

Frequency of QTc Abnormalities Seen on Electrocardiogram in Patients of Acute Stroke at the time of Presentation in Emergency Department of Mayo Hospital Lahore

RABIA RATHORE¹, NASIR FAROOQ BUTT², ADIL IQBAL³, HINA LATIF⁴, MARIAM AZEEM⁵, TARIQ WASEEM⁶

ABSTRACT

Aim: To assess the frequency of QTc abnormalities on electrocardiogram at presentation in patients with acute stroke.

Study Design: Cross-sectional study.

Place & Duration of Study: Medical emergency ward, Mayo Hospital, Lahore from January 2016 to June 2016.

Methods: A total of 205 subjects who fulfill the inclusion criteria were included in the research from Emergency ward of Medicine, Mayo Hospital, Lahore. A written approval was taken from all patients or their attendants. CT scan was done and type of cerebrovascular accidents (CVA) was noted. Then all patients underwent electrocardiogram (ECG) at presentation and ECG changes were noted if present.

Results: In our study, out of 205 cases of stroke, 54(26.34%) were within age limit 30-50 years while 151(73.65%) were 51-65 years of age, Mean±SD was calculated as 54.95±6.03 years. 125(60.98%) accounts for male patients and 80(39.02%) for females. 73(35.60%) had hemorrhagic stroke and 132(64.40%) had ischemic stroke. Frequency of ECG abnormalities was recorded in 74(36.09%) while 131(63.90%) had no ECG abnormalities. Out of 74 patients with ECG abnormalities, 21(28.37%) had abnormalities of QTc.

Conclusion: We concluded that ECG changes especially, abnormalities of QTc was seen at presentation in patients with acute stroke.

Keywords: Acute Stroke, Electrocardiogram, QTc abnormalities

INTRODUCTION

Stroke is defined as a neurological deficit due to cerebro-vascular cause that persists beyond 24 hours¹. Stroke is the third most common cause of death and it is the leading cause of disability in developed as well as in developing countries². The incidence of stroke is declining in the Western population but the burden of the disease in South Asian countries has inclined and it is still anticipated to ascend further in the near future³. In Pakistan approximate annual incidence of stroke is 250/100,000, which means 350,000 new cases every year⁴. The Stroke related mortality has been revealed to be between 7% and 20% in various researches from Pakistan. Up to 63% of all patients of stroke progress to complications and up to 89% are dependent on others for their routinely activities⁵.

Many aspects have been investigated regarding the prognosis of stroke. Recently, there has been an

interest in investigating the electrocardiographic (ECG) changes in acute stroke.⁶ A variety of ECG abnormalities are encountered in acute stroke, especially in subarachnoid hemorrhage.⁷ Some of these abnormalities may not be distinguished from those seen with an acute event of ischemic heart disease⁸. Patients usually have concurrent high blood pressure or dyslipidemia affecting coronary vessels, causing ECG changes. Furthermore many underlying cardiac problems, like endocarditis, mural thrombus, myxoma, and atrial septal defect with deep venous thrombosis, can lead to cerebral embolization; heart block, arrhythmias and diminished cardiac output, can also trigger cerebral ischemia⁹. The literature presents considerable heterogeneity regarding ECG changes in stroke patients. This ECG heterogeneity is pertinent to etiology of stroke and to the area of brain involved¹⁰. Although, many studies have shown ECG aberrancy and changes in rhythm in intracerebral bleed and subarachnoid hemorrhage¹¹ insufficient studies are available on ischemic stroke to statistically evaluate the relative frequencies of ECG changes.

In a study by Wu F, the incidence of ECG abnormalities among stroke patients ranged from

¹Associate Professor,

²Assistant Professor.

³Associate Professor.

⁴Assistant Professor.

⁵Senior Registrar

⁶Professor, West Medical Ward, Mayo Hospital Lahore, King Edward Medical University.

