International Journal of Research in Medical Sciences
Kumar S et al. Int J Res Med Sci. 2016 Jul;4(7):2930-2937
www.msjonline.org
pISSN 2320-6071 | eISSN 2320-6012

DOI: http://dx.doi.org/10.18203/2320-6012.ijrms20161979

Research Article

A study of electrocardiogram changes in patients with acute stroke

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Received: 20 May 2016
Accepted: 10 June 2016

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ABSTRACT

Background: Electrocardiogram (ECG) changes are observed in patients with acute stroke and may create confusion with ECG changes found in cardiac disorders. The aim of the study was to study the ECG changes in patients with acute stroke who are not suffering from cardiac disorders which are known to show ECG changes.
Methods: It was a prospective hospital observational based study conducted for a period of 1 year (20th July 2014 to 20thJuly 2015) including patients with acute stroke. Total 122 patients were enrolled and ECG changes were observed.
Results: Various ECG changes are observed (Table 1) in present study including rhythm disturbances (like sinus tachycardia, sinus bradycardia, AF, VPc, RBBB, LBBB, etc.) in 69 patients (56.6%) , bradycardia in 25 patients (19.5%), tachycardia 34 patients (28.1%), prolonged PR interval 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%).
Conclusions: QTc prolongation followed by T-wave inversion followed by ST segment changes were the most frequent ECG changes observed in patients with acute stroke. Various types of arrhythmias like sinus tachycardia, sinus bradycardia, AF, VPCs, BBB, Heart blocks, etc. were also among the common ECG findings. Furthermore ECG findings like PR interval prolongation, QRS interval prolongation and P-wave abnormalities (hardly any study is there in literature about these ECG findings) were additional findings in this study.

Keywords: ECG, Acute stroke, NCCT head

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 injure 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]

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. Around 12% of all stroke occurred in population below 40 years.[6] 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.[7]

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.[8] ECGs of patients with acute neurological

syndromes (ANS) can mimic acute coronary syndromes (ACS) especially in elderly.[8] Stroke induced ECG changes are evanescent, resolving over a period of days to months. However, the frequency and severity of ECG changes is highest within 48 hours of the onset of stroke which explains the importance of continuous ECG monitoring for these patients.[22]

Various earlier studies have shown patients with stroke who had ECG changes had increased mortality than those who had normal ECG. According to studies, the third day mortality was 14.8% in patients with ECG abnormalities whereas it was 8.5% in the patients without ECG changes. The overall mortality rate at the end of this interval was 29.8%.[23]

METHODS

It was a prospective hospital observational study which was conducted in Department of Medicine, Dr. Rajendra Prasad Government Medical College Kangra, Tanda, Himachal Pradesh, India. This study is conducted for a period of 1 year (20th July 2014 to 20th July 2015) including data collection, data organization, data presentation, data analysis and data interpretation. All patients with in this duration fulfilling inclusion and exclusion criteria's were included in the study.

Inclusion criteria

Patients presenting with acute stroke within 24 hours

Exclusion criteria

- Cases of head injury
- Cases who came 24 hours or more after stroke
- Individuals with known cardiac diseases which are known to show ECG changes have been excluded.

Case definition

Patient with stroke presented within 24 hours of episode having acute infract or bleed on NCCT Head/MRI.

Demographic features and general physical examination carried out along with detailed systemic examination was conducted with special emphasis on CNS examination.

Investigations

- NCCT Head/ MRI- done at the time of presentation to hospital
- ECG – 1st ECG was taken at the time of admission and 2nd ECG after 48 hours of acute stroke.
- Other relevant investigations.

Statistical analysis

Data was analyzed using standard statistical methods and results were compared.

RESULTS

Total 122 patients meeting inclusion and exclusion criteria's were enrolled. They were categorised into two groups as per NCCT Head/MRI Head findings; ischemic group and hemorrhagic group.

Ischemic group includes 66 patients (54.1%) and hemorrhagic group includes 56 patients (45.9%). Further, hemorrhagic group includes 51 patients with parenchymal haemorrhage, 4 patients (3.3%) with SAH and 1 patient (0.8%) with SDH. Out of 51 patients with parenchymal haemorrhage 2 patients also have SAH, means there are total 6 patients (4.9%) with SAH.

