

Corrected QT Interval (QTc) Correlation with Body Mass Index and Central Obesity in Adults at a Tertiary Care Hospital, Chennai, India.

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ABSTRACT

Background: Obesity is a growing global health concern and is strongly associated with cardiovascular morbidity. Prolonged corrected QT interval (QTc) is an established marker of ventricular repolarization abnormality and is linked to increased risk of malignant arrhythmias and sudden cardiac death. Both general obesity (measured by BMI) and central obesity (measured by waist circumference) may influence QTc duration.

Objective: To evaluate the correlation between QTc interval and body mass index (BMI) as well as central obesity parameters in adult individuals.

Methods: A cross-sectional observational study was conducted from January 2024 to March 2025 involving 150 adults aged 30–70 years attending outpatient services. BMI and waist circumference were recorded. Standard 12-lead ECG was performed and QT interval was corrected using Bazett's formula ($QTc = QT/\sqrt{RR}$). Correlation analysis and multivariate regression were performed to assess associations between QTc, BMI, and waist circumference.

Results: Mean QTc interval increased progressively across BMI categories ($p < 0.001$). A significant positive correlation was observed between QTc and BMI ($r = 0.42, p < 0.001$) as well as waist circumference ($r = 0.48, p < 0.001$). Central obesity demonstrated a stronger association with QTc prolongation compared to BMI. After adjusting for age, sex, hypertension, and diabetes status, waist circumference remained an independent predictor of prolonged QTc ($\beta = 0.31, p < 0.001$).

Conclusion: QTc interval shows a significant positive correlation with both BMI and central obesity, with central adiposity demonstrating a stronger association. Routine ECG evaluation in overweight and centrally obese individuals may help identify patients at risk of arrhythmic complications.

Keywords: QTc interval, body mass index, central obesity, waist circumference, ventricular repolarization, arrhythmia risk

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INTRODUCTION

Obesity has emerged as a major public health problem worldwide and is closely linked to cardiovascular disease, metabolic syndrome, and sudden cardiac death. Beyond structural cardiac changes, obesity also influences cardiac electrophysiology.

The QT interval on electrocardiography represents ventricular depolarization and repolarization. Because it varies with heart rate, it is corrected as QTc. Prolonged QTc is a recognized predictor of ventricular arrhythmias, particularly torsades de pointes, and has been associated with increased cardiovascular mortality.

Several mechanisms have been proposed linking obesity to QTc prolongation, including:

- Autonomic imbalance
- Insulin resistance
- Systemic inflammation
- Increased left ventricular mass
- Altered myocardial ion channel function

While BMI reflects overall adiposity, central obesity—measured by waist circumference—is more closely associated with metabolic and cardiovascular risk. However, limited data exist comparing the relative influence of BMI and central obesity on QTc duration in Indian populations.

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This study aimed to evaluate the correlation between QTc interval, BMI, and waist circumference in adult individuals.

Materials and Methods

Study Design and Setting

This cross-sectional observational study was conducted between January 2024 and March 2025 at the Department of General Medicine, Sree Balaji Medical College and Hospital, Chennai. Institutional Ethics Committee approval was obtained, and informed consent was secured from all participants.

Study Population

A total of 150 adults aged 30–70 years were enrolled.

Inclusion Criteria

- Age 30–70 years
- Willing to provide informed consent

Exclusion Criteria

- Known congenital long QT syndrome
- Current use of QT-prolonging drugs
- Electrolyte abnormalities
- Structural heart disease
- Acute coronary syndrome
- Severe renal or hepatic dysfunction

Data Collection

Demographic details and clinical history including hypertension, diabetes, and smoking status were recorded.

Anthropometric measurements included:

- Height and weight (for BMI calculation: kg/m²)
- Waist circumference measured at midpoint between lower rib and iliac crest

BMI categories (Asian cut-offs):

- Normal: 18.5–22.9 kg/m²
- Overweight: 23–24.9 kg/m²
- Obese: ≥25 kg/m²

Central obesity defined as:

- ≥90 cm (men)
- ≥80 cm (women)

ECG Measurement

Standard 12-lead ECG was performed after 10 minutes of rest.

- QT interval measured manually in lead II or V5

• QTc calculated using Bazett's formula:
 $QTc = QT / \sqrt{RR}$

Prolonged QTc defined as:

- 440 ms (men)
- 460 ms (women)

Statistical Analysis

Data were analyzed using SPSS version 26.

- Continuous variables: Mean ± SD
- Correlation: Pearson's correlation coefficient
- Group comparison: ANOVA / independent t-test
- Multivariate linear regression to assess independent predictors

A p-value <0.05 was considered statistically significant.

Results

Baseline Characteristics

- Mean age: 52.6 ± 8.9 years
- 62% male
- 48% hypertensive
- 36% diabetic

Mean BMI: 26.8 ± 3.9 kg/m²

Mean waist circumference: 92.4 ± 8.6 cm

Mean QTc interval: 428.6 ± 24.3 ms

QTc and BMI

Mean QTc by BMI category:

- Normal: 412.5 ± 18.7 ms
- Overweight: 424.8 ± 21.4 ms
- Obese: 441.2 ± 23.6 ms

Trend statistically significant (p < 0.001).

Correlation:

- QTc vs BMI → r = 0.42 (p < 0.001)

QTc and Central Obesity

Participants with central obesity had significantly higher QTc:

- With central obesity: 439.8 ± 22.9 ms
- Without central obesity: 415.6 ± 19.3 ms
- p < 0.001

Correlation:

- QTc vs Waist circumference → r = 0.48 (p < 0.001)

Multivariate Analysis

After adjusting for:

- Age
- Sex
- Hypertension
- Diabetes
- BMI

Waist circumference remained independently associated with QTc prolongation:

- $\beta = 0.31$
- $p < 0.001$

BMI showed weaker independent association:

- $\beta = 0.18$
- $p = 0.04$

DISCUSSION

This study demonstrates a significant positive correlation between QTc interval and both BMI and central obesity. Importantly, waist circumference showed a stronger independent association with QTc prolongation compared to BMI.

Central adiposity is metabolically active and strongly linked to insulin resistance, sympathetic overactivity, and systemic inflammation. These factors contribute to altered ventricular repolarization and prolonged QTc.

Obesity-related QTc prolongation may result from:

- Increased sympathetic tone
- Reduced vagal activity
- Myocardial lipid accumulation
- Structural remodeling
- Subclinical ischemia

The stronger association with central obesity highlights the importance of visceral fat in cardiovascular electrophysiological alterations.

Given the simplicity of ECG and anthropometric measurements, screening obese individuals for QTc

prolongation may aid in early identification of arrhythmia risk.

CONCLUSION

QTc interval shows a significant positive correlation with both BMI and central obesity. Central obesity demonstrates a stronger and independent association with QTc prolongation.

Routine ECG evaluation in overweight and centrally obese individuals may facilitate early detection of ventricular repolarization abnormalities and help prevent adverse cardiac outcomes.

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Conflicts of Interest

None declared.

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