Correspondence to Dr. Rabia Rathore Email: doctorrabia77@gmail.com, Cell: 0333-4265869

15.8%-20.4%.¹² Similarly in a study done by Wira CR, 20.4% subjects with acute cerebral ischemia showed ischemic changes in ECG¹³.

On ECG, QT interval is calculated from the beginning of the QRS complex till end of the T wave. It shows the time ventricles of the heart take to depolarize and repolarize, or to contract and relax¹⁴.

QT interval Upto 0.42 s (≤ 420 ms) is considered as normal¹⁵. The QT interval is prolonged with slower heart rate and QT is shorter when the heart rate is fast. So it's better to calculate the corrected QT interval (QTc) by using the Bazett formula i.e., QT interval divided by the square root of the R-R interval¹⁶. Importance of prolonged QT, is that it predisposes to malignant ventricular tachyarrhythmia, torsades de pointes, ventricular fibrillation and sudden death¹⁷.

Rationale of this study was to assess the frequency of electrocardiographic abnormalities i.e. prolonged QTc in patients presenting with acute cerebrovascular accidents or stroke. By learning the frequency of ECG changes in acute stroke patients, steps can be taken to prevent the development of complications.

MATERIAL AND METHODS

It was a cross-sectional study done at Department of Medicine, Mayo Hospital, Lahore on the patients presenting to emergency department with acute stroke Data collection was done from January 2016 to June 2016. Sample size of 205 patients was determined with 95% confidence level, 3.5% margin of error. A written consent was taken from all patients or their attendants. CT scan was done and type of cerebrovascular accidents (CVA) was noted. Then all patients underwent electrocardiogram (ECG) at presentation and ECG changes were noted if present. The patients included in the study were those having age between 30-65 years, of either gender, who were diagnosed with stroke presented to emergency department within 24 hours of onset of symptoms and having radiological confirmation of stroke by CT scan. Patients with central chest pain at presentation, who had transient ischemic attack, patients with history of stroke, myocardial infarction, chronic kidney disease in the past, or pregnant females were excluded from the study. QTc abnormalities were noted on ECG i.e. QT interval >0.44 seconds corrected for the rate using Bazett's Formula to calculate QTc. The data was interpreted in SPSS version 20. For quantitative variables like age mean and standard deviation was estimated. Frequency and percentage was calculated for

qualitative variables like gender of patients, type of stroke and QTc abnormalities. Data was stratified for age, gender, type of stroke to deal with effect modifiers

RESULTS

A total of 205 cases who executed the criteria of recruitment were inducted to assess the frequency of QTc abnormalities on electrocardiogram at presentation in emergency department with acute cerebrovascular accidents. Patients were distributed according to age of the patients, it showed that 54(26.34%) fall in age group of 30-50 years while 151(73.65%) were in the age group 51-65 years. Mean \pm SD was calculated as 54.95 \pm 6.03 years (Table 1).

Patients were divided according to sex, it showed that 125(60.98%) accounts for male patients and 80(39.02%) accounted for females (Table 2).

Regarding type of stroke, 73(35.60%) had hemorrhagic stroke and 132(64.40%) had ischemic stroke (Table 3).

Frequency of ECG abnormalities was recorded in 74(36.09%) while 131(63.90%) had no ECG abnormalities (Table 4).

Frequency of QTc abnormalities was seen in 21(28.38%) out of 74 patients with abnormal ECG findings, whereas no abnormalities in QTc were observed in 53(71.62%) (Table 5). The data was stratified for age, gender, type of stroke to deal with effect modifiers.

