



CARDIAC EVALUATION IN PATIENTS WITH STROKE WITH SPECIAL REFERENCE TO ECHOCARDIOGRAPHY : A TERTIARY CARE HOSPITAL BASED STUDY IN JHARKHAND

Medicine

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ABSTRACT

Objectives: To study the different changes in ECG and echocardiographic patterns in the cases of cerebrovascular accidents and to assess whether these different changes have got any prognostic significance in these cases.

Method: 100 patients of acute stroke were considered and ECG and 2D echo of these patients was done within 24 hours of admission. In hospital follow-up was done to know the prognosis of all the patients.

Results: ECG abnormalities noted among cerebral infarct group were presence of U-waves (51.47%), prolonged QTc (36.76%) were most common followed by Twave inversion (30.88%), and ST segment depression (30.88%). In cases of hemorrhagic stroke, ST depression (56.26%) and U-wave (56.26%) were the most common abnormalities. LV dysfunction was the most common 2D echo abnormality in both the stroke types - 23.53% and 56.26% i.e., in infarct and hemorrhage groups respectively. Mortality was high in patients with abnormal ECG (79%) ($p > 0.5$). 79% of patients survived with abnormal ECG. So was statistically insignificant ($p > 0.5$). Mortality was high in patients with abnormal 2D echocardiography (90.91)

Conclusion: ST segment depression, QTc prolongation and U-waves are the common ECG abnormalities in hemorrhagic strokes. QTc prolongation and Uwaves are the common ECG abnormality in ischemic stroke. LV dysfunction is the most common 2D echocardiographic abnormality in stroke patients. ECG abnormalities in stroke patients do not have any prognostic significance. LV dysfunction has prognostic significance in predicting mortality in CVA.

KEYWORDS

Stroke; ECG; 2D echocardiography.

INTRODUCTION

Cerebrovascular accident (CVA) or stroke is the most common life threatening disorder. It is the third leading cause of death in the developed countries after cardiovascular disease and cancer¹. Cerebral infarction is responsible for about 80% of all first ever in a lifetime strokes. Primary intracerebral hemorrhage (PICH) for 10% and subarachnoid hemorrhage for 5%. The incidence of stroke worldwide is 179 per 1,00,000 population in various parts. In Western countries overall prevalence rate is 794 per 1,00,000 population. CVA or strokes are capable of causing crippling morbidity in young as well as elderly individuals. They also have marked social, psychological and economic implications. Due to its wide prevalence and its high cost in economic terms as well as human disability, cerebrovascular accidents have evoked much interest in medical fraternity. Many studies have shown CVA associated with ECG changes and wall motion abnormalities of 2D echo. The changes of ECG in CVA were reported in many studies. (Bayers et al², 1947; Burch et al³, 1954; Dimant J et al⁴, 1977). Changes occurring in ECG following stroke were T-wave, U-wave, ST-segment, QT-interval and various arrhythmias, these ECG changes may resemble those of myocardial ischemia or sometime myocardial infarction. Earlier it was thought that CVA is preceded by changes in cardia, but Burch et al³ (1954) disproved this view and found ECG changes in young patients with CVA in whom others causes like IHD for ECG changes could not be accounted. Along with ECG changes many studies have shown wall motion abnormalities on 2D echo following stroke, especially with subarachnoid hemorrhage (Davies KR et al⁵, 1991; Sakka SH et al⁶, 1999).

Hence, study was undertaken to know the ECG and 2D echocardiography changes (wall motion abnormalities) in different types of cerebrovascular accidents. To know whether such changes have any prognostic significance.

MATERIALS AND METHOD

The material of the study comprised of 100 patients admitted in RIMS Ranchi between october 2017 to April 2018.

Inclusion Criteria:

Cases of CVA (CT scan proved) admitted within 72 hours after the onset of stroke were selected for the study, patients admitted beyond 72 hours after onset of stroke were excluded as the incidence of ECG changes beyond this period were infrequent.

After admission a detailed history regarding the temporal profile of the

stroke including history of risk factors like hypertension, diabetes mellitus, smoking, history of IHD and rheumatic heart disease were obtained.

Detailed neurological examination including fundoscopy and cardiovascular examination were carried out in all the cases. The diagnosis of CVA was made on the basis of following criteria

- 1.Temporal profile of clinical syndrome
- 2.Clinical examination
- 3.CT scan of brain

A 12 lead ECG and 2D echocardiography was done within 24 hours of admission. All patients were subjected to investigations like:

1. Complete blood count
2. Erythrocyte sedimentation rate
3. Renal function test
4. Serum electrolytes
5. Lipid profile

Results were analyzed with reference to age, sex and risk factors and clinical examination.

