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A STUDY OF PROGNOSIS OF STROKE WITH SPECIAL REFERENCE TO ELECTROCARDIOGRAPHIC CHANGES AND 2D-ECHO.

Medicine

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ABSTRACT

Introduction:

Stroke is the second most common cause of death and major cause of disability worldwide. Approximately 20 million people each year suffer from stroke of which 5 million do not survive. Cerebral infarction is responsible for about 80% of all first ever in a lifetime strokes. There are many risk factors for cerebrovascular accidents like hypertension, diabetes, aneurysm & coagulopathy . This study was undertaken to determine ECG changes in stroke with diabetic and its prognostic significance.

Aims & Objectives: The present study aims to determine the 2D ECHO and ST-T changes among stroke patients and its implication in assessing prognosis.

Material and Methods:

The present study was carried out in100 patients admitted in department of medicine, S.S. medical college and associated S.G.M.H hospital, Rewa (M.P.) from july 2014 to Jun. 2015.

Inclusion Criteria:

The stroke patients of both sexes aged >16 years admitted to SGMH, Rewa. Neurodeficit lasting >24 hours. Detailed neurological examination including fundoscopy and cardiovascular examination was carried out in all the cases. A 12 lead ECG was done within 24 hours of admission.

Result:

Stroke was most common in 5th and 6th decade (55%). Males had higher preponderance among stroke patients (Male-female ratio 1.5:1). Hypertension was the most common risk factor in 45% of patients. In infarct the most common presenting complaints were headache(25%), Vomiting(19.11%) & Convulsion(8.82%). Such complaints were significantly higher in hemorrhage Headache(65.62%), vomiting(78.12%) & convulsion(12.50%). Abnormal ECG changes were more common among hemorrhagic patients (78.12%) compared to infarct patients (67.64%). LV dysfunction was the most common abnormality noted in both groups i.e., infarct (23.53%) and hemorrhage (56.26%).

Conclusion:

ST segment depression in infarct(30%),hemorrhage(53.33%), QTc prolongation infarct(35.71),hemorrhage(46.66%) and prominent U wave infarct(50%),hemorrhage(53.33%) are the common ECG abnormalities in strokes. ECG abnormalities in stroke patients do not have any prognostic significance. 2D echo abnormalities were more common among hemorrhage group (75%) than in infarct (44.12%). LV dysfunction showed significant mortality in stroke patients and was statistically significant ($p<0.001$).

KEYWORDS

ECG, ST Segment, LV dysfunction, U-wave, CVA, QTc.

INTRODUCTION

Cerebrovascular accidents (CVAs) or stroke is defined as "rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 h, or longer or leading to death, with no apparent cause other than of vascular origin". [1Cerebrovascular accident 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 cancer[1].

Cerebral infarction is responsible for about 80% of all first ever in a lifetime strokes. Primary intracerebral hemorrhage accounts (PICH) for 10% and subarachnoid hemorrhage for 5%.

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. Cardiac abnormalities occur in 60–70% of patients after stroke.[14] The most common disturbances include electrocardiogram abnormalities, cardiac arrhythmias, and myocardial injury and dysfunction. Distinguishing cardiac abnormalities directly caused by stroke, however, remains difficult because the prevalence of preexisting cardiac disease is high, particularly among patients with ischemic stroke.[15] Cardiac disturbances are the most common cause of death after stroke, accounting for up to 6% of unexpected deaths during the first month.[16] Clinical observational studies among stroke patients also suggest a loss of cardiac parasympathetic tone,[17] loss of nocturnal vagal dominance,[18] and increased sympathetic tone.[19] Among acute stroke patients, prolonged QT interval 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 myocardium, but 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[3].

Along with ECG changes many studies have shown wall motion abnormalities on 2D echo following stroke, especially with subarachnoid hemorrhage [5-6].

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

MATERIAL AND METHODS

The material of the study comprised of 100 patients admitted in S.S. Medical College & Associated S.G.M. Hospital Rewa, from May 2013 to Sept. 2014.

Inclusion Criteria:

1.Cases of CVA admitted within 72 hours after the onset of stroke were selected for the study.

Exclusion Criteria:

1. Patients admitted beyond 72 hours after onset of stroke were excluded as the incidence of ECG changes beyond this period were infrequent
2. Traumatic cases producing neurological deficits,
3. Infection,
4. Neoplastic cases producing CVA.
5. CVA cases with known underlying cardiac diseases, which

produce ECG changes.

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 was carried out in all the cases.

