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RESEARCH ARTICLE

Effect of age and gender on QT interval

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ABSTRACT

Background: The sudden cardiac death syndrome has a large preponderance in men compared to women and that too in older age group. Various population studies have demonstrated four- to seven-fold increase of sudden cardiac death among men compared with women. As coronary event risk increases in post-menopausal women, sudden cardiac death risk increases proportionately. Corrected QT interval measurements may predict the chances of increased risk of sudden cardiac death in an apparently healthy individual. **Aims and Objectives:** The objective of the study was to find any independent association between age and gender on the QT-corrected interval. **Materials and Methods:** This study included 48 healthy men and 32 healthy women between 17 and 68 years age divided into three groups: Young (<30 years), middle-aged (30-60 years), and the elderly (>60 years). Standard supine 12 lead electrocardiographic was done in these subjects, and statistical analysis was done. The cutoff points for QTc were ≤450 ms (normal), 451 to 470 ms (borderline), and >470 ms (prolonged), in case of women, and ≤430 ms (normal), 431 to 450 ms (borderline), and >450 ms (prolonged) for men. **Results:** QTc was found to be 374.9 ± 31 (ms) in the young group, 386.3 ± 14.8 (ms) in middle-aged group, and 414.5 ± 11.8 (ms) in the elderly group. Males had longer QTc than the females in the young- and the middle-age groups. **Conclusion:** Age significantly correlated *(r* = 0.475) with QT and QTc interval in healthy subjects. Gender was a poor predictor of QT interval.

KEY WORDS: Age; Gender; QT Interval; QT-corrected Interval

INTRODUCTION

With an increasing number of persons surviving into their eighth decade and beyond, the knowledge of changes in the cardiovascular system that is expected to occur with aging is important. Changes occur in the myocardium, chamber cavities, valves, epicardial coronary arteries, conduction system, pericardium, and aorta. Age probably represents an accumulation of environmental influences and the effects of genetically programed senescence in the body systems.

During the past decades or so, many studies have been done to study the effect of disease states and therapeutic drugs on QT and QTc interval, and many attempts have been made to understand the relationship between QTc interval and the risk of arrhythmias, but very few data are available on the physiologic determinants of QT interval in healthy subjects.[1] It is a well-established fact that abnormal QTc prolongation on the electrocardiographic (ECG) should be viewed as an independent risk factor for sudden cardiac death.[2,3] Conflicting results have been obtained in the previous studies investigating the relationship between age and QT interval.[1,4-6]

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In the recent years, the medical problems and health care of women have received greater attention. There are poorly understood differences between men and women, both in morbidity and mortality and in the expression of diseases. Gender differences in morbidity and mortality may be explained in part by psychosocial factors such as socially-defined gender roles, poverty, participation in the workforce, and lifestyle.[7] The sudden cardiac death syndrome has a large preponderance in men compared to women during young adult and early middle age years because of the protection that women enjoy from coronary atherosclerosis before menopause. Various population studies have demonstrated four- to seven-fold excesses of sudden cardiac death among men compared with women before the 65-year-old age groups. As coronary event risk increases in post-menopausal women, sudden cardiac death risk increases proportionately. Even though the overall risk is much lower in younger women, the classic coronary risk factors are still predictive of events among women.[7] The relationship between gender and QT interval has also been investigated. The previous studies[8,9] showed that women have longer (≈10-20 ms) QTc values than men**.** The present study was undertaken to evaluate the association between age and gender on corrected QT interval in healthy individuals.

MATERIALS AND METHODS

This study included 48 healthy men and 32 healthy women between 17 and 68 years of age, who had responded favorably to the appeal for cooperation in carrying out this investigation.

The healthy subjects were judged on the following criteria:

1. No history, current or past, of any cardiac disease including hypertension.
2. Normal cardiac physical examination.
3. Not under any drugs which are able to effect ventricular repolarization.

Before undertaking the experiment, age and gender were noted. Then, the total study group was divided into three subgroups: Young (<30 years), middle-aged (30-60 years), and elderly (>60 years), for further correlation of age and gender with QTc.

ECG Measurement and Interpretation

Standard supine 10 s, 12-lead resting ECG was recorded with a computerized ECG (Recorders and Medicare Systems (P) Ltd., Chandigarh, India) at a sampling frequency of 50 Hz and stored digitally. All ECGs were processed by RMS software to obtain ECG measurements and interpretation. Based on the opinion of an *ad hoc* expert group,[10] QTc prolongation was categorized into three gender-specific categories. For women, the cutoff points were ≤450 ms (normal), 451-470 ms (borderline), and >470 ms (prolonged), and for men, ≤430 ms (normal), 431 to 450 ms (borderline), and >450 ms (prolonged).

