

Study of QT – Dispersion in ECG in Patients with Acute Cerebrovascular Accidents or Stroke

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ABSTRACT

Introduction: QT – dispersion represents interlead variability of QT interval and reflects heterogeneity of myocardial repolarization. Abnormalities in electrocardiogram are common in acute cerebrovascular events (CVA) like ST and T wave changes. However, changes in QT – dispersion are also reported recently. Objective of the study was to study of QT – dispersion in patients who have an acute stroke and its co-relation with duration of stroke, type of stroke (Ischemic or hemorrhagic), lesion extent and localization and also study of prognostic value of QT dispersion in acute stroke patients.

Material and methods: We included 100 patients of acute stroke with no previous history of sign and symptoms of cardiovascular disease. 100 control age and sex matched subjects were also taken. 12 lead ECGs were recorded within the first 24 hours (24 hour ECG) and between 72- 120 hours (72 hour ECG) from stroke onset. QTc (corrected QT interval) was assessed by single observer blinded to the clinical data.

Results: In our study, QTcD was increased significantly in the 24 hour ECG in patients compared to control and QTcD decreased and became comparable to controls at 72 hours. QTcD was also significantly higher in patients with hemorrhagic lesion compared to infarct and in patients with a large lesion compared to a small lesion but there was no significant differences found between right sided and left sided lesion. In our study, we also found that QTcD was higher in death patients in compared to discharge or lama patients.

Conclusion: This study shows that QTc dispersion increases in patients with acute stroke and the increases was more prominent in patients in the early period of stroke, patient with hemorrhagic lesion and patients with a large lesion.

Keywords:- QT – dispersion, acute cerebrovascular accidents, stroke.

INTRODUCTION

Cerebrovascular diseases include some of the most common and devastating disorders: ischemic stroke and hemorrhagic stroke. Stroke is second leading cause of death worldwide. The incidence of cerebrovascular diseases increases with age. A stroke, cerebrovascular accident, is defined as an abrupt onset of a neurologic deficit that is attributable to a focal vascular cause.¹

QT dispersion is defined as the difference between the maximum and minimum QT intervals on a surface ECG. QTcD is the measurement when the QT intervals have been corrected for heart rate.² A multitude of ECG changes^{3,4} have been observed who presented with acute strokes, both ischemic

and hemorrhagic. In particular, repolarization changes, such as prolongation in the QTc interval have been noticed in as much as 90% of unselected stroke victims.⁴ Ischemic like and repolarization ECG changes that occur in patients with acute stroke have been thought to be due to neural myocardial stunning, changes in autonomic nervous system, and catecholamine mediated injuries.⁵

QTD was demonstrated as an independent predictor of functional outcome and mortality following acute neurological events.⁶ One report attributed the increase QTD to associated myocardial injury in patients with acute neurological events.⁷

Central nervous system mediated increase in sympathetic and vagal tone are proposed to mediate the observed cardiac abnormalities. Acute stroke is reported to increase QT dispersion within 24 hours in patients without preexisting cardiovascular disease.⁸ In patients hospitalized with cerebrovascular accidents, QT dispersion may reflect either neurologic injury or underlying heart disease and is proposed to serve as a predictor of functional outcome and mortality following acute neurologic events.⁶ Increased QTc dispersion was found to be an independent predictor for in hospital mortality.⁹

MATERIALS AND METHODS

This was a study of 100 patients who were admitted to N.S.C.B. medical college and Hospital, Jabalpur with diagnosis of acute stroke between October 2014 to October 2015. 100 control age and sex matched subjects were also included. We recorded 12 lead ECGs within the first 24 hours (24 hour ECG) and between 72- 120 hours (72 hour ECG) from stroke onset. QTc (corrected QT interval) assessed by single observer blinded to the clinical data.

We included Patients older than 18 years hospitalized for acute cerebrovascular events who Presenting within the first 24 hours of symptom onset, those without any history or sign of cardiac disease and evidence of stroke on head CT scan or MRI Brain.