Table 1: Age distribution (n=205)

Age (years)	n
30-50	54(26.34%)
51-65	151(73.65%)
Total	205(100%)
Mean \pm SD	54.95 \pm 6.03

Table 2: Gender distribution (n=205)

Gender	n
Male	125(60.98%)
Female	80(39.02%)
Total	205(100%)

Table 3: Type of stroke (n=205)

Type of stroke	n
Ischemic	132(64.40%)
Haemorrhage	73(35.60%)
Total	205(100%)

Table 4: Frequency of ECG abnormalities (n=205)

ECG abnormalities	n
Yes	74(36.09%)
No	131(63.90%)
Total	205(100%)

Table 5: Frequency of QTc abnormality (n=74)

Frequency of QTc abnormalities	n
Yes	21(28.38%)
No	53(71.62%)
Total	205(100%)

DISCUSSION

Annually, more than half a million people in the world experience this devastating disease i.e., acute stroke. According to the etiology stroke is classified into ischemic, in origin due to decrease cerebral blood flow, intracerebral bleed and subarachnoid hemorrhage. This causes death in nearly 20%¹⁸. Patients often have simultaneous hypertension or coronary atherosclerosis, leading to ECG abnormalities.

This research was planned to assess the frequency of electrocardiographic abnormalities in cases presenting with sudden and new onset cerebrovascular accidents or stroke. There are only scanty earlier studies which have assessed ECG changes in patients of stroke without any prior heart disease.

We compared our results with previous studies, Peter Appelros et al¹⁹ in a systemic review in 2009 found that the higher incidence of ischemic and hemorrhagic stroke observed in males than females of the same age, based on age adjusted data. This was also shown in our research that 60.98% and 39.02% cases were males and females respectively.

A study was conducted by Marwat MA et al²⁰ in 88 selected cases of stroke in which male were 62(70.5%) and female were 26(29.5%). These are close to our study.

Study done by Malik S²¹, showed that out of 95 patients with an acute intracerebral bleeding nearly 48(50.5%) of patients had an extended QTc interval in lead III, while approximately 47(49.5%) had an extended QTc interval in lead VI. It was found that the mean QTc interval with deviation in lead III was 440.4±45.2 respectively, (Range=364-571). Our study showed that 28.38% patients had abnormalities of QTc. Fraction of QTc prolongation in lead III was lower in females than in males which was also shown in our research. There is more frequent elongation of QTc III interval in patients which fall in younger age category as compared to category of patients of older age, however, our study revealed higher rate of QTc abnormalities in older age rather than in younger individuals.

Sultan²² did a study on 60 patients of acute stroke. The QTc interval analysis revealed significant prolongation in patients with acute stroke than in control group. The QTc interval was somewhat higher with big infarct or large hemorrhage than small lesions. There was no significant difference between

right and left sided cerebral involvement regarding QTc interval values. The prolonged QTc interval following acute stroke may predispose to polymorphic ventricular tachycardia and sudden cardiac death especially after Subarachnoid Hemorrhage²³. Studies have also shown that the long-term risk of cardiac death is increased following stroke²⁴.

CONCLUSION

In conclusion, ECG changes are frequently seen following stroke and have many clinical implications. The continuous cardiac monitoring of all acute strokes for development of arrhythmia and their timely management can be considered during their initial period of hospital management. Also, as the most common cause of death following acute stroke is cardiovascular death, patients should be on regular periodic follow up.