Demographic Profile

This study includes the wide range of age distribution and mean age calculated was 63.48 years with standard deviation of 14.162. 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. In this study there were total 13 patients (10.8%) with young stroke. Out of 122 patients in this study, female contributes to 44.3% and male to 55.7%.

It was found that 51.6% patient in this study have history of hypertension. Among these hemorrhagic group had 83.9% of patients with history of hypertension, while ischemic group had only 24.2%. It means prevalence of hemorrhagic stroke is higher in hypertensive patients. Only 13 patients (10.7%) had history of diabetes mellitus.

Various ECG changes are observed (Table 1) in present study including rhythm disturbances (like sinus tachycardia, sinus bradycardia, AF, VPc, RBBB, LBBB, etc) in 69 patients (56.6%), bradycardia in 25 patients (19.5%), tachycardia 34 patients (28.1%), prolonged PR interval 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%).

QTc prolongation at the time of admission was the most common finding observed i.e. in 53patients (43.4%), followed by T-wave inversion i.e. in 44 patients (36.1%) is the 2nd most common finding.

Whereas different types of arrythmias (including sinus tachycardia, sinus bradycardia, AF, VPCs, BBB, Heart blocks) as a whole are the most common finding observed in this study i.e. in 69 patients (56.6%) at the time of admission.

There were total 6 patients with SAH in our study (among hemorrhagic group) out of which 5 patients (83%) had prolonged QTc interval, 3 patients (50%) show ST and T-wave changes and 4 patients (66.6%) with rhythm disorder including 3 patients (50%) with bradycardia and 1 (16.6%) with tachycardia.

Table 1: Various ECG changes observed in patients with acute stroke.

	Ischemic Group		Hemorrhagic Group		Total	
	1st ECG	2nd ECG	1st ECG	2nd ECG	1st ECG	2nd ECG
Rhythm disturbances	39/66 (59.1%)	37/66 (56.1%)	30/56 (53.6%)	25/56 (44.6%)	69/122 (56.6%)	62/122 (50.8%)
Heart rate						
Bradycardia	13/66 (18.5%)	12/66 (18.5%)	12/56 (21.4%)	8/56 (12.5%)	25/122 (19.5%)	20/122 (15.7%)
Tachycardia	21/66 (32.3%)	20/66 (29.2%)	13/56 (23.2%)	15/56 (28.6%)	34/122 (28.1%)	35/122 (28.9%)
Prolonged PR interval	4/66 (6.0%)	4/66 (6.0%)	6/56 (5.5%%)	2/56 (1.8%)	10/122 (9.2%)	6/122 (4.9%)
Prolonged QRS interval	17/66 (25.8%)	9/66 (13.6%)	14/56 (25.0%)	10/56 (17.9%)	31/122 (25.4%)	19/122 (15.6%)
QRS						
LVH	11/66 (16.7%)	11/66 (16.7%)	8/56 (14.3%)	8/56 (14.3%)	19/122 (15.6%)	19/122 (15.6%)
RVH	1/66 (1.5%)	1/66 (1.5%)	0/56 (0%)	0/56 (0%)	1/122 (0.8%)	1/122 (0.8%)
Prolonged QTc interval	28/66 (42.2%)	17/66 (25.8%)	25/56 (44.6%)	11/56 (19.6%)	53/122 (43.4%)	28/122 (23.0%)
P-wave abnormalities	19/66 (28.8%)	18/66 (27.3%)	11/56 (19.6%)	11/56 (19.6%)	30/122 (24.6%)	29/122 (23.8%)
Q-wave	9/66 (13.6%)	9/66 (13.6%)	2/56 (3.6%)	2/56 (3.6%)	11/122 (9.0%)	11/122 (9.0%)
ST segment						
Elevation	8/66 (12.2%)	8/66 (12.2%)	6/56 (10.8%)	6/56 (10.8%)	14/122 (11.4%)	14/122 (11.4%)
Depression	14/66 (21.2%)	14/66 (21.2%)	6/56 (10.7%)	6/56 (10.7%)	20/122 (16.4%)	20/122 (16.4%)
T-wave inversion	28/66 (42.4%)	28/66 (42.4%)	16/56 (28.6%)	16/56 (28.6%)	44/122 (36.1%)	44/122 (36.1%)
U wave	4/66 (6.1%)	4/66 (6.1%)	5/56 (8.9%)	5/56 (8.9%)	9/122 (7.4%)	9/122 (7.4%)

