ORIGINAL ARTICLE

Prognostic Value and Frequency of QT Interval and QT Dispersion in Patients with Cardiometabolic Syndrome
(Obese, Hypertensive and Diabetic Patients)

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ABSTRACT

Objective: To examine the effect of the three primary criterions of cardiometabolic syndrome namely; obesity, hypertension and diabetes on QTc interval and QTc dispersion.
Study design: Cross-sectional study.
Settings: Departments of Medicine, Mayo Hospital & Sharif Medical & Dental College Lahore.
Duration: 3 months from March 2011 to April 2011.
Subjects: A total of 75 unselected patients of cardiometabolic syndrome with obesity, diabetes and were selected hypertension for this study.
Results: A relevant association between prolonged QTc and age (P=0.85), duration of diabetes (P=0.372), duration of hypertension (P=0.213) and BMI (P=0.273) was observed. Out of total 75 patients, 28 males and 47 females with mean duration of diabetes 8.68yrs and 7.42 years, with hypertension of around 3.14years and 4.67 years. It was seen that in class II obesity (BMI >40) QTc interval was increased in a proportionate manner of 495ms.
Conclusion: QTc may be an independent marker for cardiovascular, cerebrovascular and total morbidity and mortality in patients with cardiometabolic syndrome.

Keywords: QTc, QTd, obesity, diabetes, hypertension

INTRODUCTION

QT interval in ECG reflects the total duration of ventricular myocardial depolarization and repolarization.It has been shown that a prolonged QT interval is associated with sudden death and poor survival in healthy subjects in a variety of clinical conditions such as type 1 and type 2 diabetes and hypertension[1,2,3].Based on the evidence, that non-uniform repolarization provides a substrate for the development of malignant arrhythmias, interlead differences in the QT interval duration and the range of the duration is termed as **QT dispersion (QTd**).QTd is almost the direct measure of the heterogeneity of myocardial repolarization .Many studies have shown clinical and prognostic importance of prolonged QT interval and QTd in various non-cardiac diseases which has been postulated to be involved in the increased mortality of diabetic patients.

MATERIAL AND METHODS

It was a cross- sectional survey of 75 unselected consecutive NIDDM (non-insulin dependent diabetes mellitus), obese and hypertensive patients. Main measures were seen by the proportionate relation of duration of hypertension on QT interval, P value =0.21(table 1). All consecutive, NIDDM, Obese and Hypertensive patients who were referred to our departments for the metabolic control were enrolled in this study after informed consent. Defined as non – ketoacidosis manifestation of diabetes after the age of 40 yrs and subsequent treatment with diet and oral hypoglycemic agents for more than one year.

Hypertension: defined as blood pressure of patient when noticed more than 139mm of Hg systolic and diastolic of more than 89 mm of Hg. Antihypertensive drugs were started thereafter along with diet control.

Obesity: BMI more than 27 kg/m2.None of the patients received antiarrhythmic therapy. All the baseline measurements were performed, QT interval analysis was done on a 12 lead, conventional, non - computerized registered ECG. Almost all patients had sinus rhythm .Two independent observers unaware of the diagnosis, measured retrospectively one QT interval in every such lead in which Q waves were obvious. Corrected QT interval was calculated by: **Bazett's equation QT c = QT interval (measured at ECG)/(√R-R interval):** Almost all of the patients had sinus rhythm.

Exclusion criteria:

- Hypokalemia
- Hypomagnesaemia

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- Hypocalcaemia
- Class 1A,1C and III antiarrhythmic drugs
- Macrolides, Amitriptyline, Antihistamines
- Organophosphorus poisoning
- Mitral Valve Prolapse, Acute MI, CNS Diseases

Limitations: This was a cross- sectional survey and results need to be verified by a large prospectively designed study. Relatively small sample size may have masked the identification of some important risk factors on QT interval.QTc interval itself is a only a serogate marker for the prediction of serious vascular event.

