

Study Of Electrocardiographic Changes And It's Prognostic Significance In Young Stroke Patients

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Abstract:

Title- study of electrocardiographic changes and it's prognostic significance in young stroke patients

Background - Although stroke is very common in day to day clinical practice but it's rising incidence among young population is a matter of serious concern. There are many common risk factors for stroke like diabetes mellitus, hypertension, smoking, dyslipidemia but along with these there are also many rare and hidden risk factors which needs to be studied in detail. Therefore, the use of an easy, inexpensive, bedside test like ECG (Electrocardiogram) can be a useful tool to find out the severity of stroke and hidden risk factors like undetected hypertension, arrhythmia example like atrial fibrillation etc. to explain the further prognosis. With this present study work we have tried to find out the correlation ECG changes in young stroke patients to explain the prognosis through it.

Material and Methods- This Prospective Observational Case Study was carried out in the Department of General Medicine, at Netaji Subhash Chandra Bose Medical College & Hospital, Jabalpur, Madhya Pradesh, India from August 2022 to April 2024. A total of 120 young stroke patients (age between 18 -45 years) on the basis of CT and MRI findings were taken in this study and Electrocardiographic changes of these patients were studied. The ECG findings were then correlated with NIHSS scoring system.

Results – T wave abnormalities were seen in 10 (12.9%) out of the 77 survived patients and in 10 (23.2%) out of the 43 patients who experienced death. It was the most common ECG abnormality found in both survived and death group. Out of the total 75 ischemic stroke patients, 51 patients survived and 24 experienced death. Among the 51 patients that survived, 36 patients had some kind of ECG abnormalities. Among the 24 patients that experienced death, all of them were having very high NIHSS score (21-42) and 23 patients showed significant ECG changes. Out of the total 45 hemorrhagic stroke patients, 26 survived and 19 experienced death. Among the 26 patients that survived, 23 patients had some kind of ECG abnormalities. Among the 19 patients that experienced death, all of them were having very high NIHSS score (21-42) and all 19 of them also showed significant ECG changes.

Conclusion- Hence, it was concluded that patients with higher NIHSS scores had more significant ECG changes which was associated with poor final outcome (mortality).

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I. Introduction

Stroke or cerebrovascular accident is defined as an abrupt or sudden onset of a neurological deficit that is attributable to a focal vascular cause.^[1] Earlier stroke was perceived to be a disease of older age group, but the rapidly rising burden of stroke as a major public health issue in younger population is quite alarming. The incidence of stroke in individuals less than 50 years of age accounts for around 10% of all the strokes.^[2] Even though mortality among younger population with stroke is lower as compared to that of elderly, but they have a higher risk of recurrent stroke in subsequent years.

A recent trend in the literature suggested that individuals of age in between 18 to 50 years, are being labeled as young population and are having a increased hospitalization rates for strokes.^[3] But there is no particular uniform criteria to define the exact age limit in young stroke patient. Hence, in our study we have taken the cut-off as $>/18$ and $<$ than 45 years of age. There are many common risk factors for stroke like diabetes mellitus, hypertension, smoking, dyslipidemia but along with these there are also many rare and hidden risk factors which needs to be studied in detail. Hence, the use of an easy, inexpensive, bedside tool like ECG (Electrocardiogram) can be used to find out the severity of stroke and hidden risk factors like undetected hypertension, arrhythmia like

atrial fibrillation etc. to explain prognosis. Therefore, the study of ECG observation in stroke patients can be done to reduce the excess risk of mortality. Hence, through this study we have tried to find out the ECG changes seen in young stroke patients and tried to explain the prognosis through it.

II. Materials And Methods

A Prospective Observational Case Study was carried out in the Department of General Medicine, at Netaji Subhash Chandra Bose Medical College & Hospital, Jabalpur, Madhya Pradesh, India from August 2022 to April 2024. A total of 120 young stroke patients (age between 18 -45 years) on the basis of CT and MRI findings were taken in this study and Electrocardiographic changes of these patients were studied. The ECG findings were then correlated with NIHSS scoring system.

Inclusion criteria:

- Cases with age ≥ 18 years to ≤ 45 years, both male and female gender.
- Patients with history of either ischemic or haemorrhagic stroke [Cerebrovascular accident (CVA)], who is diagnosed with any one CT scan brain or MRI brain imaging study.
- The patients with vascular risk factors for stroke like Hypertension (HTN), all types of Diabetes Mellitus (DM), hypercholesterolemia etc. were included in this study.