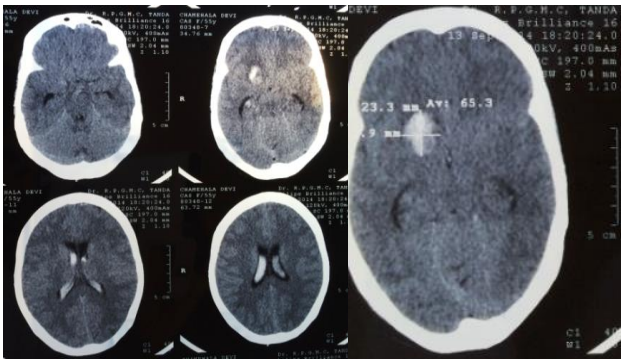

Figure 1: (NCCT Head): Intraparenchymal hemorrhage right basal ganglia with surrounding edema with intraventricular extension.

Overall ECG changes

It was found that ECG changes were found in almost all patients enrolled in study. These changes are broadly classified under ischemic and non- ischemic changes. In this study ischemic changes in the form of ST and T-wave changes and presence of Q-wave were found in 61 patients (50%) including 38 patients (57.6%) in ischemic and 23 patients (41.1%) in hemorrhagic group. While non-ischemic changes were found in 55 patients (45.1%) including 26 patients (39.4%) in ischemic and 29 patients (51.1%) in hemorrhagic group.

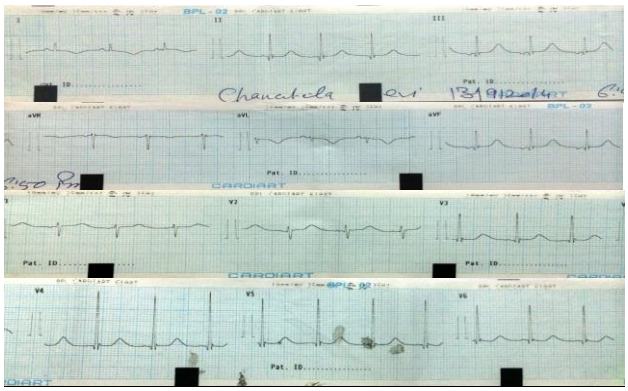

Figure 2: ECG at the time of admission (1) Prolonged QTc interval, QTc=0.49sec, (2) T-wave inversion in lead I, aVL)

Figure 3: ECG after 48 hours of acute stroke (1) QTc interval=0.44sec, (2) T-wave inversion in lead I, aVL, V2-V6).

Table 2: Overall comparison of ischemic vs non-ischemic changes among two groups of acute stroke.

ECG changes	Group		Total
	Ischemic	Hemorrhagic	
Normal	2	4	6
	3.0%	7.1%	4.9%
Ischemic	38	23	61
	57.6%	41.1%	50.0%
Non-ischemic	26	29	55
	39.4%	51.8%	45.1%
Total	66	56	122
	100.0%	100.0%	100.0%

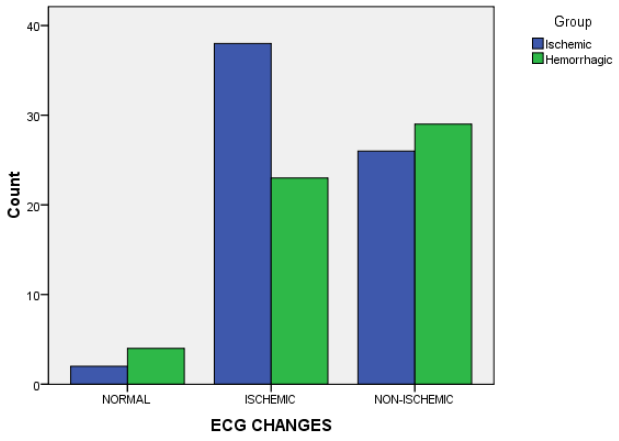

Figure 4: Comparison of ischemic versus non-ischemic changes in acute stroke.

