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STUDY OF ELECTROCARDIOGRAPHY CHANGES IN STROKE IN YOUNG PATIENTS

General Medicine

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ABSTRACT

Background: Cerebrovascular accident(CVA) plays an important role in the mortality and mortality of adults causing serious medical socio economic and rehabilitation problems. **Objective:** To determine the frequency and variations of ecg changes in the "CVA" and its relation to mortality in different types of strokes. **Methods:** CT-scan, ECG studies done on patients admitted into our institution with signs and symptoms of stroke ECG was recorded in these patients within 24 hours of admission. patients follow up was done to know the prognosis **Results:** ECG abnormalities noted in cerebral ischemic patients were Prescence of T wave inversions(23.1%) , ST segment depression (20.5%) followed by QTc prolongation(7.7%)and U waves (5.1%).In cases of hemorrhagic stroke patients T wave inversions(54.5%) and U waves (18.2%), ST segment depression(18.2%) Mortality was higher in hemorrhagic group(36.4%) compared to ischemic group (10.3%).Studying ECG changes will provide insight in prognosis . **Conclusion:** ECG changes occurred very commonly in acute stroke. The changes are independent of the nature of stroke. T wave inversion and ST segment depression are the common ECG abnormalities in ischemic stroke and T wave inversions in hemorrhagic stroke. Mortality Was higher in patients with abnormal ECG

KEYWORDS

Electrocardiography (ECG), Cerebrovascular accident (CVA), Intracranial hemorrhage (ICH)

INTRODUCTION

Ischemic and hemorrhagic strokes, two of the most prevalent and deadly conditions of cerebrovascular diseases. With 6.2 million people dying from stroke in 2015, an increase of 830,000 since year 2000, stroke is now the second biggest cause of death in the globe.

10% of all strokes are caused by ICH, and 35 to 45% of patients pass away within the first month. Blacks and Asians have relatively high incidence rates. The majority of hemorrhages are caused by hypertension, coagulopathy, sympathomimetic drugs (cocaine, methamphetamine), and cerebral amyloid angiography. The risk increases with advancing age and excessive alcohol use, and cocaine and methamphetamine use is one of the leading causes among the young (age 45 years) [1]

According to World Health Organization guidelines, a stroke is characterized by rapidly emerging clinical symptoms of a localized, occasionally widespread disruption of brain function that lasts more than 24 hours or results in death with no other obvious cause other than vascular origin.

Although a number of research on CVA in young people included people from second to fourth or fifth decade, most studies on young people and stroke include people under the age of 45. Although the etiology may differ depending on the age group, the majority of the risk factors apply to all age groups. However, some factors are only relevant to young people.

Young people who suffer from strokes could suffer terrible effects on themselves, their families, and society as a whole. Most of the studies have examined the risk factors for stroke in young people, however given that it affects the younger generation, further research is necessary to identify and change these risk factors [2]

In young adults (ages 15 to 45), stroke is a common occurrence, accounting for about 3% of cerebral infarctions in normal series. This group is likewise remarkably diverse in terms of causation. H.P. Adams and colleagues found over 40 potential etiologies among 144 of these cases. However, three types could account for the majority of strokes:

1] Atherosclerotic thrombotic infarction
2] Heart-related embolism
3] Non atherosclerotic vasculopathies (arterial trauma, dissection of the carotid artery, moyamoya, lupus erythematosus, drug induced vasculitis). Hematologically related disorders-use of oral contraceptives, the postpartum state, and other hypercoaguable state in 15 percent patients [3]

Numerous central nervous system disorders, including subarachnoid haemorrhage, head trauma, intracranial space-occupying lesions, and meningitis, have been linked to electrocardiographic abnormalities. Since then, other instances of ECG abnormalities in strokes have appeared in the literature.

There are two reasons why the electrocardiographic alterations seen in cerebrovascular accidents

1] A few ECG anomalies are thought to be caused by cerebrovascular accidents. These alterations could resemble ischemic heart disease.
2] The ECG shows alterations that are indicative of the heart disease process. Myocardial infarction evidence may offer a hint as to the cause of stroke. Electrocardiographic abnormalities can also be caused by other illnesses such hypertension, valvular heart disease, myocardial infarction, and left ventricular hypertrophy, which are linked to stroke.

Despite the numerous investigations, mortality and morbidity can be prevented with early identification and treatment.

Therefore, research has been done on the ECG and computed tomography brain changes in young patients who have had strokes.

MATERIALS AND METHODS

Study Design

Hospital based Prospective Study.