Exclusion Criteria :

- Patients with the diagnosis of Transient ischemic attack or old CVA.
- Patients with Head Injury or trauma.
- Patients having any Central nervous system (CNS) tumor, and CNS infections like meningitis or encephalitis etc.
- Patients with suspected CNS vasculitis.
- Patients with Subdural haemorrhage.
- Patients with Cortico venous Sinus Thrombosis (CVST).
- Patients with known case of Seizure disorder or Epilepsy.
- Patients with any underlying pre-existing cardiac diseases like valvular heart disease, and chronic or persistent cardiac arrhythmia.
- Patients with acute or chronic Myocardial Infarction.
- Patients with long QT syndrome.
- Patients who are on drugs that impact on cardiac rhythm or contractility.
- Patients with acute or chronic electrolytes imbalance.
- A history of cardiac pacemaker and cardiac surgery or any cardiac pathology determined during routine examination.
- Patients with severe metabolic or endocrinological disorders which affects the pattern or duration of ECG rhythm.
- Patients on anticoagulant or previous antiplatelets therapy.

The institutional ethical committee of Netaji Subhash Chandra Bose Medical College, Jabalpur approved the study protocol. Informed consent was obtained from the patients. Detailed history was taken and clinical physical examination was done. Severity score system according to National Health Stroke Scale (NIHSS) was used. Electrocardiogram of all the subject patients was done. Other relevant routine blood investigations, 2D Echo-cardiography , carotid artery doppler etc. were also done.

III. Results

Table-1--Summary of study group with their ECG changes among different types of stroke and their final outcome

ECG Change	Hemorrhagic (total -45)				Chi sq value, degree of freedom, p-value	Ischemic (total- 75)				Chi sq value, degree of freedom, p-value
	Survived (26)		Death (19)			Survived (51)		Dead (24)		
	No.	%	No.	%		No.	%	No.	%	
T wave abnormalities	4	15.6	7	36.8	2.737, 1, 0.193*	6	11.7	3	12.5	0.008, 1, 0.999
Sinus tachycardia	5	19.2	1	5.2	1.853, 1, 0.363*	5	9.8	4	16.6	0.728, 1, 0.618

QT prolongation	0	0	1	5.2	1.4 ,1, 0.844*	2	3.9	2	8.3	0.629, 1, 0.766
U waves	1	3.8	1	5.2	0.052, 1, 0.999	2	3.9	0	0	0.737, 1, 0.919
Q waves	0	0	0	0	Can't be applied	2	3.9	3	12.5	1.93, 1, 0.367
ST-T elevation	1	3.8	2	10.5	0.787, 1, 0.763	0	0	1	4.1	2.154, 1, 0.640
ST depression	0	0	1	5.2	1.4 ,1, 0.844	1	1.9	2	8.3	1.726, 1, 0.477
Sinus bradycardia	1	3.8	0	0	0.747, 1, 0.999	1	1.9	1	4.1	0.306, 1, 0.999
Arrhythmia	1	3.8	0	0	0.747, 1, 0.999	1	1.9	1	4.1	0.306, 1, 0.999
Chi-square test value	10.05									
Degree of freedom	8									
p-value	0.2619									

This table summarizes some of the significant ECG changes seen in different types of stroke and the mortality associated with it. Here we have included the findings of T wave inversion (due to ischemia), T wave inversion (due to strain pattern) and biphasic T waves under the category of T wave abnormalities. Among the 45 haemorrhagic stroke patients, 19 patients experienced death and out of those 19 patients, 7 patients (36.8%) had some form of T wave abnormalities . Among the 75 ischemic stroke patients, 51 patients survived and 24 patients experienced death. Among the 51 survived patients, 6 patients (11.7%) showed T wave abnormalities, and among the 24 patients who experienced death, 3 (12.5%) of them showed T wave abnormalities.

The chi-square test value of this table was found to be 10.05, degree of freedom was calculated to be 8 and p-value was found to be 0.26 which was statistically not significant. T wave abnormalities was the most common ECG abnormality found in both types of stroke and was also associated with highest mortality.