RESULTS

In this study done over 75 patients, results are presented as frequency and means with standard deviations. It has been seen that there was relevant association between prolonged QTc and age (P=0.85), duration of diabetes (P=0.372), duration of hypertension (P=0.213) and BMI (P=0.273). Out of total of 75 patients, there were 28 males and 47 females, with mean ages around 53 and 52 respectively, having mean duration of diabetes of around 8.68 years and 7.42 years, suffering with hypertension around 3.14 and 4.67 years (table 1). There was no effect of duration of diabetes on QT interval as has been validated in other studies. However, it was markedly affected by the duration of hypertension, among all patients 16 males had mean duration of hypertension of around 3.14 years, 34 females having mean duration of hypertension around 4.67 years (table1). 38 patients were overweighed (BMI = 25-29.9), 26 patients had obesity of class I (BMI=30-34.9) and 11 patients were having class II obesity (BMI=35-39.9).

QTc prolongation in, 38 patients having BMI=25-29.9(overweight), was observed in range of 280milliseconds to 500milliseconds, with average result of 413.07milliseconds. 26 patients having BMI=30-34.9(class I obesity)had results ranging in between 248 milliseconds to 523 milliseconds with average result of 402.31 milliseconds .Rest of 11 patients having BMI =35-39.9(class II obesity)had results ranging from 424 milliseconds to 539 milliseconds ,with average of485.16 milliseconds (Table 2). When patients' BMI goes beyond 35 mg/m2 ,corrected QT interval is increased in a proportionate manner reaching to maximum of 495 milliseconds at BMI >40 kg/m2.(figure 1)

Table 1:

	=n	Mean	Std. deviation	P value
Age of the patient (years)				
Male	28	53.12	10.19	0.851
Female	47	52.61	8.17	
Duration of diabetes (years)				
Male	28	8.68	4.82	0.372
Female	47	7.42	4.50	
Duration of hypertension (years)				
Male	28	3.14	3.03	0.213
Female	47	4.67	4.38	
Body mass index				
Male	28	29.68	2.03	0.273
Female	47	30.58	3.72	

P-value<0.05=Significant

Table 2: Descriptive Statistics for QTL (Mili Second) with Respect to BMI

QTL (Mili second)	=n	Mean	Std. Deviation	Mini	Maxi
Over weight (25-29.9)	38	413.07	60.16	280	500
Class 1obesity (30-34.9)	26	402.31	77.95	248	523
Class 2obesity (35-39.9)	11	485.16	39.60	424	539
Total	75	418.28	68.27	248	539

F-value=3.785, p-value=0.030*

Table 3: Multiple Comparisons

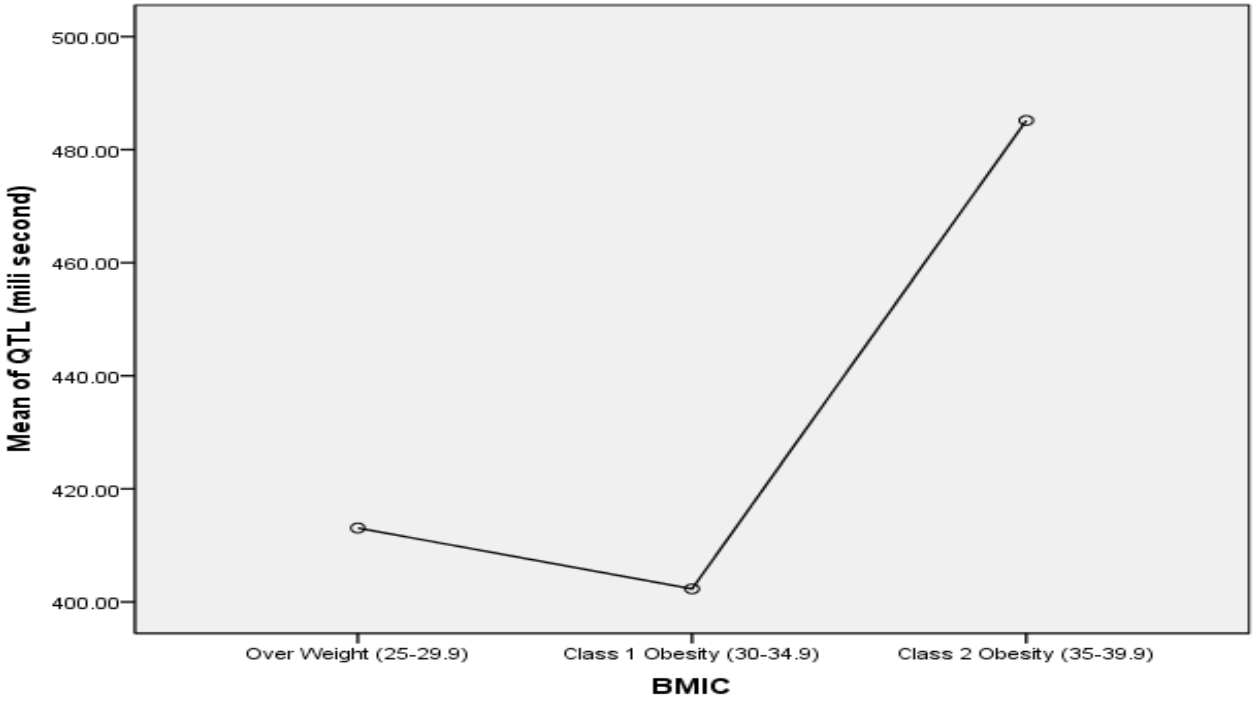
QTL (Mili second) LSD	Over weight (25-29.9)	Class 1 obesity (30-34.9)	Class 2 obesity (35-39.9)
Over Weight (25-29.9)	-	0.598	0.017*
Class 1 Obesity (30-34.9)	-		0.010*
Class 2 Obesity (35-39.9)	-		-

