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Research Article

IMPACT OF AGE AND GENDER ON QTc INTERVAL- A RETROSPECTIVE STUDY

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ABSTRACT
Prolonged QTc interval has been associated with an increased risk of sudden death in congenital Long QT syndrome and increased risk of cardiovascular and all-cause mortality in broad range of clinical population as well as healthy subjects in population based studies. Medical records of 82 patients who visited Sri R.L. Jallapa hospital during the period of six months from January to June 2008 .The basal heart rate, systolic and diastolic blood pressure were noted. Lead II of the ECG was used to calculate Heart rate, RR interval. QTc was calculated using Bazett's formula after measuring QT interval manually by using vernier caliper. In our study, Females had a significant higher heart rate (88.81 ±19.59) and QTc interval (452.84±28.53) when compare with males (80.34± 16.55),(438.67±28.64) respectively. QT interval was negatively correlated with HR, QTc and RR interval. QTc showed a positive correlation with gender and a negative correlation with DBP and MAP. Conflicting results have been obtained in previous studies investigating the relationship between ageing and QT interval, which show that there was not much increase in QTC with age as much as that for gender. An ECG with measurement of QTc interval is a simple and an inexpensive method to detect high risk individuals among middle age and elderly population.

Keywords: *QTc Interval, Electrocardiography, RR Interval, Blood Pressure*

INTRODUCTION
QT interval is the body surface summation of ventricular depolarization and repolarization Okin *et al.*, (2004). QT interval was measured in the frog's heart by Burdo-Sanderson& Page in 1880.Einthoven introduced the term QT interval and Bazett recognized the rate dependence of QT interval 80 years ago. Bazett (1920). Patients with prolonged QT interval are at the risk of malignant ventricular arrhythmias and sudden death Algra *et al.*, (1991). Prolonged QTc interval has been associated with an increased risk of sudden death in congenital Long QT syndrome and increased risk of cardiovascular and all cause mortality in broad range of clinical population as wellas healthy subjects in population based studies Schouten *et al.*, (1991), Goldbag *et al.*, (1991). Reardon *et al.*, (1996) have reported that the relationship between ageing and QTc intervaland found a significant correlation between advancing age and QTc in both men and women. Taneja *et al.*, (2001) have studied the effect of gender and ageing in electrophysiological properties without heart disease undergoing ECG testing. They found that ageing was associated with prolonged QT interval. Zareba *et al.*, (1995) observed that the female siblings of patients with congenitallong QT syndromehave a higher risk of heart diseases than those without thedisease. Such results indicate that normal female adults may have a higher risk of developing arrhythmia as a resultof the QTc prolongation.
Aims & Objectives*:* To study the relationship of QTc with age and gender.
Study Design*:* Analytical type of retrospective study.

MATERIALS AND METHODS
Medical records of 82 patients who visited Sri R.L. Jallapa hospital during the period of six months from January to June 2008. The basal heart rate, systolic and diastolic blood pressures were noted. Lead II of

the ECG was used to calculate Heart rate, RR interval. QTc was calculated using Bazett's formula after measuring QT interval manually by using verniercaliper. The start of QT interval is defined as the first deflection of QRS complex. The end of QT interval is defined as the intersection of the descending part of the T wave with the isoelectric line Pallavi *et al.,* (2004), Arduino *et al.,* (2003).

Bazett's Formula $QTc = \frac{QT}{\sqrt{RR\ interval\ (sec)}}$

Inclusion Criteria

1. Age: 30-75 yrs., 2. both gender.

Exclusion Criteria

1. Hypertensive patients
2. History of complete and incomplete heart block
3. Atrial fibrillation
4. Patients on drugs which may affect ventricular repolarization

Parameters Studied*: I. Demographic data*

1. Gender, 2. Age

II. Physiological Parameters

1. Heart rate (HR), 2. Systolic Blood Pressure (SBP), 3. Diastolic Blood pressure (DBP), 4. Mean Arterial Pressure (MAP), 5. PulsePressure (PP).6. RR interval, 7.QT interval, 8. QTc interval.

RESULTS AND DISCUSSION

Statistical Analysis

Data were presented as Mean ± SD. The difference in the variables across the groups was assessed by independent 'T' test. Pearson correlation analysis was used to assess the relationship between numerical variables. P-value less than 0.05 indicated statistical significances.

Table 1: Distribution of the study group

Gender	Number (%)
Male	49(59%)
Female	33(41%)
Total	82(100%)

Table 2: Gender difference on the following parameters in the study group

Parameters (N=82)	Male	Female	Sig	95% Confidence Interval of the Difference
AGE	44.4±19.52	40.8±17.16	0.394	-4.754 to 11.934
HR	80.34±16.55	88.81±19.59*	0.038	-16.465 to -.477
SBP	118.12±17.05	117.03±16.74	0.775	-6.495 to 8.680
DBP	73.59±9.89	73.58±10.52	0.994	-4.534 to 4.566
PP	44.53±12.04	43.45±13.85	0.71	-4.661 to 6.813
MAP	88.43±11.40	88.06±11.15	0.883	-4.692316 to 5.441853
RR	772.32±178.47	710.42±157.40	0.111	-14.442 to 138.247
QT	382.85±46.90	379.39±47.03	0.744	-17.58 to 24.506
QTC	438.67±28.64	452.84±28.53*	0.031	-26.98795 to -1.352975

Values are expressed as mean ± SD.
*$P \leq 0.05$ **$P \leq 0.01$ ***$P \leq 0.001$*

