Original Research Article

Spectrum of electrocardiographic and echocardiographic changes in acute stroke - Our experience

Niveditha R[1*], Sai Lakshmi V.S.[1], Rageswari T[2], Lakshmi Manasa S[2]

[1]Assistant Professor, [2]Post Graduate
Department of General Medicine, Siddartha Medical College, Vijayawada, A.P., India
[*]Corresponding author email: **niveditharagiri@gmail.com**

Abstract

Background: Vascular diseases remains the chief cause of death and disability in industrialised countries. Clinical and experimental data suggest that some kind of neurologically mediated myocardial injury exists especially in subarachnoid hemorrhage but not as a manifestation of joint ischemic heart disease.

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

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

Results: ST segment depression (53.1%) and U-waves (56.2%) followed by QTc prolongation (0.5±0.7 ms) were the most common abnormalities in haemorrhage group. Whereas in infarct type of stroke U-wave was the most common ECG finding (50.0%) among infarct group followed by QTc (0.45±0.08 ms) and T-wave inversion (29.4%). None of the ECG changes had much significance on mortality and was statistically insignificant (p>0.05) with either ischemic or hemorrhagic stroke. LV dysfunction, the most common abnormality was (29.4%) in infarct and haemorrhage (46.9%) stroke. LV dysfunction did not show significant impact on mortality in either of stroke subtypes (p>0.05).

Conclusion: In our experience, both ECG and ECHO abnormalities in stroke patients do not have any prognostic significance predicting mortality in CVA.

Key words

Stroke, ECG, 2D echocardiography.

Introduction

Vascular diseases remains the chief cause of death and disability in industrialised countries. Clinical and experimental data suggest that some kind of neurologically mediated myocardial injury exists especially in subarachnoid hemorrhage but not as a manifestation of joint ischemic heart disease [1]. The electro-cardiac abnormalities following an acute stroke are frequent and seen in both ischemic and hemorrhagic stroke. The changes were seen in electrocardiogram (ECG) consist of repolarization abnormalities such as ST elevation, ST depression, negative T waves, and QT prolongation [2-12]. Left ventricular dysfunction and wall motion abnormalities persist with ECG [13]. To this purpose, we evaluated the spectrum of ECG in acute stroke patients and correlated with ECHO findings to assess stroke mortality.

Materials and methods

T Hundred patients admitted to Government General Hospital, Vijayawada during December 2014 to January 2016 were enrolled after satisfying inclusion and exclusion criteria. Ethics committee of our institute approved the study proposal. Patients with CVA (CT scan proved) admitted within 72 hours after the onset of stroke were enrolled. Stroke patients admitted beyond 72 hours were excluded. At admission, details regarding demography, clinical presntation, history of risk factors for hypertension, diabetes mellitus, smoking, history of Ischemic heart disease (IHD) and rheumatic heart disease were obtained.

ECG criteria

Heart rate less than 60/ min was regarded as bradycardia and heart rate, exceeding 100/ min was seen as tachycardia. ST-segment depression of 0.5 mm or elevation of more than 1 mm was 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, V1 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 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 V1, persistent S-wave seen in V5-V6. LVH: If the sum of the depth of the S-wave in lead V1 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.

2D Echo Criterion using Ultramark 6 2D echo with colour 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. 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). Colour imaging and doppler were utilised for any regurgitation. 2-dimensional imaging was used to rule out left atrial thrombus.

Statistical methods

Data was entered into excel spreadsheet and exported to spss-16 for statistical analysis. Continued data was presented as mean and standard deviation, Nominal data as numbers and percentages. Chi Square test and unpaired t-test were used to assess statistical significance

between two groups. A probability value less than 0.05 was considered significant.

Results

During the period of December 2014 to January 2016, hundred stroke patients were selected for the present study who met inclusion and exclusion criterion was analysed with regard to 2D echo and ECG changes in stroke patients and the following observations were noted. The mean age of the patients was 58.43±13.76. Hypertension was the most common risk factor comprising 45% followed by smoking 28%, past history of stroke 22%; diabetes mellitus 13% and hyperlipidemia 8%. Right sided hemiplegia was present in 51.47% in the infarct group, whereas in the hemorrhagic stroke it was 18.75%. Left sided hemiplegia was present in 22% in infarct group, whereas it was 6.25% among haemorrhage group. The headache was presenting complaint in 25% of patients in infarct group and 65.62% of patients in haemorrhage group. Vomiting was present in 19.11% among infarct patients whereas in hemorrhage group 78.12%. Convulsions were present in 8.82% in infarct group, whereas it was 12.50% in haemorrhage group.

ST segment depression (53.1%) and U-waves (56.2%) followed by QTc prolongation (0.5±0.7 ms) were the most common abnormalities in haemorrhage group. Whereas in infarct stroke U-wave was the most common ECG finding (50.0%) among infarct group followed by QTc (0.45±0.08 ms) and T-wave inversion (29.4%). None of the ECG changes had much significance on mortality and was statistically insignificant (p>0.05) with either ischemic or hemorrhagic stroke (**Table - 1**). LV dysfunction, which was the most common abnormality, was noted in infarct (29.4%) and haemorrhage (46.9%). LV dysfunction did not show significant impact on mortality in either of stroke subtypes (p>0.05) (**Table - 2**).

Discussion

A spectrum of cardiovascular events such as cardiac arrest, arrhythmias, and severe hypotension is seen in stroke victims [5]. Many of these patients are often found not to have any preexisting cardiac disease [14]. In our study, we also found that all our ischemic stroke patients had ischemic heart disease.