DISCUSSION

The patient with stroke and with an abnormal ECG represents a common diagnostic challenge to the clinician, because ECG changes in stroke mimic the finding those of myocardial ischemia, rhythm disorders, other cardiac disorders, etc. ECG changes in acute stroke in our study are thoroughly studied as following:

Rhythm

In Goldstein's study incidence of 25% of new arrhythmias was observed compared with 3% of the control group. Among these, atrial fibrillation was the most common, present in 14% of the cases, followed by ventricular arrhythmia in 5%, with ventricular extrasystoles in the majority of cases.[9]

Arrhythmias of any type occurred in 41/150 (27%) patients with acute stroke, and new arrhythmias occurred in 13/53 (25%) patients who had prior available tracings. Atrial fibrillation was the most common arrhythmia, occurring in 21/150 (14%) patients.

Akbar MA et al studied 200 patients of stroke, found sinus tachycardia (HR>=100/min) in 63.8% patients among ischemic group and 30.95% patients among hemorrhagic group.[10] AF was observed in 17.24 % of ischemic group, not in hemorrhagic group.

Stober et al described sinus bradycardia in 23%, multifocal ventricular ectopic beats in 54%, asystolic intervals in 27%, and atrial fibrillation in 4% of the cases with conventional electrocardiography. In the present study, sinus bradycardia, atrioventricular block, and the junctional rhythm were the only arrhythmias found (9.1% for each).[11]

In present study overall rhythm disturbances (including sinus tachycardia, sinus bradycardia, atrial fibrillations, ventricular premature complexes, bundle branch block, heart block, etc) were observed in 69 patients (56.6%) at the time of admission, out of which 39 (59.1%) belong to ischemic group and 30 (53.6%) to hemorrhagic group. Atrial fibrillation found in total of 12 patients (9.8%), out of which 10 belong to ischemic group and 2 belong to hemorrhagic group (15.2 % of ischemic group and 3.6 % of hemorrhagic group had AF). These Findings appear to be similar and comparable to above studies and other old studies.

Heart rate

Goldstein's observed bradycardia in 8% and tachycardia in 2% of patients with acute stroke.[9] Stober et al described sinus bradycardia in 23%.[11] In present study at the time of admission 63 patients (52.1%) out of total 122 patients had normal heart rate, including 32 patients (48.2 %) among ischemic group and 31 patients (55.4%) among hemorrhagic group.

25 patients (19.8%) had bradycardia, out of which 13 patients (19.5 %) belong to ischemic group and 12 patients (21.4%) belong to hemorrhagic group. Also there were 34 patients (28.1%) with tachycardia, 21 (32.3%) belonging to ischemic and 13 (23.2%) to hemorrhagic group.

While after 48 hours of stroke 20 patients (19.8%) had bradycardia, out of which 12 patients (18.5 %) belong to ischemic group and 8 patients (12.5%) belong to hemorrhagic group. Also there were 35 patients (28.9%) with tachycardia, out of which 20 patients (29.2%) belong to ischemic and 15 patients (28.26%) to hemorrhagic group. It was observed that there is a significant reduction in number of patients with bradycardia after 48 hours in hemorrhagic group as compared to ischemic group. These Findings appear to be similar and comparable to above studies and other old studies.

PR interval

In present study PR interval prolongation was found in only 10 patients (9.2%) at admission, out of which 6 patients (5.5%) had prolonged PR interval after 48 hours and 4 patients reverted to normal sinus rhythm. Out of 10 patients, 6 were from hemorrhagic group and 4 from ischemic group. 4 patients who reverted to normal sinus rhythm were from hemorrhagic group. There was also 1 patient in hemorrhagic group in which complete heart block was observed at the time of admission, which on 2nd ECG after 48 hours of acute stroke reverted to normal sinus rhythm.

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.

QRS interval

In present study Prolonged QRS interval was found in 31 patients (25.4 %) out of 122 patients at the time of admission, including 17 patients (25.8 %) in ischemic group and 14 patients (25%) in hemorrhagic group. After 48 hrs of stroke it was found that out of those 31 patients with prolonged QRS interval only 19 (15.6%) had still prolonged QRS interval, including patients (13.6 %) in ischemic group and 10 patients (17.9%) in hemorrhagic group.