The mean difference is significant at the 0.05 level

Table 4 Regression Coefficients

Model	Unstandardized Coefficients		Sig.
	B	Std. Error	
Constant	188.217	91.528	.045
Duration of diabetes	-.297	2.223	.894
Duration of hypertension	1.704	2.662	.525
Body mass index	7.411	2.842	.012

Dependent Variable: QTL (mili second)



DISCUSSION

Diabetes patients are at increased risk of dying from cardiovascular diseases, reason for which is not completely understood. Excessive cardiovascular risk in this population even after the normalization of the other conventional risk factors, suggests there are other incompletely understood mechanisms which increases risk in this population .Ventricular instability as manifested in QT abnormality might be an important additional mechanism. Veglio et al[1] show the clinical and prognostic importance of increased QT interval and QT dispersion in diabetics and various studies have verified this finding. In our study of QT interval, increased QTc in diabetics was found but not influenced by the duration of diabetes[4, 5,6] had been seen in the several other studies In the present study diabetic subjects were significantly classified in the BMI category (Table 2).

Studies suggest that obesity is associated with cardiac autonomic dysfunction (Gutin et al[7], 2005). We hypothesized that as severity of obesity (BMI) in diabetics increased, QT would be more prolonged and electrical voltage measurements for left ventricular hypertrophy will increase.

Moreover, hypertension for longer duration substantially rises the risk of prolonged QTc[8]. In a hypertensive risk population identified by electrocardiographic left ventricular hypertrophy, increased QRS duration and maximum QT (apex) interval can further stratify mortality risk even in the setting of effective blood pressure-lowering treatment[9]. Study shows that, even prior to the development of cardiac hypertensive disease, a prolongation of QTc and a reduced HRV, both markers of cardiovascular risk, coexist in a proportion of patients with untreated essential hypertension[10]. In this study, it is clearly seen that longer the duration of hypertension, more prolonged the QTc

In our study done at overweight (BMI 25-29) patients, the QTc(mean) turned out to be 413.07 MS, which subsequently decreased to 402 ms and in class II obesity(BMI>40), it was found in mean range of around 485.16 ms. This was in contrast to the other studies done.

It is known that insulin resistance is increased in obesity. Disturbed glucose metabolism of the heart may have directly contributed to an impaired myocardial electrical stability. Interestingly in a report of previous study, QTc duration was associated with level of insulin and glucose tolerance [12].The authors speculated that reduce myocardial glucose uptake may be involved in impaired cardiac repolarization as indicated by a prolongation of QT interval. QT prolongation may also result from cardiac adrenergic dysinnervation with altered balance of sympathetic and parasympathetic cardiac neuroactivity[13,14,15], myocardial cell defects[16]and lead to a reduced electrical stability in diabetic patient.

CONCLUSION

In concluding the study, QT c is an important independent marker for total cardiovascular, cerebrovascular mortality in NIDDM and is influenced by the obesity, duration of diabetes and hypertension. Since this parameter is easy to assess, it may help in identifying high risk patients in daily practice. Intervention studies aiming at reducing this severely increased risk should be undertaken.

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