Each case was subjected to 12-lead ECG and 2D echo within 24 hrs of admission and the following criterions were applied in their analysis

ECG Criterias in the study:

- Heart rate less than 60/min was regarded as bradycardia and heart rate
- exceeding 100/min was regarded as tachycardia.
- ST segment depression of 0.5 mm or elevation of more than 1 mm were taken
- abnormal.
- T-wave was considered abnormal when inversion of T-waves in which it should
- have been upright i.e., I, II V3-V6 may be variable in III, aVL, V, and V2.
- QTc prolongation: The QT interval is measured from the beginning of the QRS
- complex to the end of T-wave, the rate corrected QTc is obtained by dividing the
- actual QT by the square root of the RR-interval (both measured in seconds). QTc
- is taken as prolonged if it is more than 0.44 m-seconds.

- U-wave was taken as significant when exaggeration of U-wave voltage was noted
- when appeared in more than 2-leads when appeared in leads in which it was not
- normally seen (other than V3-V4).
- RVH: R-waves in right chest leads and the R-wave may be taller than the S-wave
- in lead VI; persistent S-wave seen in V5-V6.
- LVH: If the sum of the depth of the S-wave in lead V, and the height of the R wave
- in either lead V5 or V6 exceeds 35 mm, an R-wave of 11 to 13 mm or more
- in lead aVL is another criteria for LVH.
- Echocardiographic Criterias in the study

Philips exe version 11.0 2D echo with color Doppler was used:

- LV ejection fraction was used to assess LV systolic function. Doppler indices (A>E across mitral valve) were used look for LV diastolic dysfunction.
- EF was calculated using Teichs method.
- Mitral valve opening using planimetry was used to look for mitral stenosis apart from this valve thickening and doming of AML and paradoxical motion of PML were used.
- Flow across aortic valve was used to look for aortic stenosis including opening (severe AS if AVO <8 mm).
- Color imaging and doppler were utilized for any regurgitation.
- 2-dimensional imaging was used to rule out cardiac thrombus.

RESULTS

During the period of October 2017 to April 2018, 12,623 were medical admissions and 385 were stroke patients,

among this stroke patients were selected for the present study who met inclusion and exclusion criterion were analyzed with regard to Echocardiography and ECG changes in stroke patients and the following observations were noted.

Table-1: Age and sex distribution in stroke patients

| Age | Male | Female | Total | Percent |
|-------|------|--------|-------|---------|
| 21-30 | 4 | 2 | 6 | 6% |
| 31-40 | 7 | 3 | 10 | 10% |
| 41-50 | 15 | 5 | 20 | 20% |
| 51-60 | 20 | 16 | 36 | 36% |
| 61-70 | 5 | 9 | 14 | 14% |
| 71-80 | 6 | 5 | 11 | 11% |
| 81-90 | 1 | 2 | 3 | 3% |
| Total | 58 | 42 | 100 | 100% |

As evident from the above table, the incidence of stroke in the present study was more common in 5th and 6th decade and there was slight male (58%) preponderance compared to females (42%) making male-female ratio of 1.4:1.

Table-2: Incidence of Risk Factors in stroke patients

| Risk factor | No of cases | percentage |
|-------------------|-------------|------------|
| Hypertension | 45 | 45% |
| Diabetes Mellitus | 13 | 13% |
| Smoking | 28 | 28% |
| Hyperlipidemia | 8 | 8% |
| History of stroke | 6 | 6% |

The above table shows that hypertension was the most common risk factor and was present in 45% of the cases, followed by smoking in 28%, diabetes mellitus in 13% of patients, history of stroke in 8%, and hyperlipidemia in 6% of stroke patients.

Table-3: Relationship between stroke types and ECG changes

| Type of Stroke | Total no of cases | ECG Changes | | | |
|----------------|-------------------|-------------|-------|----------|-------|
| | | Normal | | Abnormal | |
| | | No | % | No | % |
| Ischemic | 68 | 22 | 32.35 | 46 | 67.64 |
| Hemorrhage | 32 | 7 | 21.8 | 25 | 78.12 |

In the above table, it is evident that ECG abnormalities were more common in patients of stroke. ECG abnormalities were more in hemorrhagic stroke (78.12%) compared to infarct (67.64%), which is statistically insignificant (p>0.05).