QRS

Most of the patients of hemorrhagic stroke had ECG evidence of left ventricular hypertrophy. Their proportion was quite large when compared with sufferers of cerebral infarction (69% vs 15.51%).[10] Bozluoclay M et al left ventricular hypertrophy is detected more frequently in sufferers of hemorrhagic stroke (69%) than cerebral infarction (15.5%). A higher rate of occurrence of hypertension in patients with intra-cerebral hemorrhage could explain such difference.[12]

Goldstein gave a figure of 26% for this ECG change. But he gave an overall estimate of this illness, rather than acute stroke, forms the basis for left ventricular hypertrophy and Bundle branch blocks.[10] The underlying mechanism is volume/pressure overload.

Arruda WO observed 21.8% patients with acute cerebrovascular hemorrhagehad LVH.[13] In present study it was found that out of 122 patients enrolled in this study, 19 patients (15.6%) had LVH as per ECG finding, 11 were (16.7%) of ischemic group and 8 (14.3%) of hemorrhagic group. Only 1 patient (0.8%) had RVH and also 1 patient (0.8%) had low voltage complex.

LVH was appear to be found in hypertensive patients usually in hemorrhagic group in almost all the studies in past, but in this study LVH was not so common and not appear to be so much associated with only hemorrhagic group, may be because of rural population & healthy life style.

QTc interval

Goldstein DS ***c***orrected QT intervals were prolonged in 45% of the patients with stroke, constituting the most frequent single ECG abnormality and the most common *new* ECG abnormality in stroke. QT prolongation occurred significantly more frequently in subarachnoid haemorrhage (71%) than other types of stroke (39%), and in intracranial haemorrhage (28/44, 64%) than in strokes without intracranial haemorrhage (40/106, 38%; x2= 8.42, $p < 0.01$).[9]

Arruda WO in 1992 observed 67.2% patients with acute cerebrovascular hemorrhage had prolonged QTc. 75 Akbar MA et al 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.[10] In present study QTc interval was found prolonged at the time of admission in 53 patients (43.4 %) out of 122 patients enrolled , including 28 patients (42.4%) in ischemic group and 25 patients (44.6%) in hemorrhagic group. While after 48 hours of stroke out of those 53 patients with prolonged QTc interval, only 28 patients (23%) show prolonged QTc interval, including 17 patients (25.8%) in ischemic and 11 patients(19.6%) in hemorrhagic group.

Hence the prolongation of QTc interval was the major finding observed at the time of admission (usually all the patient enrolled had presented within 24 hours and ECG was done as soon) and in repeat ECG done after 48 hrs of stroke onset normal QT interval was found (in whom there was QTc prolongation at the time of admission). Hence this finding is comparable and matching to all the studies done in past.

P-wave

In present study P-wave abnormalities including p-pulmonale found in 8 patients (6.6%), wide biphasic p-wave in 8 patients (7.6%) and broad p-wave in 2 patients (1.6%) at the time of admission and after 48 hrs of stroke p-pulmonale was found in 8 patients (6.6%), wide biphasic p-wave in 7 patients (5.7%) and broad p-wave

in 2 patients (1.6%). These findings appear to be persistant, hence may or may not be associated with ECG changes in acute stroke, likely related to smoking / underlying COPD, etc.

Q-wave

According to Goldstein stroke patients had an increased frequency of pathologic Q waves (30 patients, 20%) and left ventricular hypertrophy (39, 26%), but these were not new findings at the time of the stroke.[9] Ebrahim K et al observed pathological Q-waves in 12.7 % (33/262).[14]

In present study out of 122 patients enrolled, Q-wave found in 11 patients (9%), including 9 patients (13.6%) in ischemic and 2 patients (3.6%) in hemorrhagic group, which persisted even after 48 hours in all of those. Hence the Q-wave observed in any studies appear to be due to old changes, not appear to be because of acute stroke.

Ischemic changes

Arruda WO observed 34.5% patients with acute cerebrovascular hemorrhage had ischemic T and ST changes.[13] Goldstein DS states ST-depression and T-inversion were more common manifestations of ischemic change than ST-elevation (46.66% vs 15.5%). This was true irrespective of the stroke type.[9] In present study ischemic changes were observed in the form of ST and T-wave changes. ST segment elevation was found in total of 14 patients (11.4%) out of 122, including 8 patients (12.2%) in ischemic group and 6 patients (10.7%) in hemorrhagic group.