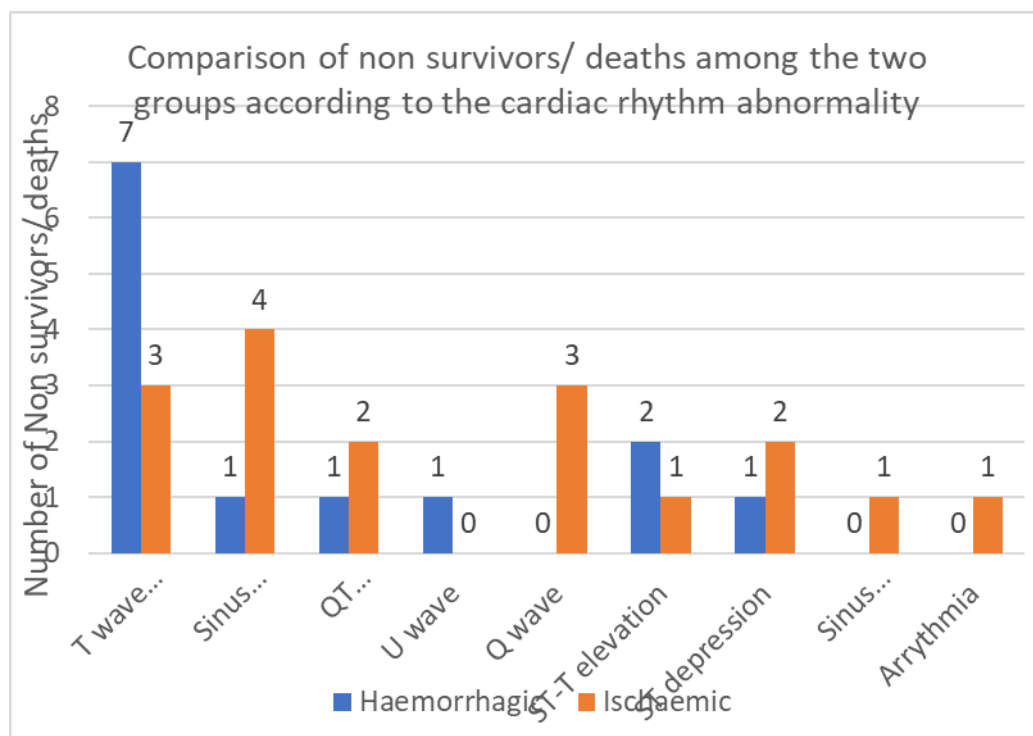


Fig 1 : Column diagram representing the distribution of study group with their ECG changes among different types of stroke and final outcome

Table 2 - Summary of distribution of study subjects on the basis of ECG changes and their final outcome

ECG Change	Total patient (n-120)	
	Survived (total 77)	Death (total 43)

	No.	%	No.	%
T wave abnormalities	10	12.9	10	23.2
Sinus tachycardia	10	12.9	5	11.6
QT prolongation	2	2.5	3	6.9
U waves	3	3.8	1	2.3
Q waves	2	2.5	3	6.9
ST-T elevation	1	1.2	3	6.9
ST depression	1	1.2	3	6.9
Sinus bradycardia	2	2.5	1	2.3
Arrythmia	2	2.5	1	2.3
Chi-square test value	5.603			
Degree of freedom	8			
p-value	0.692			

The above table shows the summary of various ECG changes on the basis of their final outcome. T wave abnormalities was seen in 10 (12.9%) out of the 77 survived patients and in 10 (23.2%) out of the 43 patients who experienced death. It was the most common ECG abnormality found in both survived and death group.

In this study it was found that the Chi square value was 5.603, degree of freedom was 8, and P value was calculated to be 0.692 which was statistically not significant.