Table-4: Relationship between stroke types and echocardiography changes

| Type of Stroke | Total no of cases | ECG Changes | | | |
|----------------|-------------------|-------------|-------|----------|-------|
| | | Normal | | Abnormal | |
| | | No | % | No | % |
| Ischemic | 68 | 38 | 55.88 | 30 | 44.12 |
| Hemorrhage | 32 | 8 | 25 | 24 | 75 |

The above table showing echocardiography abnormalities in patients of stroke and was more common in patients of hemorrhagic stroke (75%) compared to infarct (44.125) and was statistically significant (p<0.01).

Table-5 : ECG changes in stroke patients

| ECG changes | Ischemic stroke (n=68) | | Hemorrhagic stroke (n=32) | |
|-----------------------|------------------------|-------|---------------------------|-------|
| | No | % | No | % |
| QTC prolongation | 25 | 36.76 | 16 | 50 |
| T-wave inversion | 21 | 30.88 | 9 | 28.13 |
| ST Segment depression | 21 | 30.88 | 18 | 56.26 |
| U waves | 35 | 51.47 | 18 | 56.26 |
| Tachycardia | 24 | 35.29 | 16 | 50 |
| Bradycardia | 0 | 0 | 2 | 6.25 |
| Atrial fibrillation | 5 | 7.35 | 0 | 0 |

From the above table, it is evident that ECG abnormalities among infarct group, U-wave (51.47%), QTC prolongation (36.76%) were the most common abnormalities followed by T-wave inversion (30.88%) and ST-segment depression (30.88%). In cases of hemorrhage group ST segment depression (56.26%) and U-wave (56.26%) were the most common abnormalities followed by prolonged QTc (50%) and T-wave inversion (28.13%).

Table-6 : Echocardiography changes in stroke patients

| Echo changes | Ischemic stroke (n=68) | | Hemorrhagic stroke (n=32) | |
|--------------------------|------------------------|-------|---------------------------|-------|
| | No | % | No | % |
| LV dysfunction | 16 | 23.53 | 18 | 56.26 |
| LV hypertrophy | 14 | 20.59 | 17 | 53.12 |
| Cardiac thrombus | 3 | 4.41 | - | - |
| Mitral valve abnormality | 14 | 20.59 | - | - |
| Aortic valve abnormality | 3 | 4.41 | - | - |
| Normal | 24 | 35.30 | 2 | 6.25 |

Table-7 : Echocardiography changes in stroke patients

From the above table, it is evident that echocardiography abnormalities among the infarct group, LV dysfunction (23.53%) was most common, followed by LV hypertrophy(20.59%) , mitral valve (20.59%) and aortic valve (4.41%) abnormality. In cases of hemorrhagic strokes again LV dysfunction (56.26%) was most commonest abnormality. Normal echo was seen in 35.30% of infarct and 6.25% in hemorrhagic stroke.

Table-8 : Relationship of mortality with abnormal ECG in stroke patients

| | Electro Cardiogram (ECG) | | | |
|-------|--------------------------|-------|----------|-------|
| | Normal | | Abnormal | |
| | No | % | No | % |
| Alive | 24 | 35 | 54 | 79 |
| Dead | 5 | 22.72 | 17 | 77.27 |

From the above table, it is evident that mortality was high in patients with abnormal ECG (79%) in contrast to normal ECG (22.72%) mortality was less.

Table-9: Relationship of mortality with abnormal ECHO in stroke patients

| | Echocardiography (ECHO) | | | |
|-------|-------------------------|-------|----------|-------|
| | Normal | | Abnormal | |
| | No | % | No | % |
| Alive | 44 | 56.41 | 34 | 43.59 |
| Dead | 2 | 9.09 | 20 | 90.91 |

From the above table, it is evident that mortality was high in patients with abnormal echocardiography (90.91%) (p<0.001) compared to normal echocardiography (9.09).

