

QTC INTERVAL CHANGES IN CLINICALLY HEALTHY SUBJECTS IN RELATION TO AGE AND SEX

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ABSTRACT: BACKGROUND AND OBJECTIVES: The diagnostic accuracy of ECG to differentiate between 'Normal' and 'Abnormal' rests entirely on analysis of distribution in 'Normal', i.e. clinically healthy, population. Age is biologically most important variable and there is significant age differences found in QTc interval measured. This study was undertaken to see the QTc changes in different age groups in healthy adults. **MATERIALS & METHODS:** A study was conducted in a group consisting of 150 (75 male and 75 female) healthy adults in the age group 21 to 80 years. All the subjects were divided into different subgroups according to their sex and age. Lead II ECG was recorded on all subjects in supine position in an ambient temperature for 3 minutes by using Power lab 8/30 series with dual bio amplifier. And the analysis of the QTc interval was done by the software in the same instrument. **RESULTS:** There was prolongation of QTc Interval with increasing age in both males and females. **CONCLUSION:** In this study there were changes in QTc interval between males and females of different age groups. But all these changes were within physiological limits.

KEYWORDS: QTc interval, Aging.

INTRODUCTION: The heart is endowed with a special system for generating rhythmical electrical impulses to cause rhythmical contraction of the heart muscle and conducting these impulses rapidly through the heart. When the cardiac impulse passes through the heart, electrical current also spreads from the heart into the adjacent tissues surrounding the heart. As body along with its fluid act as a volume conductor, the electrical impulses produced by the heart can spread through the body. A small portion of the current spreads all the way to the surface of the body. If electrodes are placed on the skin on opposite sides of the heart, electrical potentials generated by the current can be recorded; the recording is known as an electrocardiogram (ECG).¹ The electrocardiogram (ECG or EKG) is a graphic recording of electric potentials generated by the heart. The signals are detected by means of metal electrodes attached to the extremities and chest wall and are then amplified and recorded by the electrocardiograph. Q-T interval is measured from onset of Q wave to the end of T wave & represents duration of electrical systole. The QT interval varies with the heart rate & with autonomic nervous input. The QT interval may be corrected for heart rate (QTc).

The normal QTc usually does not exceed 0.42 s in men & 0.43 in women. An early work on ECG was conducted on 50 healthy subjects to study the amplitude of various waves and the length of the various intervals, which forms the basis of our present day interpretation of ECG.^{2,3} ECG finding in the aged suggested that the reliability of ECG assumes a greater role in evaluation of cardiac status in people of older group, and also suggested that ECG may be a highly reliable

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indicator of heart diseases in the ninth and tenth decades.⁴ A study on influence of age and somatic variables on ECG in 1285 subjects revealed an increase in the magnitude of initial P, QRS duration, QT interval and T magnitude in young males.⁵ It has been reported that the frequency of ECG abnormalities increases with age in both men and women.⁶ The QT interval is of potential use in cardiovascular risk profiling.⁷ Various western studies have associated between prolongation of QT interval with mortality.^{8,9} During the last decade, the heart rate adjusted QT interval or QTc interval and its dispersion is being increasingly associated with diagnosis of various cardiac abnormalities.¹⁰ This study reported a prolonged QTc interval in men and that the prevalence in both the sexes increases markedly with age. Another study revealed that QTc interval increased with advancing age.¹¹

ECG leads actually display the instantaneous differences in potential between these electrodes. ECG is a noninvasive, inexpensive, and highly versatile test and used in detecting arrhythmias, conduction disturbances, and myocardial ischemia, and also reveals other findings related to life-threatening metabolic disturbances (e.g., hyperkalemia) or increased susceptibility to sudden cardiac death.

MATERIALS AND METHODS: The study was conducted on male and female subjects of different age groups. The subjects were recruited from general population in and around Raichur. Ethical clearance was obtained from the Navodaya Medical College Ethical Committee for Human Research to conduct the study. 150 (75 males and 75 females) healthy male and female adults in the age group 21 to 80 years were included in the study and subjects with h/o hypertension, diabetes, heart diseases, smoking and alcohol consumption were excluded from the study. All the subjects were divided into different subgroups according to their sex and age. Group I included age between 21-40 yrs, group II included age between 41-60 yrs and group III included age between 61- 80 yrs in both males and females, each group comprising 25 subjects.

After thorough history taking and clinical examination, the purpose and procedure of the study was explained to all the subjects. Informed consent was taken from all the subjects. After rest for 10 minutes, Lead II ECG was recorded on all subjects in supine position in an ambient temperature for 3 minutes by using Power lab 8/30 series with dual bio amplifier (Manufactured by AD instruments, Australia with model no ML870) and the analysis of the QTc interval was done by the software in the same instrument. BMI, hip circumference, waist circumference and waist /hip ratio was calculated.

