ORIGINAL ARTICLE

Frequency of Prolonged QT Interval in Obese, Hypertensive and Diabetic Patients

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ABSTRACT

Objective: Examine the effect of obesity, hypertension and diabetes on QTc interval.
Materials and methods: cross-sectional study, department of Medicine, Mayo hospital Lahore.50 unselected patients of obesity, diabetes and hypertension .QTc was calculated using Bazett's equation.
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 50 patients, 16 males and 34 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 maybe an independent marker for cardiovascular, cerebrovascular and total morbidity and mortality.

Key words: QTc, 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.

OBJECTIVE

Primary objective of study was to determine the frequency of prolonged corrected QT interval in the population of obese, hypertensives and diabetics. Our secondary objective was to examine the effect of hypertension, obesity and diabetes on prolonged QT c.

MATERIAL AND METHODS

Study design : It was a cross- sectional survey.

Setting: Department of Medicine Mayo Hospital, Lahore

Duration of study: three months from March 2011 to May 2011.

Subjects: 50 unselected consecutive NIDDM (non-insulin dependent diabetes mellitus), obese and hypertensive patients

Measures of outcome: main measures were seen by the proportionate relation of duration of hypertension on QT interval, P value =0.21(table 1)

Patients and methods: All consecutive, NIDDM, Obese and hypertensive patients who were referred to our department for the metabolic control were enrolled in this study after informed consent.

NIDDM: 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 139 mm 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 (ECG,X -

ray,pulses,ankle reflexes, light and touch sensation ,vibration sensation using 125 Hz tunning fork.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)/($\sqrt{}$R-R interval.)

Almost all of the patients had sinus rhythm.

EXCLUSION CRITERIA

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

LIMITATIONS

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

RESULTS

In this study done over 50 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 BM (P=0.273).

Out of total of 50 patients, there were 16 males and 34 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).

28 patients were overweighed (BMI = 25-29.9), 16 patients had obesity of class I (BMI=30-34.9) and 6 patients were having class II obesity (BMI=35-39.9).

Table 1:

Sr		Gender	N	Mean	Std. Deviation	p-value
1	Age of the Patient (Years)	Male	16	53.12	10.19	0.851
		Female	34	52.61	8.17	
2	Duration of Diabetes (Years)	Male	16	8.68	4.82	0.372
		Female	34	7.42	4.50	
3	Duration of Hypertension (Years)	Male	16	3.14	3.03	0.213
		Female	34	4.67	4.38	
4	Body Mass Index	Male	16	29.68	2.03	0.273
		Female	34	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	Minimum	Maximum
Over Weight (25-29.9)	28	413.07	60.16	280	500
Class 1 Obesity (30-34.9)	16	402.31	77.95	248	523
Class 2 Obesity (35-39.9)	6	485.16	39.60	424	539
Total	50	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

		Unstandardized Coefficients		
		B	Std. Error	Sig.
Model	(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

a. Dependent Variable: QTL (mili second)

QTc prolongation in, 28 patients having BMI=25-29.9(overweight), was observed in range of 280milliseconds to 500milliseconds, with average result of 413.07milliseconds. 16 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 6 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).
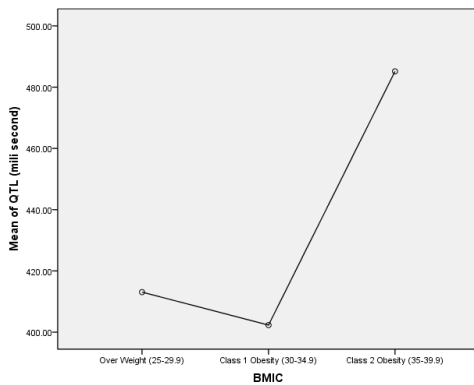
Fig. 1:

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 all[1] shows 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 all[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 ,this 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.

