

ORIGINAL RESEARCH

Impact of Obesity On QT And QTc Intervals – Is It Age Related?

Nalini Jeyaprakash,¹ D. Rajakumar,² Prema Sembulingam³

ABSTRACT

Introduction: Literature says that QT and QTc intervals are prolonged in obese subjects and it is correlated with cardiovascular morbidity. As these reports are from higher age group subjects, we were intrigued to see whether obesity in younger age group also reflects the same effect on QT and QTc intervals.

Material and Method: 50 young male and female volunteers in the age group of 17 to 22 years participated in the study. 24 of them were normal-weight subjects and 26 of them were obese subjects. Anthropometric variables were noted and the body mass index (BMI) was calculated from the height and weight of the subjects. Electrocardiogram was recorded in supine position for all the subjects in Lead II. From the recording, QT interval was calculated & QTc was derived by using Bazett's formula. The difference in QT and QTc intervals between the two groups was calculated by using Student's t test

Results: The results revealed that there was no statistically significant difference in QT ($p < 0.584$) or QTc intervals ($p < 0.460$) between the obese and non-obese subjects. It is contrary to the earlier reports. This controversy may be because of the difference in the age group. But still, our study showed a non-significant increase in QT and QTc intervals in obese subjects leading to the speculation that it may become significant as age advances.

Conclusion: Based on this, counseling can be done to the young obese subjects to control the obesity and avoid the future cardiovascular problems.

Keywords: Bazett's formula, Body mass index, obesity, QT interval, QTc interval

How to cite this article: Nalini Jeyaprakash, D.Rajakumar, Prema Sembulingam. Impact of Obesity On QT And QTc Intervals – Is It Age Related? *Int J Cont Med Res.* 2015;2(2):96-100

Source of Support: Nil

Conflict of Interest: None

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INTRODUCTION

Obesity is a global epidemic in both adults and children in the modern era. Globally, about 2.8 million people die every year because of complications of overweight or/and obesity and about 35.8 million (2.3%) of epidemics are caused by overweight or/and obesity.¹ Obese subjects are at an increased risk for developing many medical problems, like insulin resistance, diabetes mellitus, impaired glucose tolerance (IGT), increase in total cholesterol (TC) and triglycerides (TGs), decrease in high-density lipoprotein cholesterol (HDL-C)²⁻⁵ and gastrointestinal disorders like gastro-esophageal reflux disease (GERD).⁶ They are even prone for colorectal polyps, colon cancer, liver diseases and psychological problems like eating disorder, depression, social stigmatization and discrimination.⁷ Obesity is also a risk factor for cardiovascular diseases like hypertension (HT), coronary artery disease, left ventricular hypertrophy, cardiomyopathy, cardiac failure etc.⁸⁻¹⁰ Because of these complications, obesity poses a lot of mental and physical agony to the

individual and large financial burden on the economy of the country.¹¹⁻¹³

Obesity related cardiovascular diseases were studied extensively and ECG had been the mainstay for the diagnosis of these diseases. Invariably, changes were noticed in the QT interval of ECG recording in obese persons.¹⁴⁻¹⁶ QT interval is part of QRS complex that extends from the beginning of QRS complex to the end of T wave. Functionally, it represents the electrical activity of the ventricular myocardium that includes depolarization and repolarisation. The normal value for QT interval is 0.4 sec (seconds) and it ranges between 0.4 to 0.43 sec.¹⁷

Clinically, QTc is preferred to QT. QTc is the corrected QT interval. As QT interval depends on the HR and HR variation occurs even under physiological conditions, correction factor has to be applied to get real time of the QT interval. This was done by using Bazett formula named after the Physiologist Henry Cuthbert Bazett. The formula is $QTc = QT / \sqrt{RR}$ where QTc is the QT interval corrected for heart rate, RR is the interval between the peak of two R waves in the QRS complex.¹⁸ If the value is 400 msec or less it is considered as normal both in male and female. Increase in QTc is an indication of some cardiovascular problems like cardiac arrhythmia and sudden cardiac death.¹⁹⁻²²

The earlier reports showed that QT interval was longer in obese subjects than in non-obese subjects and they developed cardiac arrhythmia resulting in sudden death. Those studies were done on adult males of higher age group or premenopausal and postmenopausal females.²³⁻²⁵

As obesity among youngsters has become common now-a-days, we were intrigued to see whether obesity-based QT interval changes and the related cardiovascular problems occur in these subjects also.