RESULTS: One way ANOVA test followed by post-hoc Tukey-Kramer Multiple Comparisons Test and students 't' test for parametric and Mann-Whitney Test for non-parametric data were used for comparison between groups. Pearson's correlation coefficient 'r' was used to examine relationship between QTc interval changes with difference age groups. A two tailed p-value less than 0.05 will be considered as significant. The mean recorded values of QTc interval in males and females were 0.21 ± 0.09 , 0.22 ± 0.05 and 0.27 ± 0.12 and 0.22 ± 0.05 , 0.26 ± 0.07 and 0.26 ± 0.05 in group I, group II and group III respectively. QTc interval was within normal range in all the age groups. There was prolongation of QTc interval with increase in age. This prolongation was statistically significant when compared between I and III group.

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Parameters	Group I	Group II	Group III	Post hoc multiple Comparison
QTc Interval (s)	0.21±0.09	0.22±0.05	0.27±0.12	Gr I vs II, p>0.05 Gr I vs III, p<0.05* Gr II vs III, p>0.05

Table 1: Comparison of QTc interval between males of different age groups

* Statistically significant

Parameters	Group I	Group II	Group III	Post hoc multiple Comparison
QTc Interval (s)	0.22±0.05	0.26±0.07	0.26±0.05	Gr I vs II, p>0.05 Gr I vs III, p<0.05* Gr II vs III, p>0.05

Table 2: Comparison of QTc interval between females of different age groups

* Statistically significant

Parameters	Male	Female	p-value
QTc Interval (s)	0.21±0.09	0.22±0.05	P=0.57

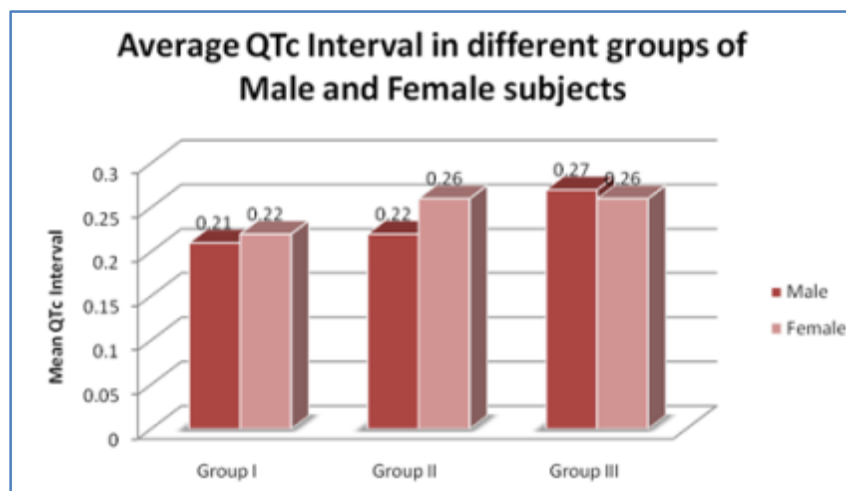
Table 3: Comparison of QTc interval between males & females of age group-I

Parameters	Male	Female	p-value
QTc Interval (s)	0.22±0.05	0.26±0.07	P=0.07

Table 4: Comparison of QTc interval between males & females of age group-II

Parameters	Male	Female	p-value
QTc Interval (s)	0.27 ± 0.11	0.26 ± 0.05	P=0.47

Table 5: Comparison of QTc interval between males & females of age group-II



Graph 1

DISCUSSION: The diagnostic accuracy of ECG to differentiate between 'Normal' and 'Abnormal' rests entirely on analysis of distribution in 'Normal', i.e., clinically healthy, population.¹² Our study revealed that QTc intervals increased with advancing age in both males and females. But the increase was significant only in males in the age group 61-80 years compared to 21-40 years. When compared between gender we found that females had a slight but insignificant longer QTc than males in the young and middle-aged group. Our findings match with previous studies.¹¹ Several studies have shown that women have longer QTc interval than men.¹³ QTc interval may increase with age due to aging processes occurring in the myocardium, such as fibrosis and amyloidosis of the myocardium. Another explanation for the increased QTc interval with age is an imbalance between sympathetic and parasympathetic tone. In the elderly, an exaggerated shift toward sympathetic activity has been reported.¹⁴ There was prolongation of QTc interval in males with increase in age. This prolongation was statistically significant when compared between I and III group. There was prolongation of QTc interval in females with increase in age. This prolongation was statistically significant when compared between I and III group. There was statistically insignificant prolongation of QTc interval in females compared males in all the groups. In this study we saw changes in QTC interval in both males and females of different age groups. There were changes in QTc interval between males and females of different age groups. But all these changes were within physiological limits.

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