Source Of Data

The study shall be conducted among the patients being admitted to AL AMEEN MEDICAL COLLEGE and DISTRICT HOSPITAL VIJAYAPURA from JAN 2021 TO JUNE 2022 diagnosed as stroke considering the inclusion and exclusion criteria

Inclusion Criteria

1] Age less than 45 years
2] Patient admitted in general medical ward/neurology ward with abrupt onset of focal neurological deficit of vascular origin (ischemic or hemorrhagic) and persisting for more than 24 hours
3] Those presenting within 7 days of stroke

Exclusion Criteria

1] Head trauma
2] Age more than 45 years
3] Age less than 15years
4] Pregnant woman or postpartum within 30 days
5] Subdural hemorrhage
6] Neuroinfections causing weakness
7] CNS tumors with weakness(malignancy)
8] Neurological dysfunctions secondary to metabolic encephalopathy.

Sample Size Estimation

With anticipated prevalence of Stroke 105 to 152 per 100000

population[4], the study would require a sample size of 45 patients with 95% level of confidence and 3% absolute precision, Using Statulator software (http://statulator.com/SampleSize/ss1P.html)
Formula used
$n=z^2 p*q$
d^2

Where Z= Z statistic at α level of significance
d^2= Absolute error
P= Proportion rate
q= 100-p
Minimum sample size= 45
The sample size taken for study is 50

Protocol Of The Study
For each and every patient who met the inclusion and exclusion requirements,
1] A thorough medical history, including risk factors for stroke such hypertension, diabetes mellitus, dyslipidemia, a history of heart conditions, and smoking, was obtained.
2] A thorough neurological evaluation was performed
3] The following investigations were carried out: - Full blood count.

After a 10-hour fast, blood was drawn to measure blood sugar levels. lipid profile. Serum electrolytes

CT scan of brain: It was done within 24 hours of admission E cg recording was done within 24 hours of admission

Procedure For ECG Recording
1] The ECG machine was calibrated so that 1mV of signal causes a deflection of 1 cm on the ECG paper. ECG recording speed was 25 mm/sec.
2] The procedure was explained to patient/patient's bystanders.
3] Patient was placed in supine position.
4] Limb leads and chest leads were attached to the electrodes which was then placed on the patient after application of electrode gel in the following positions
A] Electrode on the Right Leg marked RL
B] Electrode marked LL is placed on Left leg. Both LL and RL are placed just above the ankles.
C] Electrode marked LA is attached to Left Arm and RA to Right Arm just above the wrist.
D] V_1- electrode in the 4th intercostal space just to the right of the sternum.
E] V_2- electrode on the 4th intercostal space just to the left of the sternum.
F] V_3- electrode placed midway between V_2 and V_4.
G] V_4- electrode in the mid clavicular line in the 5th intercostal space.
H] V_5- electrode in anterior axillary line at the same level as V_4.
I] V_6- electrode in mid axillary line at the same level as V_4.

12 lead ECG recording was done. In all cases, rhythm strip (lead II) was taken ECG printout was detached on which patient's name, inpatient number, date and time were written.

After the procedure, electrodes were removed and the sites were cleaned.

The following ECG criteria were applied for analysis:
Heart rate: Sinus bradycardia <60beats/min Sinus tachycardia >100beats/min

PR interval >0.2second: considered as prolonged
QRS width >0.1second: considered as wide

ST segment depression of 0.5mm or elevation of 1mm: considered abnormal

Rate corrected QT (QTc) >0.44second: considered as prolonged
T wave negative in lead II and V_4-V_6 : considered as abnormal Presence of very deep, widely splayed T wave inversions.

Exaggeration of U wave voltage.

Right Ventricular Hypertrophy (RVH)
1] A tall R wave in lead V_1, equal to or larger than the S wave in that lead
2] Right axis deviation
3] T wave inversion in V_1-V_4 chest leads

Left Ventricular Hypertrophy (LVH)
1] 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
2] A high voltage R wave (11 to 13mm or more) is seen lead aVL when the QRS axis is horizontal
3] Inverted T waves in leads with tall R waves
4] Left axis deviation

As thus, the study's data was statistically analysed.

Statistical Analysis
Statistical Methods
Chi square analysis: It is a method of testing the significance of difference between two proportions. It has the advantage that it can be used when more than two groups are to be compared.

Descriptive statistics in the form of percentage and number of cases were considered in the study.

Statistical Software
The statistical operations were done through SPSS (Statistical Presentation System Software) for Windows, version 17. Significance was taken at 5% level.

RESULTS
Fifty patients in total are included in the project. Between January 2021 and June 2022 at AL AMEEN Medical College and VIJAYAPURA DISTRICT HOSPITAL 33 of the 50 cases were men and 17 were women.