Goldstein, et al. [15] study showed Increased QTc in 41%, T-wave inversion in 15%, Tachycardia in 2%, Bradycardia in 8%, U-wave in 28% and ST-segment in 13%, whereas it was QTC prolongation in 44%, T wave in 30 %, Tachycardia in 38%, Bradycardia in 2%, ST segment in 38% and U wave in 52%

We found that, LV dysfunction in ischemic stroke was present in 29.4% of cases, which is higher that reports of Gagliardi, et al. [16] and Uma, et al. [13] 22% and 26% respectively. Mitral valve abnormality was present in 19.1% much lesser than to Uma, et al. [13] study where it was 30%. Aortic wall abnormality was 7.4%, even this was much lesser than Gagliardi, et al. and Uma, et al. 18.5% and 20% respectively.

In infarct, group 2D echo 19.1% had mitral valve abnormality and aortic wall abnormality in 7.4%, and no patients had LA thrombus. In the hemorrhage group, none of the patients had LA thrombus, mitral valve or aortic valve abnormality and 25% were normal. The percentage of normal ECGs in patients who survived stroke is 35%, while 22.72% succumbed to a stroke, 79% of stroke survivors had abnormal ECG, while 77.27% of patients who died of stroke had abnormal ECG (p>0.5) and is statistically not significant. Among stroke survivors 56.41% had normal 2D echo findings while 43.59% had abnormal 2D echo study, while among patient died due to stroke had 90.91%) abnormal 2D echo finding. However, such a conclusion was not significant between ischemic and hemorrhagic strokes.

Conclusion

In acute stroke patients, changes in ECG were commonly seen. ST segment depression, QTc

prolongation and U wave 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 2D echocardiographic abnormality in stroke patients. In general mortality was high in cases of hemorrhagic compared to the ischemic group. In our experience, both ECG and ECHO abnormalities in stroke patients do not have any prognostic significance predicting mortality in CVA.

Table – 1: Clinical Parameters between Hemorrhagic and Ischemic stroke patients.

		Hemorrhagic		Ischemic		P value
		N	%	N	%	
Gender	Female	13	40.6%	29	42.6%	P<0.05
	Male	19	59.4%	39	57.4%	
Hypertension	No	20	62.5%	35	51.5%	P>0.05
	Yes	12	37.5%	33	48.5%	
Diabetes	No	31	96.9%	56	82.4%	P<0.05
	Yes	1	3.1%	12	17.6%	
Smoking	Yes	23	71.9%	49	72.1%	P<0.05
	No	9	28.1%	19	27.9%	
T Wave	Normal	22	68.8%	48	70.6%	P<0.05
	Inversion	10	31.2%	20	29.4%	
ST Segment	Normal	15	46.9%	47	69.1%	P<0.05
	Depression	17	53.1%	21	30.9%	
U- Wave appearance	No	14	43.8%	34	50.0%	P>0.05
	Yes	18	56.2%	34	50.0%	
Tachycardia	No	17	53.1%	45	66.2%	P>0.05
	Yes	15	46.9%	23	33.8%	
Bradycardia	No	31	96.9%	67	98.5%	P>0.05
	Yes	1	3.1%	1	1.5%	
Echo Normal	No	20	62.5%	34	50.0%	P>0.05
	Yes	12	37.5%	34	50.0%	
LV Dysfunction	No	17	53.1%	48	70.6%	P>0.05
	Yes	15	46.9%	20	29.4%	
Mirtal valve V Abnormalities	Yes	32	100.0%	55	80.9%	P<0.05
	No	0	0.0%	13	19.1%	
Aortic Valve Abnormalities	Yes	32	100.0%	63	92.6%	P>0.05
	No	0	0.0%	5	7.4%	
Death	Yes	13	40.6%	9	13.2%	P<0.05
	No	19	59.4%	59	86.8%	
LA Thrombus	No	32	100.0%	68	100.0%	NA
Ischemic Heart Disease	No	32	100.0%	68	100.0%	NA

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Table – 2: Associations of ECG and RCHO parameters with mortality in Hemorrhagic and Ischemic stroke patients.

| | | Hemorrhagic | | | | Ischemic | | | |
| | | Death | | Alive | | Death | | Alive | |
		N	%	N	%	N	%	N	%
T Wave	Normal	10	76.9%	12	63.2%	5	55.6%	43	72.9%
	Inversion	3	23.1%	7	36.8%	4	44.4%	16	27.1%
ST Segment	Normal	5	38.5%	10	52.6%	7	77.8%	40	67.8%
	Depression	8	61.5%	9	47.4%	2	22.2%	19	32.2%
U- Wave appearance	No	8	61.5%	6	31.6%	5	55.6%	29	49.2%
	Yes	5	38.5%	13	68.4%	4	44.4%	30	50.8%
Tachycardia	No	5	38.5%	12	63.2%	6	66.7%	39	66.1%
	Yes	8	61.5%	7	36.8%	3	33.3%	20	33.9%
Bradycardia	No	13	100.0%	18	94.7%	9	100.0%	58	98.3%
	Yes	0	.0%	1	5.3%	0	0%	1	1.7%
Echo Normal	No	10	76.9%	10	52.6%	5	55.6%	29	49.2%
	Yes	3	23.1%	9	47.4%	4	44.4%	30	50.8%
LV Dysfunction	No	5	38.5%	12	63.2%	5	55.6%	43	72.9%
	Yes	8	61.5%	7	36.8%	4	44.4%	16	27.1%
Mirtal valve Abnormalities	Yes	13	100.0%	18	94.7%	7	77.8%	48	81.4%
	No	0	.0%	1	5.3%	2	22.2%	11	18.6%
Aortic Valve Abnormalities	Yes	12	92.3%	19	100.0%	8	88.9%	55	93.2%
	No	1	7.7%	0	.0%	1	11.1%	4	6.8%
Neither ECG nor ECHO parameters were significantly associated with mortality in stroke patients									