MATERIAL AND METHODS

The present study was designed as an experimental study conducted in the Department of Physiology, Rajah Muthiah Medical College, Annamalai University, Annamalai Nagar, Chidambaram, Tamil Nadu. Fifty male and female student volunteers in the age group of 17 to 22 years were selected randomly for the study.

Sample size was determined by using the formula

$$n = [Z_{\alpha/2}\sigma/E]^2$$

They were divided into 2 groups: non-obese group (Group-1) and obese (Group-2). Classification of obese and non-obese subjects was done according to WHO criteria.²⁶

Selection of the subjects

Inclusion criteria

For group 1, 24 normal non-obese subjects (13 males and 11 females) with body mass index (BMI) less than 24.9 were included for the study. For group 2, 26 age-matched obese subjects (13 males and 13 females) with BMI more than 24.9 and not suffering from any clinical conditions were selected for the study.

Exclusion criteria:

Subjects with cardiovascular diseases like hypertension, congenital heart disease and valvular heart disease, respiratory disease, neurological disorders, asthmatics, diabetics, smokers, pan chewers and alcoholics were excluded from the study. Those who were on medication for some reason or other and those who were on regular exercise or yoga practice or athletes were also excluded from the study. The study was approved by the Institutional Ethical Committee and the written informed consent was obtained from the participants after explaining the procedure to them.

Procedure

The subjects were instructed to avoid caffeinated beverages for 12 hours prior to the test. They were instructed to report in the Research laboratory of the Department of Physiology in the institution at 11 AM and were rested for 10 min. After recording the anthropometric variables (age, sex, height and weight) BMI was calculated from the height and the weight. The ECG was recorded for one minute in supine position using electrocardiograph (Model – Cardiart 108T (MK V1)). The recording in the standard bipolar limb lead II was used for calculating the QT interval. Three QT intervals were chosen randomly from the recorded strip and the average of these QT intervals was taken as the reliable value. From

this value of QT interval QTc was calculated

STATISTICAL ANALYSIS

The data were analysed in SPSS, 20th version. Continuous variables were expressed as mean ± SD. Pairs of groups were compared using student’s ‘t’. Statistical significance was set at p<0.05.

RESULT

Demographic variables: The age (p < 0.04), weight (p< 0.000) and the BMI (p < 0.000) of the obese subjects were significantly higher than the non-obese subjects whereas height of the two groups did not show any significant difference (Table 1)

QT and QTc intervals: There was no statistically significant difference either in QT interval (p < 0.584) or in QTc interval (p < 0.460) between the two groups (Table 2, Fig 1)

DISCUSSION

The results of the present study showed that QT and QTc were not affected in young obese subjects. This is in contradiction to the earlier reports where prolongation of QT and QTc was shown in obese subjects.²¹⁻²³ This contradiction may be attributed to the age of the obese subjects; in the earlier studies, older age group subjects were the targets for the study.^{27, 28} It may be possible that this age group people are already susceptible for cardiovascular problems like hypertension, arrhythmia, coronary artery disease etc. With added disadvantage of obesity, there is possibility of aggravating these problems.