The diagnosis of CVA was made on the basis of following criteria:
- Temporal profile of clinical syndrome
- Clinical examination
- CT scan of brain wherever possible

A 12 lead ECG was done within 24 hours of admission. All patients were subjected to investigations like:
- Complete blood count
- Erythrocyte sedimentation rate
- Renal function test
- Serum electrolytes
- Lipid profile

In hospital follow-up was done to know their prognosis under two categories:
1. Live
2. Dead

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.

ECG changes are interpreted with rate, rhythm, ST-segment, QRS complex, T-wave amplitude and morphology, and QTc interval were calculated. Data were tabulated and subjected to statistical analysis.

RESUIT

During the period from May 2009 to Sep. 2011, 100 stroke patients, admitted in Department of Medicine, SSMC and SGM Hospital Rewa, were selected for the present study who met inclusion and exclusion criterion. They were analyzed with regard to 2D echo and ECG changes in stroke patients and the following observations were noted.

Table-1
Age and sex distribution in stroke patients

Age (years)	Male	Female	Total	Percent
21-30	2	1	3	3.00
31-40	6	4	10	10.00
41-50	15	5	20	20.00
51-60	16	11	27	27.00
61-70	14	14	28	28.00
71-80	4	4	8	8.00
81-90	-	2	2	2.00
91-100	1	1	2	2.00
Total	**58**	**42**	**100**	**100.00**

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

		No. of Cases	Percent
No risk Factor (n-28)		**28**	**28.0**
Risk Factors (n-72)		**72**	**72.0**
a.	Hypertension	45	62.5
b.	DM	13	18.05
c.	Smoking	28	38.88
d.	Hyperlipidemia	8	11.11

The above table shows that hypertension was the most common risk factor and was present in 62.5% of the cases, followed by smoking in 38.88%, diabetes mellitus in 18.05% and hyperlipidemia in 11.11% in stroke patients.

Table-3
Incidence of Infarct & Hemorrhage with reference to sex

Type of Stroke	Male		Female		Total	Percent
	No	%	No	%		
Ischemic CVA	35	51.47	33	48.33	68	68.00
Hemorrhage CVA	19	59.37	13	40.63	32	32.00
Total	**54**		**46**		**100**	**100.00**

$p > 0.05$

The above table shows the incidence of infarct was (68%) more common compared to hemorrhage (32%) and the incidence of stroke was little more common among males, but was statistically insignificant ($p>0.05$).

Table-4:
Relationship between stroke types and 2D Echo changes

Type of Stroke	ECHO Changes			
	Normal		Abnormal	
	No	%	No	%
Ischemic (n-68)	38	55.88	30	44.12
Hemorrhage (n-32)	8	25.00	24	75.00

$p<0.01$

The above table showing 2D echo 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 (n-68)				Hemorrhage (n-32)			
	Normal		Abnormal		Normal		Abnormal	
	No	%	No	%	No	%	No	%
QTc prolongation	43	63.23	25	36.76	16	50.0	16	50.00
T-wave inversion	47	69.11	21	30.88	23	71.87	9	28.13
ST Segment depression	47	69.11	21	30.88	14	43.75	18	56.26
U waves	33	48.52	35	51.47	14	43.75	18	56.26
Sinus tachycardia	44	64.70	24	35.29	16	50.0	16	50.0
Sinus bradycardia	68	100.0	0	0	30	93.75	2	6.25

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
2D Echo changes in stroke patients

ECHO changes	Ischemic (n-68)				Hemorrhage (n-32)			
	Normal		Abnormal		Normal		Abnormal	
	No	%	No	%	No	%	No	%
LV dysfunction	52	76.47	16	23.53	14	43.75	18	56.26
LA thrombus	68	100.0	-	-	32	100.0		-
Mitral valabnormality	54	79.41	14	20.59	32	100.0	-	-
Aortic valve abnormality	65	95.58	3	4.41	32	100.0	-	-
Normal	30	44.11	38	55.88	24	75.0	8	25.00

From the above table, it is evident that 2D echo abnormalities among the infarct group, LV dysfunction (23.53%) was most common, followed by mitral valve (20.59%) and aortic valve (4.41%) abnormality in cases of hemorrhagic strokes again LV dysfunction (56.26%) was most common abnormality

Table-7
Total Analysis in patients of stroke who died

Type of stroke	No. of died patients (n-22)	Percentage
Ischemic	9	40.00
Hemorrhagic	13	59.00

ECG abnormalities		
QTc prolongation	10	45.00
T-wave inversion	7	31.81
ST-segment depression	10	45.00
U-waves	9	40.90
2D echo abnormalities		
LV dysfunction	16	72.00
LA thrombus	--	--
Mitral valve abnormality	2	9.09
Aortic valve abnormality	--	--

From the above table, it is evident that among the total number of patients who died of stroke, hemorrhage was the culprit in 59% and ischemia in 40%. QTc prolongation and ST depression was the common ECG abnormality present in 45% of cases. U-wave stood second with 40.90% and the least was T-wave inversion with 31.81%. LV dysfunction was the common 2D echo abnormality present in 72% of patient followed by mitral valve abnormality with 9.09%.