Table 3: Correlations of the following parameters in the study group

Parameters (N=82)	GENDER	AGE	HR	SBP	DBP	PP	MAP	QTC	RR	QT
GENDER	1									
AGE	-0.095	1								
HR	.229*	0.059	1							
SBP	-0.032	0.074	-0.125	1						
DBP	-0.001	-0.124	-0.01	.657**	1					
PP	-0.042	0.196	-0.157	.802**	0.076	1				
MAP	-0.016	-0.037	-0.068	.892**	.926**	.446**	1			
QTc	.239*	0.178	0.102	-0.158	-.262*	-0.001	-.235*	1		
RR	-0.178	-0.057	-.897**	0.105	0.003	0.137	0.054	-0.126	1	
QT	-0.037	0.057	-.776**	0.018	-0.138	0.133	-0.074	.420**	.842**	1

** Correlation is significant at the 0.05 level (2-tailed).*
***. Correlation is significant at the 0.01 level (2-tailed).*

***Table 1*:** Shows the total number of subjects and number of males and females included in the study. Males were 49 (59%) and Females were33 (41%). Total of 82 subjects were included in the study.
***Table 2*:** shows the baseline characters of the subjects. The mean age of the total subjects were 42.96± 18.5, males being older than females. Females had a significant higher heart rate (88.81±19.59) than males (80.34± 16.55). SBP, DBP, PP&MAP showed no gender difference. No significant difference was observed for R-R and QT interval. However there was a significant difference with QTc interval with gender. Females showed a higher QTc interval (452.84±28.53) when compared tomales (438.67±28.64).
***Table3*:** shows the correlation within variables. Heart rate showed a positive correlation with gender. RR interval was negatively correlated with HR. QT interval was negatively correlated with HR, QTc and RR interval. QTc showed a positive correlation with gender and a negative correlation with DBP and MAP.

Discussion

Conflicting results have been obtained in previous studies investigating the relationship between ageing and QT interval, which show that there was not much increase in QTC with age as much as that for gender. Few studies have shown a significant correlation between advancing age and QTc in both men and women Reardon *et al.,* (1996), Arduino *et al.,* (2003), Taneja *et al.,* (2001). In contrast Merri *et al.,* (1989) who looked at descriptive ECG features of ventricular repolarization did not find any relationship between age and QT interval. Our study also showed no significant correlation between age and QT interval. The ambiguity might be related to the different ways used to express and calculate the QT interval.

Gender related difference in QTc has been shown in previous studies, women have longer (~10-20 ms) QTc values than men. Molnar *et al* evaluated the range and variability of QTc interval in 21 healthy

subjects aged between36-76 years over 24 hours. They observed that the percentage of readings > 450ms was significantly greater in women Molnar *et al.,* (1996).Our study confirms this finding. Sagie *et al.,* (1992) using the Data from Framingham study measured QTc interval in 5,018 subjects without cardiovascular diseases and observed that women had a consistently longer QTc over a wide range of RR intervals.

The gender related difference seems to be caused by a prolongation of repolarization duration in women. Drici *et al.,* (1996) confirmed the women have longer resting QTc interval than men. The shorter QT interval in men reflects the possible gender difference in behavior of the different ventricular trans mural cell types and possible effects of sex hormones on the behavior of channels that govern repolarization. Lehman *et al.,* (2001) in their study of familial long QT syndrome found that women have longer QTc interval than men. This phenomenon can be related to different sex hormones blood levels as it is not present at birth and appears only after puberty Stramba- Badiale *et al.,* (1995). Rautaharju *et al.,* (1992) reported that QTc showed no gender difference for subjects under 15 years old, and that after this age QTc is greater in women than in men.

According to previous studies, estrogen controls the ion channel onset and inhibits the potassium current, especiallyIks (the slow component of the delayed rectifier) to increase QTc, whereas testosterone is considered to narrow the interval. Shin *et al.,* (2005). Arduino *et al.,* (2003) observed that no difference in QT interval between males and females in elderly supporting the hypothesis of a hormone mediated phenomenon, which is lost after the menopause.

A Korean study has observed that age and DBP were associated with QTc prolongation in normal adults. Our study has shown a correlation between increased QTc and DBP and MAP. There were citations in the literature showing an increase in SBP & DBP with increase in QTc, in contrast, this study showed a decrease in DBP with increase in QTc. This observation can be because of the study pattern being a retrospective study.

Conclusion

An ECG with measurement of QTc interval is a simple and an inexpensive method to detect high risk individuals among middle age and elderly population.Corrected QT interval (QTc) measurement did not show any change with advancing age but there was an increase in QTc interval in females than males. In our study, the majority of females in themiddle-age group and post-menopausal, this might explain our findings. Previous studies showed that there was an increase in DBP with increase in QTc but this study shows that there was decrease in DBP with increase in QTc interval. Finally, due to a lack of information on some important cardiovascular risk factors, such as body mass index, and smoking status, we were unable to evaluate the performance of the QTc interval (Nielsen *et al.,* 2014).

Lacunae and Recommendations

The limitations of the present study were related to its retrospective nature and to the fact that QT measurements were obtained from relatively small sample of patients and need to be confirmed in large group. The measurement of QTc was manual; this may have led to an error. Several other factors such as changes in autonomic neural tone and metabolic factors might play an important role in determining these electrocardiographic parameters. Errors can be minimized if QTc is calculated electronically while recording the ECG.

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