myocardial scintigraphy, and scanning techniques for coronary artery territory, asymptomatic coronary heart disease may have remained undetectable.

Conclusion

In conclusion, 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. In addition, specific ECG abnormality correlated with a localized intracranial pathological change could not be established. Further studies are required to more precisely clarify the causal connection between these abnormalities and the intracranial lesion.

Continuous ECG monitoring should be advisable to patients with acute stroke for detection of these changes and urgently management of life threatening arrhythmia if occur, may improve the survival outcomes of such patients.

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