Patients who presented after 24 hours of symptom onset

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How to cite this article: Janki Punekar, Amit Anurag Singh, Kalu Singh Rawat. Study of QT – dispersion in ecg in patients with acute cerebrovascular accidents or stroke. International Journal of Contemporary Medical Research 2016;3 (2) :458-461.

were excluded. Similarly, the patients who died before 72 hours of symptom onset, who has lacunar stroke or had transient ischemic attack (TIA) were excluded. All patients having a history of coronary artery disease, valvular heart disease, heart failure, cardiac arrhythmia, patients with bundle branch block, cardiomyopathy. Patients taking any drug known to affect cardiac repolarization like digoxin, anti-arrhythmics, phenothiazine, tricyclic antidepressants, lithium carbonate, erythromycin, theophylline, and levodopa and patients with electrolyte imbalance (serum potassium and/or calcium levels) were excluded.

Simultaneous 12 lead ECGs were recorded within the first 24 hours (24h-ECG) and again between 72 - 120 hours (72h-ECG) after stroke onset following neurologic stabilization of the patients. The QT intervals manually measure and defined as the distance between the start point of the QRS complex to the end point of the T wave and T wave's end point at the isoelectric line. If the U wave present, then the lowest point of T and U wave junction we accepted as the end of QT interval. Corrected QT (QTc) we calculated by the Bazett¹⁰ formula ($QTc = QT / (RR)^{1/2}$). ECG with 9 or more leads having measurable QT interval were taken. Corrected QT dispersion (QTcD) is defined as maximum minus minimum QTc interval.

A complete neurologic examination performed on enrollment in the study and after 72 hours. Patients who admitted with acute stroke undergone for CT or MRI brain.

Subtypes of stroke are defined as lacunar infarct (LACI), total anterior circulation infarct (TACI), partial anterior circulation infarct (PACI), and posterior circulation infarct (POCI) according to the classification made by the Oxfordshire Community Stroke Project (OCSP). Patients with hemorrhagic stroke classified as having either a large hemorrhage (>33mm) in diameter, with or without ventricular extension) or a small hemorrhage (< 33mm).

Results from patients with total anterior circulation infarct and large hemorrhage compared with those from patients with partial anterior circulation infarct and small hemorrhage to determine the effect of lesion size. Results from patients with right sided lesion (all subtypes together) we compared with those for patients with left sided lesions to assess the laterality effect.

STATISTICAL ANALYSIS

Qualitative data was represented in the form of frequency and percentage. Association between qualitative variables was assessed by chi-square test with continuity correction for all 2 X 2 tables and Fisher's exact test for all 2 X 2 tables where p-value of chi-square test was not valid due to small counts. Quantitative data was represented using mean±SD. Analysis of Quantitative data between the two groups was done using unpaired t-test if data passes 'Normality test' and by Mann-Whitney Test if data fails 'Normality test'. SPSS software Version 20 was used for analysis.

RESULTS

The present study included 100 patients of acute stroke above

18 years of age. Patients likely to have any other cause of altered QT dispersion were excluded as per exclusion criteria. The patients were subdivided into various subgroups; whether having hemorrhagic lesion (N=42) or ischemic lesion (N=58), whether lesion was right sided (=51) or left sided (=49), whether lesion was small (N=52) or large (N=48).

In our study, out of 100 patients, 56 were males and 44 were females. Most patients in study population were in the age group of 50 to 59 followed by 60 to 69 years. Out of 100 patients, 58 patients died and 42 survived. Hypertension (98%), smoking (43%), dyslipidemia and alcoholic (27%), and diabetic (15%) were common co-morbid conditions in patients.