Table 1: Age Distribution

Age(Years)	No. of Patients	Percentage
< 20	1	2.0
20 – 24	5	10.0
25 – 29	11	22.0
30 – 34	9	18.0
35+	24	48.0
Total	50	100.0

In patients with stroke, ECG abnormalities were frequent. ECG alterations were discovered to be significant in 38 out of 50 individuals. When compared to hemorrhage (24%) incidence, ischemia (78%) was more prevalent. 11 of the hemorrhage instances involved cerebral bleeding. In the ischemia group, 29/39 patients (74.35%) had ECG abnormalities. 9/11 individuals (81.81%) who were in the hemorrhagic group experienced ECG abnormalities. Though statistically significant .

(p=0.001), the anomalies were more prevalent in the hemorrhagic group (81.81%) than the ischemia group (74.35%).

Table 2- Relationship Between Stroke Type And Ecg Changes

Type of stroke	Total cases	ECG changes			
		Normal		Abnormal	
		Total	%	Total	%
Ischemic	39	10	25.641	29	74.
Hemorrhagic	11	2	18.182	9	81.818

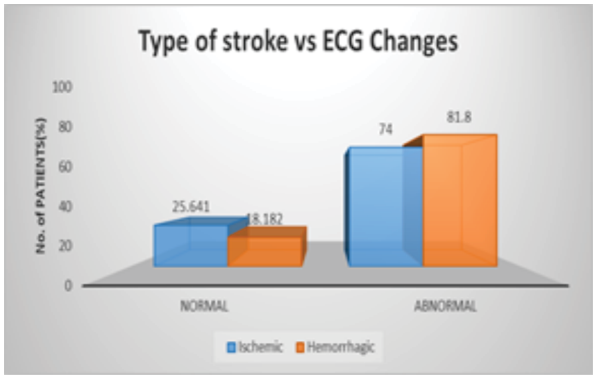

Figure No 1: Bar Graph Showing Types Of Stroke And ECG Changes,

ECG CHANGES

The ECG abnormalities happened regardless of the kind of stroke, or, to put it another way, they were distributed equally among the different forms of stroke. Further examination of the patients was conducted

Sinus Tachycardia: This occurred in 11 patients (28.20%) with ischemia

Sinus Bradycardia: Seen in 3patients (7.7%%) with ischemia. However, bradycardia carried comparatively lesser significance to sinus tachycardia.

P Waves: no p wave abnormality seen in both ischemic and hemorrhagic stroke

QT_C Prolongation: 3 ischemic patients (7.7%) and 1 hemorrhagic patient (9.1%) had QT prolongation defined as corrected QT>446msec.Among these 1 had borderline elevations.

The 3 major QT prolongations occurred in: -

1] One case of cerebellar infarct
2] Ischemic in 2 cases one in right capsule ganglionic lesion(subcortical) and other in left capsule ganglionic region(subcortical)
3] One case of right capsule ganglionic bleed (hemorrhagic stroke)

T wave Inversions: 9 out of 39 (23.1%) ischemic patients and 6 out of 11 (54.5%) patients had T wave inversions which is statistically significant (0.044)

ST Segment: 8 ischemic patients (20.5%) and 2 hemorrhagic patients (18.2%) had ST depressions

U Waves: 2 ischemic patients (5.1%) and 2 hemorrhagic patients (18.2%) had u waves

Arrythmias: 5 patients among ischemic group had atrial fibrillation

There were 8 fatalities in total. The hemorrhagic group 4/11 is where the majority of deaths took place. 4/39 of the fatalities in the ischemic group had ECG abnormalities. It is clear from the data that patients with ST depression (25%) and t wave inversion alterations (33.33%) had higher mortality in the ischemic group, while patients with T waves (66.66%) had higher mortality in the hemorrhagic group. When compared to the ischemia group (4/39), hemorrhagic cases (4/11) had higher mortality, but the difference was not statistically significant (p=0.5281).

Compared to patients with normal ECGs, those with aberrant ECGs had a higher mortality rate.

DISCUSSION

Our study included age groups above 15yrs. Majority of the patients in the study were less than 20(2%) and between 21-24yrs (10%) followed by 25-29yrs (22%). Less number of patients were between 30-34yrs (8%), 35-39(18%) and more than 35 was 48%.

According to study conducted by Jeyaraj Durai Pandian et al mean age of patients with stroke was 50 - 67 years respectively.[5]

The average age at stroke dramatically dropped from 71.2 years in 1993/1994 to 69.2 years in 2015 (p 0.0001), according to Brett M. Kissela et al In 2015, 18.6% of all strokes occurred in people under the age of 55, up from 12.9% in 1993/1994.[6]

When compared to earlier study periods, regression modelling revealed a shift toward younger strokes as a significant change over time (p 0.002). Both Western and Asian patients saw considerably higher rates of stroke incidence among individuals 20 to 54 years old.