ECG Finding



Fig 1 LVH WITH STRAIN

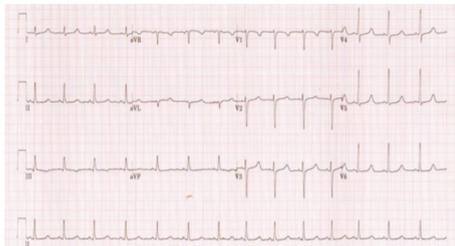


Fig 2 QTc prolongation

CT SCAN BRAIN IMAGES



Fig 3 INFARCT



Fig 4 HAEMORRHAGE

2D ECHO IMAGES

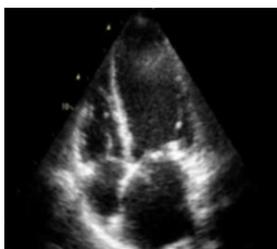


Fig 5 LV DYSFUNCTION

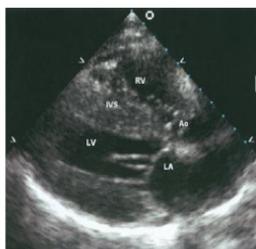


Fig 6LVH

DISCUSSION

A hospital based prospective study was done to know the ECG and echocardiography changes in stroke and whether they had any prognostic significance in stroke patients. In this study, CT scan was mandatory in the inclusion criteria to prove the stroke and type of stroke. Among the 100 patients 58 were males and 42 were females

(sex ratio was M:F - 1.4:1), age ranged from 24-92 years and the mean age of patients of alive and dead were 58.73 and 54 years respectively. The cases of stroke were more common in the 5th and 6th decade, making 50%, which is comparable to Venkataramana et al7 study in which the percentage of stroke cases above the age of 51 years was 41% and in the Carlo8 study (2003) was 71.8%. Stroke is one of the leading causes of death in many countries. Although there was a lack of unanimity, several factors have been reported to increase the risk of stroke. Reports from different countries have implicated different factors associated with high risk of stroke. To evaluate the risk factors, a prospective survey of a given population of the years as done in the Framingham Study was essential. The only epidemiological study of Abraham et al (1970) who found hypertension, diabetes mellitus, hypercholesterolemia and syphilis to be the risk factors associated in hemiplegia patients. Shaper et al9 in 1991 concluded that, hypertension, cigarette smoking and pre-existing IHD was found to be the major risk factors. In the present study, hypertension was present in majority of the cases i.e, 45%, which is comparable with that found in the studies of Smith10 (2005) and Carlos8 (2003) i.e., 87% and 48% respectively and next commonest risk factor was smoking (28%) and history of stroke (8%), which are comparable with that found in Smith (2005) i.e., 35.22% and diabetes mellitus was present in 13% of the patients in the present study and the least was hyperlipidemia. In this study, 68% of the patients has ischemic stroke, which was comparable with that found in the studies of Daniele et al11, Roy et al12 and Mikolich et al13 i.e., 78.20%, 1.00% and 93.33% respectively. 32% had stroke in the present study comparable with 21.80%, 29% and 6.66% in the Daniele et al, Roy et al and Mikolich et al study group. Increased QTc was seen in 32% of cases in Goldstein et al, while in our study it is 41%. T-wave inversion was seen in 15% by Goldstein et al while in our study it is 30%. STsegment depression was seen in 13% in Goldstein while in the present study it was 20%. U-wave was seen in 28% in Goldstein et al, while in our study it was seen in 40%. Atrial fibrillation was seen in 7.4% of cases which is seen in only 2% in Goldstein et al. In the present study, LV dysfunction in ischemic stroke was present in 23.53% of cases, which is comparable to the series of Gagliardi et al and Uma et al who reported 22% and 26% respectively. In the present study, LV hypertrophy in ischemic stroke was present in 20.59% of cases, which is comparable to the series of Gagliardi et al and Uma et al who reported 15% and 12% respectively. Mitral valve abnormality was present in 14% comparable to Uma et al who present 30%. Aortic wall abnormality in present study was 3% compared to the other studies it varied, Gagliardi et al and Uma et al 18.5% and 20% respectively. In infarct group echocardiography was normal in 35.30% (24 out of 68 patients) while LV dysfunction was seen in 23.53% (16 out of 68 patients) and LV hypertrophy in 20.59% (14 out of 68 patients) mitral valve abnormality in 20.59% (14 out of 68 patients) and aortic wall abnormality in 4.41% (3 out of 68 patients) and 3 patients had LA thrombus. In the hemorrhage group a high number of patients 18 out of 32 i.e., 56.26% had LV dysfunction, 12 out of 32 i.e., 37.50% had LV hypertrophy. None had LA thrombus, mitral valve or aortic valve abnormality and 25% were normal (8 out of 32). In the either group LV dysfunction was the most common abnormality noticed.

CONCLUSION

ST segment depression, QTc prolongation and U are the common ECG abnormalities in hemorrhagic strokes.

QTc prolongation and U-waves are the common ECG abnormality in ischemic stroke. LV dysfunction is the most common echocardiographic abnormality in stroke patients. ECG abnormalities in stroke patients do not have any prognostic significance. LV dysfunction has prognostic significance in predicting mortality in CVA

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