In the Framingham heart Study, the annual Sudden Cardiac Death (SCD) rate was 40 times higher in obese subject than in an age matched non obese subjects.¹⁰ According to Carella et al, QT interval prolongation was common in obese subjects²⁰ and they showed that whenever there was a 50% increase in fat mass (FM%) above normal, there was 5 msec increase in QTc. J-J Park and PD Swan also found significant Qtc interval prolongation (p<0.001) in the obese women aged between 26-47 years.²⁸ Thus literature shows that obesity is one of the criteria

Variables	Group 1	Group 11	Significance p<.05
Age in years	17 ± 0.63	18 ± 0.97	0.04*
Height in cm	169.2 ± 9.7	167.7 ± 10.6	0.24
Weight in kg	61.9 ± 8.9	79 ± 12.3	0.000*
BMI	21.56±1.91	28.08±3.19	0.000*
QT in sec	0.3488±0.025	0.3536±0.036	0.584
QTc in sec	0.3889±0.025	0.3963±0.043	0.460

Table-1: Demographic variables and QT and QTc intervals in non-obese and obese subjects (Group 1 – Non-obese subjects, Group II – obese subjects)

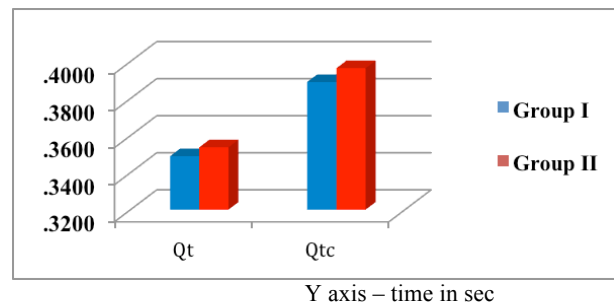


Figure:1- QT and QTc intervals in non-obese and obese subjects

for prolonged QT and QTC in higher age group people. J-J Park and PD Swan speculated that changes in QTc depended not only on age and obesity but also on the pattern of obesity. According to them, prolongation of QTc was more in upper body obesity (426 msec) than in lower body obesity (413 msec) & non-obesity (399 msec) and this was shown as one of the causes for prolonged QTc in premenopausal females.²⁸

However, Girola et al., were of the opinion that there was no correlation between the obesity and QT (QTc) interval irrespective of the age and pattern of fat deposition and they named it as “uncomplicated obesity”.¹⁹ Our results correlate with that of Girola et al. However, this should not be a consolation factor because, if older age group obese subjects are exhibiting prolonged QT and QTc interval, the younger obese group may also start getting this complication at one time or other unless the obesity is controlled. Moreover, though there was no statistical significance in the

difference of QT and QTc interval between the two groups in the present study, these two variables show non-significant increase in obese subjects (Table-1, Fig-1). Lack of statistical significance may be because of less number of subjects or it may be in the process of increase which may be expressed frankly as the age advances. And if prolongation of QT and QTc interval is one of the valid diagnostic tool for future cardiovascular morbidity which can be found out by the simple ECG recording, it can be executed in younger uncomplicated obese subjects periodically and precautionary measures can be taken to avoid further complications.

Leotla et al. also of the opinion that QT interval can be a valuable marker for prevention of future cardiovascular problems.²⁹ Alexandria Papaioannou et al have gone a step ahead and stated that obesity not only causes prolonged QTc but is also associated with “acquired prolonged QTc interval”.³⁰ However, one thing that is common among every one is that weight loss program in a proper time has got a positive effect in reducing the QTc and preventing the further complications of not only cardiovascular system but the physical and mental health as whole.

CONCLUSION

The present study explored the impact of age on QT and QTc interval in obese subjects in comparison with non-obese subjects. It gives an impression that obesity in younger age group is an “uncomplicated obesity”. But this consolation is transient because the results of the present study show a small increase in QT and QTc in obese subjects though it is not statistically significant. So, there may be possibility for these obese youngsters to enter into the danger zone of cardiovascular complications if the obesity is not checked and tackled now. This is possible if these youngsters can be advised for periodical ECG recording to find out the status of QT and QTc interval and control the obesity to avoid further complications as age advances.

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