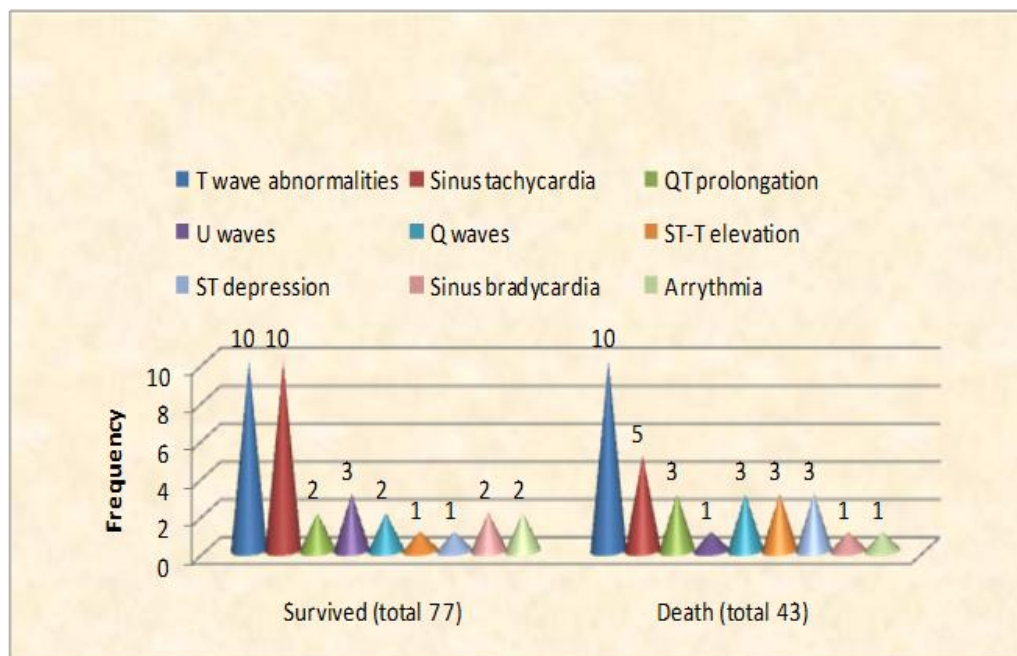


Fig 2 : Column diagram representing the Summary of distribution of study subjects on the basis of ECG changes and their final outcome

Table 3 - Distribution of study group on the basis of ECG abnormalities and their final outcome.

ECG changes	Survived	Death	Total
Abnormal	59 (58.4%)	42 (41.5%)	101(100%)
Normal	18 (94.7%)	01 (5.2%)	19 (100 %)
Total	77 (64.1%)	43 (35.8 %)	120 (100 %)

Chi square value 9.175; p-value 0.002

The above table shows the distribution of study group on the basis of ECG abnormalities and their final outcome. Out of the 120 patients, 101 patients showed some ECG changes. Out of the 101 patients, 59 patients (58.4%) survived and 42 patients (41.5%) experienced death. The remaining 19 patients showed normal sinus rhythm, out of which 18 patients (94.7%) survived and only 1 patient (5.2%) experienced death.

The chi square value was found to be 9.175. P-value of this study was found to be 0.002 which was considered to be statistically significant.

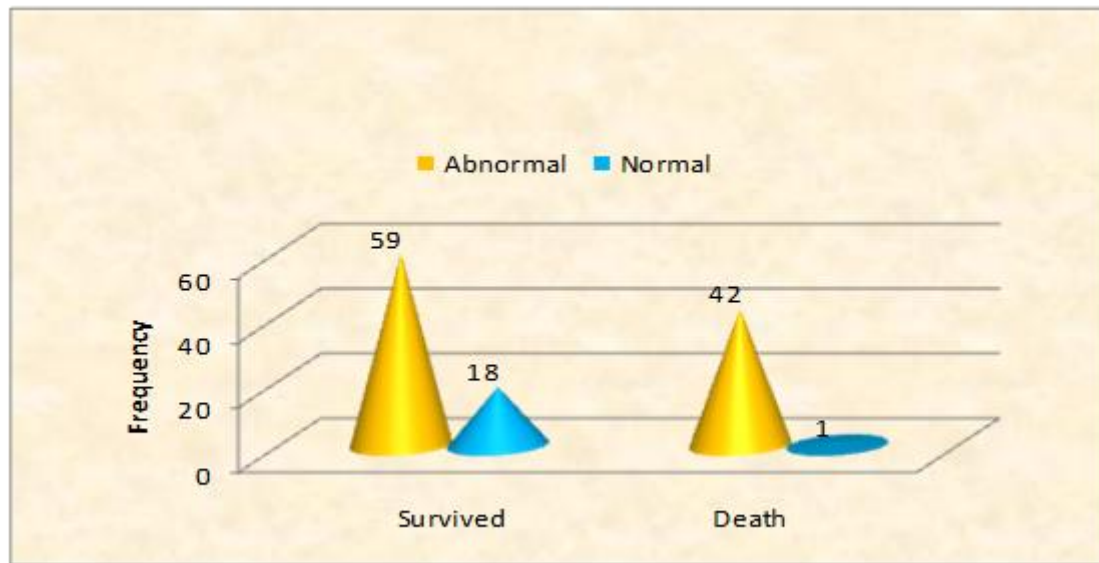


Fig 3 : Column diagram representing the distribution of study group on the basis of ECG abnormalities and their final outcome.