REFERENCES

1. Lahano AK, Chandio MA, Bhatti MI. Frequency of common modifiable risk factors of stroke. *Gomal J Med Sci* 2014; 12: 222-6.
2. Chin JH, Vora N. The global burden of neurologic diseases. *Neurology*. 2014 Jul 22;83(4):349-51.
3. Feigin VL, Forouzanfar MH, Krishnamurthi R, Mensah GA, Connor M, Bennett DA. et al. Global and regional burden of stroke during 1990–2010: findings from the Global Burden of Disease Study 2010. *Lancet*. 2014;383(9913):245–254.
4. Kamal A, Aslam S, Khattak S. Frequency of risk factors in stroke patients admitted to DHQ teaching hospital. *Gomal Journal of Medical Science*.2010; 8(2) :200-3.
5. Wasay M, Ali S. Growing burden of neurological diseases in Pakistan--need for a national health survey. *J Pak Med Assoc*. 2010 Apr;60(4):249-50.
6. Ebrahim K, Mohamadali A, Majid M, Javad A. Electrocardiograph changes in acute ischemic cerebral stroke. *J Appl Res*. 2012;12 (1):53-7.
7. Chatterjee S. ECG Changes in Subarachnoid Haemorrhage. *Neth Heart J* 2011;19:31–34.
8. Park I, Kim YJ, Ahn S, Sohn CH, Seo DW, Kim WY. Subarachnoid hemorrhage mimicking ST-segment elevation myocardial infarction after return of spontaneous circulation. *Clin Exp Emerg Med*. 2015 Dec 28;2(4):260-263.
9. Togha M, Sharifpour A, Ashraf H, Moghadam M, Sahraian MA. Electrocardiographic abnormalities in acute cerebrovascular events in patients with/without cardiovascular disease. *Ann Indian Acad Neurol*. 2013 Jan;16(1):66-71.
10. Rincon F, Dharmoon M, Moon Y, Paik MC, Boden-Albala B, Homma S et al. Stroke location and association with fatal cardiac outcomes: Northern Manhattan Study . *Stroke*. 2008 Sep; 39(9):2425-31.

11. Ahmadian A, Mizzi A, Banasiak M, et al. Cardiac manifestations of subarachnoid hemorrhage. *Heart Lung Vessel*. 2013; 5:168-78.
12. Wu F, Cao W, Ling Y, Yang L, Cheng X, Dong Q. The predictive role of electrocardiographic abnormalities in ischemic stroke patients with intravenous thrombolysis. *IJC Heart & Vessels* 2014;4:81-3.
13. Wira CR 3rd, Rivers E, Martinez-Capolino C, Silver B, Iyer G, Sherwin R, Lewandowski C. Cardiac complications in acute ischemic stroke. *West J Emerg Med*. 2011 Nov;12(4):414-20.
14. Johnson JN, Ackerman MJ. QTc: how long is too long? *Br J Sports Med*. 2009 Sep;43(9):657-62.
15. Pieter G. Postema and Arthur A.M. Wilde The Measurement of the QT Interval. *Curr Cardiol Rev*. 2014 Aug; 10(3): 287–294.
16. Postema PG, De Jong JS, Van der Bilt IA, et al. Accurate electrocardiographic assessment of the QT interval: teach the tangent. *Heart Rhythm*. 2008;5:1015-1018.
17. Ambhore A, Teo SG, Bin Omar AR, Poh KK. Importance of QT interval in clinical practice. *Singapore Med J*. 2014 Dec;55(12):607-11.
18. Sörös P, Hachinski V. Cardiovascular and neurological causes of sudden death after ischaemic stroke. *Lancet Neurol*. 2012 Feb;11(2):179-88.
19. Appelros P, Stegmayr B, Terént A. Sex differences in stroke epidemiology: a systematic review. *Stroke*. 2009 Apr;40(4):1082-90.
20. Marwat MA, Usman M, Hussain M. Stroke and its relationship to risk factors. *Gomal J Med Sci*. 2009;7:17- 21.
21. Malik S, Abdul Sattar R, Shah S, Rehman H, Tahira, Ismail MA. Frequency of QTc prolongation in patients with hemorrhagic stroke. 2013 *J Ayub Med Coll Abbottabad*. Jul-Dec; 25(3-4):75-7.
22. Sultan, Hasan I. The relationship between prolonged QT interval and acute stroke in Tikrit teaching hospital. *Tikrit Medical Journal* . 2012, Vol. 18 Issue 2, p46-51.
23. Koppikar S, Baranchuk A, Guzmán JC, Morillo CA. Stroke and ventricular arrhythmias. *Int J Cardiol*. 2013 Sep 30;168(2):653-9.
24. Krishnamoorthy V, Mackensen GB, Gibbons EF, Vavilala MS. Cardiac Dysfunction After Neurologic Injury: What Do We Know and Where Are We Going? *Chest*. 2016 May;149(5):1325-31.