Review

QT INTERVAL IN DIABETES MELLITUS

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ABSTRACT

Ventricular myocardial depolarization and depolarization are reflected in QT interval. In diabetics cardiac autonomic neuropathy is well known and is associated with QT prolongation. Hyperglycemia per se can also affect QT interval. QT prolongation in diabetics may contribute to ventricular fibrillation and sudden death. Care should be taken in using other drugs in diabetics which are well known to affect QT interval.

KEY WORDS: QT interval; Diabetes mellitus; Cardiovascular complications; Drugs and QT Interval.

INTRODUCTION

QT prolongation has been shown to predict cardiac death in both type I and type 2 diabetes mellitus. Assessment of QT interval could be cost effective way of identifying diabetes mellitus with high risk for cardiovascular complications and sudden death. Excess of cardiovascular risk persists in diabetes even after normalization of other conventional risk factors like hypertension, dyslipidemia, lack of exercise, tobacco as smoking or chewing, and homocysteinemia. Ventricular instability as manifested as QT abnormalities might be an important added risk factor.

QT INTERVAL

It reflects the total duration of ventricular myocardial depolarization and repolarization in the ECG . It is usually corrected for heart rate by Bazett formula (1), where QTc = QT $\sqrt{}$RR interval. The Bazett formula gives a slight over correction of QT interval at higher heart rates.

Hodges et al (2) also gave a formula to get corrected QT as follows: QTc = QT + 1.75 (rate-60) and is gaining more acceptance. QTc prolongation in ischemic heart disease carries an increased risk (2-5 times) of sudden cardiac death. There is increased incidence of ventricular fibrillation with prolonged QTc.

QTd is the difference between the maximum and minimum QT interval in 12 lead ECG. QTd = QTmax – QTmin. Increase QTd may indicate non-uniform ventricular repolarization leading to malignant ventricular arrhythmias. There is no need to correct QTd.

Increased QTc, QTd are seen in chronic heart failure(3), peripheral vascular disease(4), hypertension(5), hypertrophic cardiomyopathy(6) and myocardial infarction(7).

QTc more than 440 ms (0.44 s) and QTd over 80 ms are considered abnormally prolonged. Prolongation of QT interval is seen in type 1 and type 2 diabetes (8, 9) more so in diabetics with autonomic neuropathy (10).

Approximately 16% of type 1 diabetics and 26% type 2 diabetics have QT prolongation. Increased QTd has been reported as 7% in type 1 and 33% in type 2 diabetes (10). Diabetic patients with more pronounced QT abnormalities tend to have a higher age and blood pressure and they tend to have cardiovascular complications. Even in recently diagnosed diabetes mellitus QT interval is prolonged in the absence of CHD, and autonomic neuropathy, prolonged QTc and QTd are independent markers of CHD are predictors of sudden cardiac death (11).There has been no association of QTd and microvascular complications of diabetes.

Cardiac autonomic neuropathy is a well recognized complication of diabetes. Ewing's (13) battery of tests is done for assessment of cardiac autonomic neuropathy. QT prolongation may be a single test less cumbersome single test for predicting cardiac autonomic neuropathy in diabetics. Further studies are indicated to justify the above statement.

QT INTERVAL AND HYPERGLYCEMIA

Uncontrolled hyperglycemia per se contributes to QT prolongation and increased QTd. In a study of healthy non-diabetic subjects an independent association between high plasma glucose concentration and increased QTc and QTd was reported (14). A similar relation was observed between QTc duration and fasting glucose. QT interval duration was found to be independently associated with HbA_{1c} in type 1 diabetes in the Eurodiab (15) IDDM complication study.

Acute hyperglycemia has numerous effects on the

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cardiovascular system. Hyperglycemia impairs ischemic preconditioning, a protective mechanism for ischemia. Infarct size increases in the setting of hyperglycemia, there is reduced coronary collateral flow. Acute hyperglycemia may induce cardiac myocyte death through apoptosis or by increasing ischemic reperfusion cellular injury (16).

Other vascular consequences of acute hyperglycemia relevant to outcome of diabetic patients include blood pressure changes, catecholamine elevation, platelet abnormalities and electrophysiological changes. Marfella (17) reported increased systolic and diastolic blood pressure and increased endothelin level with acute hyperglycemia in type 2 diabetic patients.

Overall increased QTd seems to represent the sum of several adverse cardiac abnormalities such as fibrosis, hypertrophy, dilatation, ischemia and probably autonomic dysfunction. Thus QTd as a summation could be a global prognostic marker for cardiac mortality in diabetic patients. It has been suggested that a patient with QT abnormalities should undergo tests for myocardial ischemia (Treadmill Test) as well as left ventricular abnormalities (Echocardiogram).

Drugs which Prolong QT Interval and Their Use in Diabetes Mellitus Sparfloxacin, Pentamidine, Haloperidol, Probucol, Cisapride, Amiodarone, Disopyramide, Flecainide, Amitriptylline, Doxepin, Imipramine, Astemizole, Terfenadine, Gatifloxacin and Halefentrine are some of the drugs which are said to have definite role in prolonging QT interval. These drugs are not to be used indiscriminately in diabetics. Only to be used when there is definite indication. Caution should be used in prescribing these drugs.

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