Table 4 - Distribution of study group on the basis of NIHSS score in different type of stroke, ECG changes and their final outcome.

	Type of stroke							
NIHSS	Ischemic (n"-75)				Haemorrhagic (n"-45)			
[0-42]	Survived (51)	ECG Changes seen	Death (24)	ECG Changes seen	Survived (26)	ECG Changes seen	Death (19)	ECG Changes seen
0	0	0	0	0	0	0	0	0
1-4	03	02	0	0	0	0	0	0
5-15	20	12	0	0	0	08	08	0
16-20	22	20	0	0	11	09	0	0
21-42	06	02	24	23	02	01	19	19
Total	51	36	24	23	26	23	19	19
Chi-square test	8.434							
p-value	< 0.004 (s)							

The above table shows the distribution of study group on the basis of severity of NIHSS score in different type of stroke, ECG changes and their final outcome. Out of the total 75 ischemic stroke patients, 51 patients survived and 24 experienced death. Among the 51 patients that survived, 36 patients had some kind of ECG abnormalities. Among the 24 patients that experienced death, all of them were having very high NIHSS score (21-42) and 23 patients showed significant ECG changes..

Out of the total 45 haemorrhagic stroke patients, 26 survived and 19 experienced death. Among the 26 patients that survived, 23 patients had some kind of ECG abnormalities. Among the 19 patients that experienced death, all of them were having very high NIHSS score (21-42) and all 19 of them also showed significant ECG changes.

The chi-sqaure test value of this table was found to be 8.434 and p value was found to be <0.004 which is considered to be statistically significant.

Hence, the patients who had mortality (in both ischemic and haemorrhagic group) as their final outcome, were having very high NIHSS score and significant ECG changes.

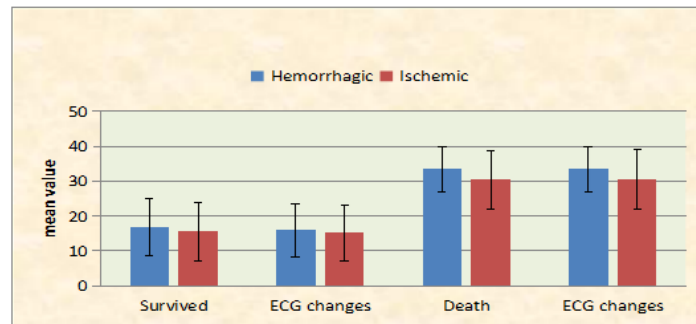


Fig 4 : Column diagram representing the distribution of study group on the basis of NIHSS score in different type of stroke, ECG changes and their final outcome

Table 5 - Co-relation of NIHSS scoring system with ECG changes and its association with mortality

NIHSS Score [total score 0-42]	Total Survived - (77)		Total Dead (43)	
	No.	ECG changes	No.	ECG changes
0	0	0	0	0
1-4	8	7	0	0
5-15	28	20	0	0
16-20	33	29	0	0
21-42	8	3	43	42
Chi-square test	89.47			
Degree of freedom	3			
p-value	<0.001 (s)			

The above table shows co-relation of NIHSS scoring system with ECG changes and its association with mortality. There were 8 patients whose NIHSS score was in between 1-4 and 7 among them showed some significant ECG changes. 28 patients had a score in between 5-15 and out of them 20 patients showed some form of ECG changes. 33 patients had a score in between 16-20 and out of them 29 patients showed some form of ECG abnormality. There was no mortality found in patients whose NIHSS score was ≤ 20 .

51 patients had a score in between 21-42, and among them 43 experienced death and only 8 patients survived. Out of the 43 patients that experienced death, 42 of them had some kind of ECG abnormalities associated with them. The chi-square test value of this table was found out to be 89.47, degree of freedom was found to be 3 and p-value was calculated to be < 0.001 which is considered to be statistically significant.

Hence, it was concluded that patients with higher NIHSS scores had more significant ECG changes which was associated with poor final outcome (mortality).