32% of individuals in the current study had hypertension, which is consistent with findings from investigations by Pandiyan et al. and Watila et al. The two most prevalent risk factors were smoking (42%) diabetes mellitus (42%), which is identical to the figures observed by Pandiyan et al.88, which were 23.6% and 49.8%. The next condition was hyperlipidemia, which was present in 12% of the cases. This can be contrasted with the Watila et al. study from 1989, which found 10%.[7][8]

According to prospective studies conducted in Framingham, hypertension is the most prevalent risk factor for stroke. Elevated systolic and diastolic levels increase the risk; the association is almost linear and unaffected by age or sex. Stroke risk is decreased when hypertension is managed with anti-hypertensive medications [9]

In the current study, a large majority of stroke patients (76%) showed ECG abnormalities. This is consistent with earlier research by Goldstein and Bozluolclay, in which 92% and 62.1% of patients, respectively, had ECG abnormalities.[10][11]

Only 8% of the individuals in our study had increased QTc prolongation.

T wave inversions, st depression, tachycardia, bradycardia, and u waves are all present in a percentage of cases (30%), respectively.

Similar observations were found in studies

1] Dr. Jitendra Kumar et al. conducted a cross-sectional observational study on 109 patients who had symptoms of stroke and were diagnosed on the basis of clinical symptoms and CT scan results. The patients were admitted to the emergency and outpatient departments of Narayana Medical College and Hospital. Following confirmation of the stroke diagnosis, an ECG was performed on every patient who had a stroke-related condition in 76% of cases [12]
2] From 2014 to 2017, Gurpal singh sachadeva et al. carried out a prospective observational study at Rajindra Hospital Patiala. The study comprised 80 acute stroke patients who were admitted to medical wards with a diagnosis of CVA supported by CT/MRI. T wave inversion, which was present in 32.5% of patients, was the most frequent ECG abnormality seen. The most frequent ECG abnormality seen in patients of intracerebral hemorrhage was QTc prolongation. Other ECG alterations included ST depression (25% of patients), bradycardia (12.5%), tachycardia (5%), atrial fibrillation (3.75% of cases), and U waves (7.5% of cases) [13]
3] D Nagaraj performed a study on 100 instances of ischemic cerebral infarction admitted to NIMHANS, including retrospective analysis of 50 fatal cases and prospective examination of 50 non-fatal stroke patients. 12 lead ECGs were taken in all instances, and the results showed that: 1. Ischemic cerebral infarction had a 62% incidence of electrocardiographic abnormalities.

ST segment shift and abnormalities in T waves were the most frequent set modifications, with incidences of 28% each.

There was no discernible difference between the fatal and nonfatal groups' electrocardiographic data.

A sizable majority of individuals had sinus bradycardia and sinus tachycardia.

Under-40-year-olds made up 18% of our series' cases of cerebrovascular accidents.

While aberrant T waves were more common in older patients, they were also more common in younger patients in the nonfatal group, perhaps indicating their general nature (due to stroke)

A subsequent ECG test six months later clearly demonstrates that sinus tachycardia, bradycardia, and conduction abnormalities are primarily momentary during a stroke and are likely related to the stroke itself [14]

4] Jani Pirinen et al. conducted a retrospective study on data from the Helsinki Young Stroke Registry at the department of Neurology and Cardiology, Helsinki University Hospital with 1008 consecutive patients with first-ever ischemic aged 15 to 49 years admitted in hospital between 1994 and 2007 and found that an elevated risk of all cause and cardiovascular mortality in young adults is associated with a higher heart rate during the subacute phase after stroke. Only higher all cause mortality is linked to a longer QTc interval. Additional research is required on P wave characteristics and their potential relationship to mortality [15]

It has been proposed that autonomic nervous system modifications, neuronal myocardial shocking, and catecholamine-mediated damage are the causes of repolarization and ischemic like ECG changes seen in

patients with acute stroke. Some have related this to lesions in the insular cortex, which have been linked to cardiac abnormalities such myocytolysis, arrythmias and ischemic-like alterations. This can often make it challenging to diagnose cardiac problems in patients who have just suffered an acute stroke [16]

CONCLUSION

1] Acute cerebrovascular incidents frequently involve ECG abnormalities.
2] The ECG changes happen regardless of the kind of stroke, i.e., they appear in both the ischemic and hemorrhagic groups equally.
3] ST depression, t wave inversion, QTc prolongation, and positive U waves were the main ECG abnormalities.
4] Mortality rates are increased in stroke patients who have ECG abnormalities. Therefore, prognostic indicators should be discovered and efforts should be made to control diabetes mellitus and hypertension in order to lengthen the survival period and decrease morbidity and mortality in patients of cerebrovascular accidents.
5] In addition to identifying and addressing ECG abnormalities, Specific pathology, such as ischemia and hemorrhage, should be treated
6] All stroke patients admitted should undergo holter monitoring to check for any ECG abnormalities.

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