Statistical Analysis

Differences in clinical characteristics of patients between subgroups of QTc duration were assessed, and results are shown as mean ± standard deviation. To assess whether QTc was independently related to age and gender, a univariate regression analysis was used. Pearson's correlation analysis was used to assess the relationship between numerical variables.

RESULTS

Table 1 shows the three different groups and their distribution. In <30 years of age group, 16 (20%) were male and 6 (7.5%) were female. In 30-60 years of age group, it was 24 (30%) versus 23 (28.7%), and in >60 years of age group, it was 8 (10%) versus 3 (3.8%), respectively. Table 2 shows the mean QTc values across the three groups of the study population. It shows that the mean QTc was higher in the 30-60 years of age group and highest in the group with age >60 years, so we can conclude that the elderly persons are prone for high QTc and constitute high-risk group.

Graph 1 shows the variation of QTc in the three different age groups. It shows that with increasing age QTc was also found to be more, thus making the elderly group more prone for ventricular arrhythmias. Graph 2 shows the correlation of age and QTc in the study population. A univariate regression analysis showed that QTc significantly correlated with age ($P < 0.001$, $r = 0.475$). Graph 3 shows the gender-related differences in QTc in three age groups of the study population. Males had a longer QTc than females in the young- and middle-aged group. This difference, however, was no longer

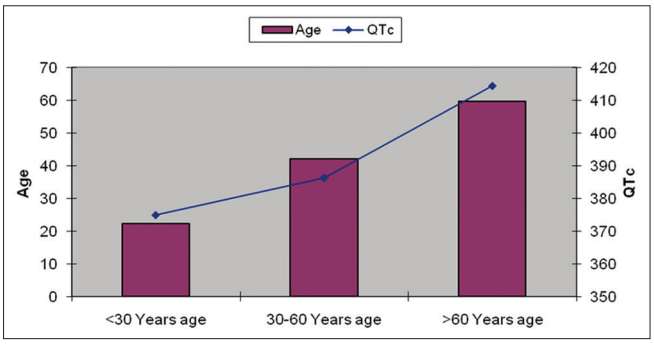
Table 1: Age and gender distribution of the study population

Age (years)	Male (%)	Female (%)	Total (%)
<30	16 (20)	6 (7.5)	22 (27.5)
30-60	24 (30)	23 (28.7)	47 (58.7)
>60	8 (10)	3 (3.8)	11 (13.8)
Total	48 (60)	32 (40)	80

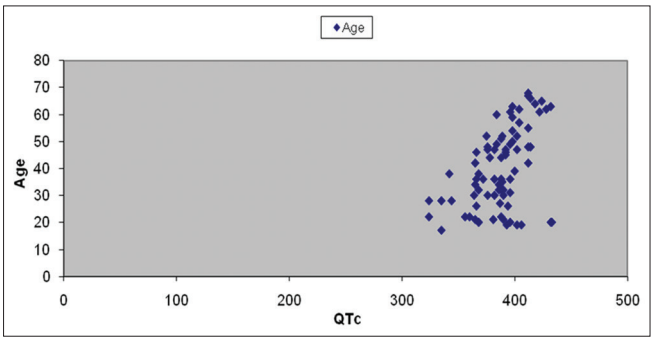
Table 2: Mean QT and QTc values of the study population as per mean±SD

Parameters	<30 years of age	30-60 years of age	>60 years of age
Age (in years)	22.2±3.3	42.3±8.7	63.8±2.3
QT (ms)	316.3±12.1	317.1±7.9	331.9±12.6
QTc (ms)	374.9±31	386.3±14.8	414.5±11.8

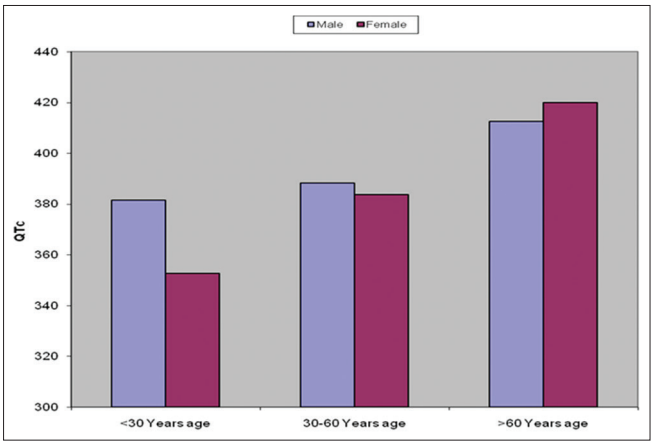
SD: Standard deviation



Graph 1: Distribution of QT corrected with age



Graph 2: Correlation of QT corrected with age



Graph 3: Distribution of QT corrected with gender

evident in the elderly age group in which females had a slightly longer QTc.