The QTcD at 24 hour ECG was significantly higher than control and 72 hour ECG, but there was no significant differences (p value= 0.37) between QTcD at 72 hour ECG in patients (51.06 ± 19.24) and control (48.83 ± 15.61). The mean value of QTcD was significantly higher in patients with a large lesion compared to patients with a small lesions (98.90 ± 20.08 Vs 83.10 ± 17.12 , p value ≤ 0.001). Patients with a hemorrhagic lesion had higher QTcD than the patients with ischemic lesion (101.88 ± 22.52 Vs 82.57 ± 13.54 , p value ≤ 0.001).

In 1st day ECG QTcD, there was no significantly differences between right sided and left sided lesion (87.51 ± 17.12 vs 93.98 ± 22.65 , p value=0.11). In 3rd day ECG QTcD in acute stroke patient there was no significant difference between large lesion and small lesion, Right sided lesion and left sided lesion, hemorrhagic and ischemic lesion. QTcD was higher in death patients in compared to discharge or lama patients (100.02 ± 18.12 vs 77.79 ± 15.28).

DISCUSSION

The present study is prospective observational study to evaluate QT dispersion in acute stroke patients and it's prognostic value in acute stroke patients.

Most of the patient in the study population were in the age group of 52 – 59 years followed by 40 – 49 years age group. A study in department of medicine, Government Medical College and New Civil Hospital, Majura gate, surat. R.P. Eapen, J.H. Parikh, N.T. Patel¹¹ found that in stroke patients common age group was 51 - 60 years. Another study by Naik M. Rauniyar R.K. Sharma U.K. et al¹² who found mean age of 58.27 yrs.

The incidence of stroke is maximum in the age group of 50 – 59. It also correlates with the findings of Wadhawani et al¹³ who found highest incidence in the age group 51 – 60. Aiyar

Study	Common age group
Our study	50-59
R. P.Eapen, J. H. Parikh et al ¹¹	51-60
Naik M. Rauniyar R. K. Sharma U.K. et al ¹²	Mean age 58.27
Wadhawani et al ¹³	51-60
Aiyar et al ¹⁴	51-60
Pinhero et al ¹⁵	Mean age 54.85

Table-1: Incidence of age in stroke patients

Etiology	Present study	R.P.Eapen, J.H. Parikh et al ¹¹	Aiyar et al ¹⁴	Sotaniemi et al ¹⁶	Yitzchok S. Lederman et al ¹⁷
Infarcts	58%	68%	70%	66.2%	59%
Hemorrhage	42%	32%	30%	33.8%	41%

Table-2: Incidence of pathological lesions in cerebrovascular disease

	24- hour ECG	ECG	P Value
	Large Lesion N= 48	Small Lesion N= 52	
QTcD (ms)	98.90±20.8	83.10±17.12	<0.001 [significant]
	Right Sided Lesion N=51	Left Sided Lesion N=49	
QTcD (ms)	87.51±17.12	93.98±22.65	0.11[ns]
	Hemorrhagic Lesion N=42	Ischemic Lesion N=58	
QTcD (ms)	101.88±22.52	82.57±13.54	<.001 [significant]
	72 hour ECG	ECG	
	Large Lesion N= 48	Small Lesion N= 52	P Value
QTcD (ms)	98.90±20.8	83.10±17.12	<0.001 [significant]
	Right Sided Lesion N=51	Left Sided Lesion N=49	
QTcD (ms)	87.51±17.12	93.98±22.65	0.11 [ns]
	Hemorrhagic Lesion N=42	Ischemic Lesion N=58	
QTcD (ms)	101.88±22.52	82.57±13.54	<.001 [significant]