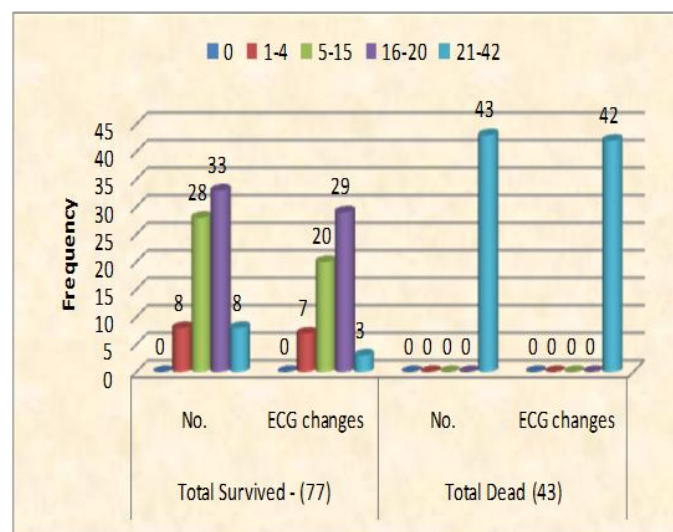


Fig 5 : Column diagram representing the distribution of study subjects with their NIHSS scoring system severity with associated ECG changes and its final outcome

IV. Discussion

In our study, it was observed that T wave abnormalities were seen in 10 (12.9%) out of the 77 survived patients and in 10 (23.2%) out of the 43 patients who experienced death. T wave abnormalities was the most common ECG abnormality found in both survived and death group and it was also the most common ECG finding associated with mortality. In this study it was found that the Chi-square value was 5.603, degree of freedom was 8, and p-value was 0.692 which was statistically not significant. Similar results were also observed in study conducted by **P. Asadi et al. (2019)**^[4]. They observed that the rate of mortality in patients with inverted T wave was around 59.3%. The statistical results of this study were comparable to the results of the study conducted by **Suraj Sundaragiri et al. (2016)**^[5]. They have also observed that the chi-square value as 6.07, degree of freedom as 6 and a non-significant p value.

In the present study, out of the total 75 ischemic stroke patients (n=120), 51 patients have been survived and 24 experienced death. Among the 51 patients that survived, 36 patients had some kind of ECG abnormalities. Among the 24 patients that experienced death, all of them were having very high NIHSS score (21-42) and 23 patients showed significant ECG changes. Out of the total 45 haemorrhagic stroke patients (n=120), 26 survived and 19 experienced death. Among the 26 patients that survived, 23 patients had some kind of ECG abnormalities. Among the 19 patients that experienced death, all of them were having very high NIHSS score (21-42) and all 19 of them also showed significant ECG changes. In this study it was found that the chi-square test value was 8.434 and P-value was 0.004 which is considered to be statistically significant. Hence, the patients who had mortality (in both ischemic and hemorrhagic group) as their final outcome, were having very high NIHSS score and significant ECG changes. Similar results were also seen in the study conducted by **Ramesh R.S et al. (2022)**^[6]; they observed that the NIHSS score was found to be higher in patients who were having significant ECG changes. The presence of ECG changes in patients with higher NIHSS score was associated with poor final outcome. The p-value of their study was found to be < 0.001, which was considered to be statistically significant.

There were 8 patients whose NIHSS score was in between 1-4 and 7 among them showed some significant ECG changes. 28 patients had a score in between 5-15 and out of them 20 patients showed some form of ECG changes. 33 patients had a score in between 16-20 and out of them 29 patients showed some form of ECG abnormality. There was no mortality found in patients whose NIHSS score was ≤ 20 . 51 patients had a score in between 21-42, and among them 43 experienced death and only 8 patients survived. Out of the 43 patients that experienced death, 42 of them had some kind of ECG abnormalities associated with them. The chi-square test value of this study was found out to be 89.47, degree of freedom was found to be 3 and p-value was calculated as < 0.001 which was considered to be statistically significant. Similar results were also seen in the study conducted by **Ramesh R.S et al. (2022)**^[6], they observed that the presence of ECG changes in patients with higher NIHSS score was associated with poor final outcome as mortality. The p value of their study was found to be < 0.001, which was considered to be statistically significant.

V. Conclusion

The percentage of cases of ECG abnormalities was found to be more in the haemorrhagic study group. T wave abnormalities were the most common ECG abnormality found in both types of stroke. It was observed that significant ECG changes are seen in patients who had higher NIHSS score and mortality as their final outcome.

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