While ST segment depression was found in total of 20 patients (16.4%) out of 122, including 14 patients (21.2%) in ischemic group and 6 patients (10.7%) in hemorrhagic group. These changes were found to persist even after 48 hours of acute stroke. There were 44 patients (36.1%) out of 122 patients enrolled in this study in which T-wave inversion seen, including 28 patients (42.4%) in ischemic group and 16 patients (28.6%) in hemorrhagic group and these changes were found to persist even after 48 hours of acute stroke.

T-wave inversion was the 2nd most common finding observed (after QTc interval prolongation) in this study, followed by ST segment changes. ST and T-wave changes are comparable with other studies, and results are comparatively similar to above studies.

U-wave

Goldstein DS in 1979 observed presence of U-waves in 13 % of stroke patients.[9] Arruda WO observed 12.7% patients with acute cerebrovascular hemorrhage had U-wave.[13] In present study 9 patients (7.4%) out of 122, including 4 patients (6.1%) of ischemic group and 5 patients (8.9%) of hemorrhagic group, found to have presence of U-wave.

These findings appear to be comparable with above two studies.

In SAH

Goldstein observed the QTc prolongation more commonly in patients with SAH (20/28, 71%) than in other types of stroke, Byer et al assessed 29 patients with SAH, observing that 67% of ECG suggested a pattern of ischemia associated with a prolonged QT interval and Rudehill et al, in a study of 22 patients, prolonged QT intervals (75%), prominent U waves (45%), and cerebral T waves (15%).[9,15,17] In present study ischemic group includes 66 patients (54.1%) and hemorrhagic group includes 56 patients (45.9%).

Further, hemorrhagic group includes 51 patients with parenchymal hemorrhage, 4 patients (3.3%) with SAH and 1 patient (0.8%) with SDH. Out of 51 patients with parenchymal hemorrhage 2 patients also have SAH, means there are total 6 patients (4.9%) with SAH. There were total 6 patients with SAH out of which 5 patients (83%) had prolonged QTc interval, 3 patients (50%) show ST and T-wave changes and 4 patients (66.66%) with rhythm disorder including 3 patients (50%) with bradycardia and 1 (16.66%) with tachycardia. QTc prolongation was the most common finding observed in SAH, along with ST and T-wave changes and rhythm disorders. These all findings are comparable with all above studies mentioned and other old studies on ECG changes in SAH patients.

Overall ECG findings

In present study the ischemic changes in the form of ST and T wave changes along with presence of Q-wave were found in 61 patients (50%) including 38 patients (57.6%) in ischemic and 23 patients (41.1%) in hemorrhagic group. While non-ischemic changes were found in 55 patients (45.1%) including 26 patients (39.4%) in ischemic and 29 patients (51.1%) in hemorrhagic group.

QTc prolongation at the time of admission was the most common finding observed i.e. in 53patients (43.4%), followed by T-wave inversion i.e. in 44 patients (36.1%) is the 2nd most common finding. Whereas different types of arrythmias (including sinus tachycardia, sinus bradycardia, AF, VPCs, BBB, Heart blocks) as a whole are the most common finding observed in this study i.e. in 69 patients (56.6%) at the time of admission.

Hardly any study is there in literature about some ECG findings like PR interval prolongation, QRS interval prolongation, P-wave abnormalities, etc. in acute stroke. In present study, PR interval prolongation was observed in 10 patients (9.2%) at admission (6 from hemorrhagic and 4 from ischemic group), out of which 4 patients reverted to normal sinus rhythm after 48 hours of acute stroke (all of these 4 were from hemorrhagic group).

There was one patient in hemorrhagic group in which complete heart block was observed at the time of admission, which on 2nd ECG after 48 hrs of acute stroke, reverted to normal sinus rhythm.

Prolonged QRS interval was found in 31 patients (25.4 %) out of 122 patients at the time of admission, including 17 patients (25.8 %) in ischemic group and 14 patients (25%) in hemorrhagic group. After 48 hours of stroke, 12 (8.6%) reverted to normal QRS interval. Hence prolonged QRS interval may be considered among the ECG findings seen in acute stroke, which appears to revert lateron with time.

P-wave abnormalities including p-pulmonale found in 8 patients (6.6%), wide biphasic p-wave in 8 patients (7.6%) and broad p-wave in 2 patients (1.6%) These findings appear to be persistant, hence may or may not be associated with ECG changes in acute stroke. Likely related to smoking / underlying COPD, etc.