Table-3: QT Dispersion (QTcD) According To Stroke Type And Lesion Localisation In 24 and 72 Hour ECG

et al¹⁴ also found highest in age group 51 – 60 which comprised this finding also similar with the study done by Pinhero et al¹⁵ who found mean age 54.85 years. (Table No.1) In this study, out of 100 cases, 56% were male and 44% were female. A study in department of medicine, Government Medical College and New Civil Hospital, Majura gate, surat. R.P. Eapen, J.H. Parikh, N.T. Patel¹¹ also found that the cerebrovascular stroke are common in male (67%) than female (33%) . In this study male to female ratio was 2:1. In another study Aiyaret al¹⁴ found that male to female ratio 1.9:1. So we can conclude that the incidence of stroke is more common in malesex. This finding also correlate with the study done by Aiyar et al¹⁴ and Pinhero et al¹⁵ who found the incidence of stroke is more common in males than females. In our study 98% were hypertensive, 43% cases were smokers, 27% cases were alcoholics and 27% cases have dyslipidemia and 15% cases have diabetics. A study in department of medicine, Government Medical College and New Civil Hospital, Majura gate, surat. R.P. Eapen, J.H. Parikh, N.T. Patel¹¹ also found that most com-

mon risk factor was hypertension, alcoholism, smoking and hyperlipidemia. Another study by Naik M, Rauniyar R.K., Sharma U.K. et al¹² who found hypertension was a most common risk factor in acute stroke patients.

In our study out of 100 patients, 58 cases had infarct and 42 cases had hemorrhagic lesion. A study in department of medicine, Government Medical College and New Civil Hospital, Majura gate, surat. R.P. Eapen, J.H. Parikh, N.T. Patel¹¹found that 68 patients had cerebral infarction and 32 patients had hemorrhagic stroke. Another study done by Aiyar et al¹⁴ who found clinical diagnosis of infarction in 70% cases and Sotaniemi K. A. et al¹⁶ who found 66.2% infarct and 33.8% hemorrhage. Another study done by Yitzchok S. Lederman¹⁷, BA, Clotile Balucani, MD,PHD, Jason Lazar, MD, MPH, Leah Steinberg, M, James Gugger, PharmD, Steven R Levine, Found that In total 888 stroke patients: 59% ischemic 41%hemorrhagic (Table No.2) .

In the present study we found that QTcD was significantly higher in patients at 24 hour ECG than controls and QTcD value become comparable to controls at 72 hours. We also found that the mean value of QTcD was significantly higher in patients with large lesion compared to patients with a small lesion, Patients with hemorrhagic lesion had higher QTcD than patients with ischemic lesion and there was no significantly difference between right sided and left sided lesion (Table No.3) .

A study done by SN Chug, Arvind Garg, Amit Yadav,Saurabhi Yadav¹⁸ in 2011, also found that QTcD was higher in patients with large lesion compared to patients with small lesion, this study also found that QTcd was higher in patients with hemorrhagic stroke than patients with ischemic lesion. Another study by Lazar et al¹⁹; also reported similar results. Randell et al²⁰ also reported that patients with subarachnoid hemorrhage have increased QTcD compare with controls.

A study by Nazire Afsar²¹, MD also found that QT dispersion is increased in the first 24 hours in patients with acute stroke and no cardiovascular disease compared with the control group. Although this finding seems to be related to the size of the lesion rather than to the stroke localization. Another study by Lazar et al¹⁹; also noticed that QTcD was higher in patient with intracerebral hemorrhage as compared to ischemic lesion.

Similarly in the study group, both QTD and QTcd values on first hospitalization day were significantly higher than the respective value on the third day (p,0.001 for both) but no significant differences were found between right and left sided subgroups, regarding QT interval measurements, whether on the first or third day (p> 0.05 for all) . In this study we found that QTcD was higher in death patients (100.02 ± 18.12) in 1st day ECG in compare to discharge or lama patients (77.79±15.28) .

CONCLUSION

There was no significant difference in QTcD in acute stroke patient between right sided and left sided lesion and this study also shows the value of QTcD in predicting patients prognosis with early stage of acute stroke patients. As increased QTcD could represent a substrate for arrhythmias, close ECG monitoring of stroke patient during the acute phase could be advantageous.

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Source of Support: Nil; **Conflict of Interest:** None

Submitted: 29-12-2015; **Published online:** 12-01-2016