DISCUSSION

A hospital based prospective study was done to know the ECG and 2D echo changes had any prognostic significance in stroke patients.

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 55%, which is comparable to Venkataramana et al (1977)[11] study in which the percentage of stroke cases above the age of 51 years was 41% and in the Carlo study (2003)[12] 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 Framinghan 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.[13] Shaper et al in 1991 concluded that, hypertension, cigarette smoking and pre-existing IHD was found to be the major risk factors.[14]

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 Smith (2005) and Carlos (2003) i.e., 87% and 48% respectively and next commonest risk factor was smoking (28%) and history of stroke (22%), which are comparable with that found in Smith (2005) i.e., 35.22% and 39.30% and diabetes mellitus was present in 13% of the patients in the present study and the least was hyperlipidemia.[15,4]

In the present study, headache was present in 38% of the cases, which is comparable to the series of Mohr et al (1978), who reported an incidence of 26%.[16] Foulkes et al (1988) reported severe headache in 41% of cases.[17] Vomiting was present in 38% of our patients, which is comparable to Mohr et al (44%), Foulkes et al (1988), who reported frequency of headache in 49% of the cases. Convulsions in the present series were present only in 10% of the total patients, which is comparable to that of Mohr et al (1978) and Foulkes et al, who reported frequency of 7% and 9% respectively.[16-17]

In this study, 68% of the patients has ischemic stroke, which was comparable with that found in the studies of Daniele et al, Roy et al and Mikolich et al (1981) i.e., 78.20%, 71.00% and 93.33% respectively. 32% had stroke in the present study comparable with 21.80%, 29% and 6.66% in the Daniele et al (2002), Roy et al (1995) and Mikolich et al study group.[18,19,20]

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 this study it is 30%. ST-segment 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 this study it was seen in 53%. Tachycardia was seen in 2% in Goldstein et al while in this study it was 40%. Bradycardia was seen in 8% in Goldstein et al, while in the present study it was 2%.[21]

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 (1985) and Uma et al (1999) who reported 22% and 26% respectively. Mitral valve abnormality was present in 14% comparable to Uma et al (1999) who present 30%. Aortic wall abnormality in present study was 3% compared to the other studies it varied, Gagliardi et al (1985) and Uma et al (1999) 18.5% and 20% respectively.[23-24]

In infarct group 2D echo was normal in 55.88% (38 out of 68 patients) while LV dysfunction was seen in 23.53% (16 out of 68 patients) and mitral valve abnormality in 20.59% (14 out of 68 patients) and aortic wall abnormality in 4.41% (3 out of 68 patients) and no patients had LA thrombus.

In the hemorrhage group a high number of patients 18 out of 22 i.e., 56.26% had LV dysfunction. None had LA thrombus, mitral valve or aortic valve abnormality and 25% were normal (8 out of 22).

In the either group LV dysfunction was the most common abnormality noticed.

The percentage of normal ECG in patients who survived stroke is 35% (24 out of 78), while 22.72% (5 out of 22) succumbed to stroke, 79% (54 out of 78) of stroke survivors had abnormal ECG, while 77.27% (17 out of 22) of patients who died of stroke had abnormal ECG ($p>0.5$) and is statistically insignificant.

Among stroke survivors 56.41% (44 out of 78) had normal 2D echo findings while 43.59% (34 out of 78) had abnormal 2D echo study, while among patient who died due to stroke had 90.91% (20 out of 22) abnormal 2D echo finding, wherein only 9.09% (2 out of 22) patients had normal echo findings so the mortality in abnormal 2D echo was high and was statistically significant ($p<0.001$).

CONCLUSION

In conclusion, patients with cerebrovascular accidents often have abnormal ECG in the absence of known organic heart disease or electrolyte imbalance. These ECG changes are more common in intracerebral hemorrhage and subarachnoid hemorrhage than in infarcts. 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 was most common 2D echocardiographic abnormality in stroke patients.

ECG abnormalities in stroke patients do not have any prognostic significance.

LV dysfunction had prognostic significance in predicting mortality in CVA.

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