Limitations of the study

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.

CONCLUSION

In this prospective hospital based observational study QTc prolongation followed by T-wave inversion followed by ST segment changes were the most frequent ECG changes observed in patients with acute stroke. Various types of arrhythmias like sinus tachycardia, sinus bradycardia, AF, VPCs, BBB, Heart blocks, etc. were also among the common ECG findings. Other finding like LVH, RVH, LAD, RAD, P-wave abnormalities, Pathological Q-wave, U-wave, etc were less frequent observed. Two types of strokes manifest the more or less similar ECG changes.

Further in this study, QTc prolongation followed by ST and T-wave changes and rhythm disorders, were the most common finding observed in SAH among hemorrhagic group.

Furthermore ECG findings like PR interval prolongation, QRS interval prolongation and P-wave abnormalities (Hardly any study is there in literature about these ECG findings) were additional findings in this study.

PR and QRS intervals prolongation appear to occur in acute stroke which normalizes with time, while p-wave abnormalities appear to be old finding. PR interval prolongation appears to occur more in hemorrhagic group and findings are seem to be reversible, most likely related to raised ICT in case of hemorrhagic stroke. Hence PR prolongation may be taken as a marker for hemorrhagic stroke and need further evaluation in future.

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

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Smith WS, English JD and Johnston SC. In: Longo DL, Fauci AS, Kasper DL, Hauser, Jameson JL, Loscalzo J, editors. Harrrison`s principles of internal medicine. 18th ed. New York: McGraw-Hill. 2011;370:3270.
2. Ince B, Celik Y, Bingol H, Harmanci H, Denktas H. Electrocardiographic findings and prognosis inischemic stroke. Cerrahpasa J Med. 1998;29:70-4.
3. Fentz V, Gormsen J. Electrocardiograph patterns in patients with acute cerebrovascular accidents. Circulation. 1962;25:22-8.
4. Oppenheimer SM, Hachinski V. The cardiac consequences of stroke. Neurol Din. 1992;10:167-76.
5. Melville KI, Blum B, Shistr HE. Cardiac ischemic changes and arrhythmias induced by hypothalamic stimulation. Am J Cardiol. 1963;12:78.
6. Anand K, Chowdhury D, Singh KB, Pandav CS, Kapoor SK. Estimation of mortality and morbidity due to stroke in India. Neuroepidemiology. 2001;20:208-11.
7. Cropp D, Manning GW. Electrocardiographic changes simulating myocardial ischemia and infarction associated with spontaneous intracerebral hemorrhage. Circulation. 1980;12:25.
8. Venkatesan S, Rare skills in medicine: Diagnosing stroke with the help of electrocardiogram. Editor Venkatesan S. 2010;11:28.
9. Goldstein DS. The electrocardiogram in stroke: Relationship to pathophysiological type and comparison with prior tracings. Stroke. 1979;10:253-9.
10. Akbar MA, Awan MM, Haider SA, Choudhry GM. Stroke; electocardiographic changes, Professional Med J Mar. 2008;15(1):91-5.
11. Stober T. Cardiac arrhythmias in subarachnoid hemorrhage. Acta Neurochir. 1998;93:37-44.
12. Bozluoclay M, Ince B, Celik Y, Harmanci H, Llerigelen B, Pelin Z. Electrocrdiographic findings and prognosis inischemic stroke. Neurol Ind. 2003;51:500-2.
13. Arruda WO. Electrocardiographic findings in acute cerebrovascular hemorrhage. Arq Neuro-psiquiat (sao paulo). 1992;50(3):269-74.

14. Ebrahim K, Mohamadali A, Majid M, Javad A. ECG changes in acute ischemic cerebral stroke. The Journal of Applied Research. 2012;12(1).
15. Byer E, Ashman R, Toth LA. Electrocardiogram with large upright T waves and long QT intervals. Am Heart J. 1947;33:796-806.
16. Rudehill A, Gordon E, Sylven C. A study of ECG abnormalities and myocardial specific enzymes in patient with subarachnoid hemorrhage. Acta Anaesth Scand. 1982;26:344-50.

Cite this article as: Kumar S, Sharma GD, Dogra VD. A study of electrocardiogram changes in patients with acute stroke. Int J Res Med Sci 2016;4: 2930-7.