DISCUSSION

The present study shows that age significantly correlated with QTc interval (r = 0.475). On comparing the effects of different age groups on QTc interval, it was found that mean QTc was lowest (374.9 ± 31) in the young age group, more in the middle age group (386.3 ± 14.8), and highest in the elderly age group (414.5 ± 11.8), showing that with increase in age there is increase in QTc interval which was statistically significant (P < 0.001). It was also found that 60% of study populations were males and 40% were females. The male-female distribution in the three different groups were 20% versus 7.5% in young age group, 30% versus 28.7% in middle age group, and 10% versus 3.8% in elderly age group, respectively. This study evaluated the relationship between gender and QTc interval and found that young male (age group <30 years) had longer QTc interval than their female counterparts. This gap reduced in middle age group persons (30-60 years) and elderly age group (>60 years). Females had slightly more QTc interval than males of the same age group.

The discordance in the results obtained in this study forage than other studies[1,6-8] might be related to the different ways used to express and calculate the QT interval. The relationship between advancing age and QT interval in the present study might be explained by the changes in the heart, and vasculature observed in healthy elderly subjects. These include cardiac hypertrophy, increased vascular stiffness, and aortic impedance. This cardiac hypertrophy is due to large measure to an increase in the size of cardiac myocytes. The latter is associated with a significant prolongation of the transmembrane action potential and might provide an explanation for the prolongation of QT interval associated with advancing age.[11] The previous studies evaluating gender[7,8] showed that women have longer (>10-20 ms) QTc values than men. The present study shows that gender differences in QT interval, although not statistically significant, might be of some relevance in young subjects, which is consistent with the findings of Taneja et al.[5] This gender-related difference might be related to different sex hormone blood levels since it is not present at birth and appears only after puberty.[12]

The authors would like to include more number of participants and more variables such as body mass index and blood pressure into account which may have an independent influence on the QT-corrected interval and thus sudden cardiac death. There is no conflict of interest to declare and is a non funded study.

CONCLUSION

In our study, age showed a significant independent association with QTc interval (r = 0.475, P < 0.001). It was found that young male had longer QTc than their female counterparts, but the association was poorly established. Age is independently associated with QT and QTc interval in healthy subjects. The increase of QT interval associated with aging might be secondary to cardiac hypertrophy and myocardial action potential prolongation. Gender is a poor predictor of QT interval.

REFERENCES

1. Mangoni AA, Kinirons MT, Swift CG, Jackson SH. Impact of age on QT interval and QT dispersion in healthy subjects: A regression analysis. Age Ageing. 2003;32(3):326-31.

2. Schwartz PJ. QT prolongation, sudden death, and sympathetic imbalance: The pendulum swings. J Cardiovasc Electrophysiol. 2001;12(9):1074-7.
3. Al-Khatib SM, La Pointe NM, Kramer JM, Califf RM. What clinicians should know about the QT interval. JAMA. 2003;89:1363-72.
4. Reardon M, Malik M. QT interval change with age in an overtly healthy older population. Clin Cardiol. 1996;19(12):949-52.
5. Taneja T, Mahnert BW, Passman R, Goldberger J, Kadish A. Effects of sex and age on electrocardiographic and cardiac electrophysiological properties in adults. Pacing Clin Electrophysiol. 2001;24(1):16-21.
6. Merri M, Benhorin J, Alberti M, Locati E, Moss AJ. Electrocardiographic quantitation of ventricular repolarization. Circulation. 1989;80(5):1301-8.
7. Anthony LK, Andrea ED, Fauci AS, Kasper DL, Hauser SL. Women's health. Harrison's Principles of Internal Medicine. 15th ed. New York: McGraw-Hill; 1998. p. 21-5.
8. Molnar J, Zhang F, Weiss J, Ehlert FA, Rosenthal JE. Diurnal pattern of QTc interval: How long is prolonged? Possible relation to circadian triggers of cardiovascular events. J Am Coll Cardiol. 1996;27(1):76-83.
9. Sagie A, Larson MG, Goldberg RJ, Bengtson JR, Levy D. An improved method for adjusting the QT interval for heart rate (the Framingham heart study). Am J Cardiol. 1992;70(7):797-801.
10. Committee for Proprietary Medicinal Products. The Assessment of the Potential for QT Interval Prolongation by Non-Cardiovascular Medicinal Products. London: Committee for Proprietary Medicinal Products; 1997.
11. Capasso JM, Malhotra A, Remily RM, Scheuer J, Sonnenblick EH. Effects of age on mechanical and electrical performance of rat myocardium. Am J Physiol. 1983;245(1):H72-81.
12. Stramba-Badiale M, Spagnolo D, Bosi G, Schwartz PJ. Are gender differences in QTc present at birth? MISNES Investigators. Multicenter Italian study on neonatal electrocardiography and sudden infant death syndrome. Am J Cardiol. 1995;75(1):1277-8.

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