REFRENCES

1. Elming H, Holm E, Jun L, Torp-pedersenC,kober L,etal. The prognostic value of the QTInterval and QT interval dispersion in all-cause andcardiac mortality and morbidity in a population of Danish citizen Eur Heart J 1998; 19:1391-1400.
2. Naas AO,Divadson NC,ThmpsonC,CummingF,Ogston SA,etal.QT andQTcdispersion are accurate predictors of cardiacdeath in newly diagnosed non-insulin dependentdiabetes:acohort study.BMJ 1998; 316:745-746.
3. Rossing P,Breum L,Major-Pederesen A,SatoA,Winding H,etal.Prolonged QTc interval predictsmortality in patients with type 1 diabetesmellitus.Diabet Med 2001;18:199-205. .
4. Veglio M,Bruno M,Borra M,etal.Prevalance ofincreased QT interval duration and dispersion intype 2 diabetic patients and its relationship withcoronary heart disease.a population-based cohort.JInter Med 2002; 251:317-324.
5. Veglio M,Giunti S,Steven L,etal.Prevalance ofQT interval dispersion in type 1 diabetes and itsrelation with cardiac ischemia.Diabetes Care2002;25:702-707
6. Cardoso C,Bloch K,Goncalves S,DeccacheW.clinical determination of increased QT dispersion in patients with diabetes mellitus.Internationaljournal of cardiology 2001;79:253-262. 1
7. Gutin,B.,Howe,C.,Johnson, M., Humphries, M., Snieder, H., & Barbeau,P. (2005). Heart rate variability in adolescents: Relations to Physical activity, fitness, and adiposity. Medicine and Science in Sports Exercise,37, 1856−1863
8. Maule S, Rabbia F, Perni V, Tosello F, Bisbocci D, Mulatero P, Veglio F; Prolonged QT interval and reduced heart rate variability in patients with uncomplicated essential hypertension. Hypertens Res. 2008 Nov;31(11):2003-10.
9. Oikarinen L, Nieminen M, Viitasalo M, Toivonen L, Jern S, Dahlöf B, Devereux R, Okin P, for the LIFE Study Investigators;QRS Duration and QT Interval Predict Mortality in Hypertensive Patients With Left Ventricular Hypertrophy
10. S, Rabbia V,Perni V, Tosello F, Bisbocci D,Mulatero P and Veglio F;Prolonged QT Interval and Reduced Heart Rate Variability in Patients with Uncomplicated Essential Hypertension. Hypertension Research (2008) 31, 2003–2010; doi:10.1291/hypres.31.2003.
11. Prediabetes and Blood Pressure Effects on Heart RateVariability, QT-Interval Duration, and Left VentricularHypertrophy in Overweight-Obese AdolescentsShirleatha Lee, Patricia Ann Cowan,Glenn T. Wetzel, Pedro Velasquez-Mieyer, Journal of Pediatric Nursing (2010) .
12. Dekker J,Feskens E,Schouten E,etal.QTcduration is associated with levels of insulin andglucose tolerance.Diabetes 1996; 45:376-380.
13. Bellavere F,Ferri M,Guarini L,etal.Prolonge QTperiod in diabetic autonomic neuropathy apossible role in sudden cardiac death.Br Heart J1988; 59:379-383.
14. Shimabukuro M,Chibana T,etal.Increased QTdispersion and cardiac adrenergic

dysinnervation in diabetic patients with autonomic neuropath.Am JCardio 1996; 78:1057-9.

15. Turpenien A,Vanninen E,etal.Demonstration ofregional sympathetic denervation of the heart in diabetes.Diabetes Care 1996;1083-90.

16. Towbin J.New revelation about the long QTsyndrome.N Engl Med 1995;333:384-385.

17. Sawicki P, Kiwitt S, Bender R, Berger M. Thevalue of QT interval dispersion for identification of total mortality risk in non-insulin dependentdiabetes mellitus. Journal of internal medicine 1998; 243: 49-56.