Original Article

Effect of Coronary Artery Bypass Graft on QT interval Dispersion: A Measure of Inhomogeneity in Ventricular Repolarization

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Background: The QT interval dispersion (QTd) has been described as the maximum minus minimum QT intervals in simultaneously 12-lead electrocardiographic recording which reflect inhomogeneity in myocardial repolarization.
Increased QTd has been illustrated in patients with a variety of cardiac diseases such as myocardial infarction and left ventricular dysfunction and was suggested as a risk factor for development of ventricular arrhythmias and sudden death. QTd may also be a prognostic factor in patients undergoing Coronary Artery Bypass Grafting (CABG). The purpose of this study was to evaluate the influence of CABG on QTd in patients with coronary artery disease.
Method: In this retrospective study we evaluated the effect of CABG on QTd in 79 consecutive patients with coronary artery disease .Measurement of QTd was performed on ECGs taken before and 24 hours after operation.
Result: There was no significant QTd changes in post CABG patients compared with baseline QTd (0.06±0.04 vs. 0.06±0.03, P=0.18). In subgroups analysis, decrease in QTd was observed following CABG only in those with two-vessel coronary involvement compared with baseline (0.05±0.04 SD seconds versus 0.07±0.02SD seconds, P<0.05).
Conclusion:
The present study showed that CABG does not affect QTd except in few patients with two-vessel coronary involvement.

Keywords: Coronary Artery Bypass Grafting (CABG), QT dispersion (QTd)

Introduction

QTd defined as maximum minus minimum QT intervals which was proposed as an index of the spatial dispersion of ventricular recovery times and could display repolariztion inhomogeneity.[1] Increased QTd is associated with an increased risk of serious ventricular arrhythmias in patients with the long QT syndrome,[2-4] hypertrophic cardiomyopathy,[5]chronic heart failure[6] myocardial infarction(MI) and in balloon inflation-induced myocardial ischemia.[7-15]

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On the other hand, QTd decrease has been shown after successful thrombolysis of MI, percutaneous coronary angioplasty, post restenosis intervention and during exercise stress test.[16-19]

Reduction of QTd has been reported after CABG in patients with left ventricular dysfunction, similar result was noted after CABG concomitant with aneurysmectomy.[20-23]

The aim of this study was to assess short term changes in QTd after successful CABG.

Patients and Methods

A total of 120 consecutive patients with Coronary Artery Disease (CAD) who had undergone CABG were retrospectively investigated at Imam Khomeini Hospital-Ahwaz from August 2008 to May

2009. Exclusion criteria were pacing rhythm, bundle branch block, complete atrioventricular block, any tachyarrhythmias, and also LV aneurysm. Therefore, 79 patients were included in this study. Age, sex, family history of premature CAD, history of myocardial infarction in addition to data regarding smoking, hyperlipidemia, hypertension, and diabetes mellitus were collected from the admission charts. Patients were divided into 3 subgroups according to the number of vessels suffering significant stenosis (one, two or three-vessel disease)

Significant stenosis was defined as equal or more than 70 percent reduction in coronary lumen diameter.

ECG Determination

Twelve lead electrocardiograms (ECG) were obtained before and 24 hours after CABG. The ECGs were recorded at paper speeds of 25 mm/sec. The QT intervals was measured by using a caliper from the onset of the QRS complex to the end of T wave, defined as its return to the T-P isoelectric baseline. When U waves were present, the end of the T wave to the nadir of the curve between the T and U waves was measured. QTd was calculated by two investigators blinded to study results and defined as maximum QT minus minimum QT intervals.

Statistical analysis

Data were expressed as mean±SD for continuous variables and as counts and percentages for discrete variables. Statistical analyses were conducted with a commercially available software package (SPSS version 16.0, SPSS, Chicago, IL). Paired Student t-test was used for comparisons of continuous variables at each time point. Comparisons of demographic variables between groups were performed using a nonparametric (Mann-Whitney U test. P value of less than 0.05 was considered statistically significant.

Table 1. General characteristics of the study population

	Prevalence
Hypertension	42.1
Hyperlipidemia	33.7
Diabetes Mellitus	25.3
Smoking	32.6
Family history	36.2
MI history	37.9
LV Ejection Fraction	48.1±9.2

Results

Demographic and basic clinical characteristics of 79 patients were shown in Table 1. The study population had an average age of 57.3±12 and included 58 men and 21 women. Moreover characteristics of patients according to the number of diseased vessels were illustrated in Table 2. According to our data, three and two vessel diseases were found in 75.9% and 20.3% of the patients respectively

Comparison of post-CABG with baseline QTd revealed no significant change in QTd (0.06±0.04 vs. 0.06±0.03, P=0.18) Subgroup analysis of electrocardiograms in regard to the number of stenotic vessels showed significant decrease (P<0.05) in post-CABG QTd in patients with two-vessel disease (Table 3) compared with two other groups

Table 2. Characteristics of patients according to the number of involved coronary vessels

Characteristics	1VD (n=3)	2VD (n=16)	3VD (n=60)
Age (years)	53.3±1.02	58.3±9.2	58.9±1.2
Men (%)	100	68.8	73.3

VD= Vessel Disease

Discussion

QT dispersion, late potential, heart rate turbulence, heart rate variability, and T wave alternance are known indicators of cardiac autonomic regulation and could be predictors of life threatening ventricular arrhythmias and cardiovascular mortality and morbidity.

Increased QT dispersion is used as an ECG marker of disturbances and inhomogeneity of ventricular repolarization.[23- 31]

The present study revealed significant decrease in QTd after CABG only in patients with two vessel disease. CABG had not any considerable effect on QTd in the other two groups (single and three vessels disease) in the first 24 hours after operation. These results are somewhat different from that reported by Cagli et al that showed increased QTd in all patients on first and third day post CABG.[32]

Wozniak-Skowerska et al explored the effect of coronary revascularization on QTd in patients with coronary artery disease and reported a significant reduction in QTd at rest and during exercise 6 months and 2 years after CABG.[33] Moreover, in a similar study by Nikparvar and his colleagues' momentous decline of QTd on third day post CABG was reported.[34]

Table 3. The difference between measured QTd before and 24 hours after CABG in study patients according to the number of stenotic vessels.

	1VD (n=3)	2VD (n=16)	3VD (n=60)
Baseline	0.06±0.02	0.07±0.02	0.06±0.03
24h	0.06±0.02	0.05±0.04	0.06±0.03
P value	0.500	0.050	0.450

QTd=QT dispersion, VD= Vessel Disease

As late postoperative events such as new ischemia, drug consumption, and new arrhythmias could adversely affect ECG parameters, so that to minimize the effect of these time related factors, we considered post operative QTd evaluation 24 hours after CABG.

Most of investigations have enrolled patients with low left ventricular ejection fraction. Padmanabhan et al.[35] showed that increase in QTd was associated with severity of LV dysfunction. However we enrolled patients regardless of left ventricular ejection fraction.

Moreover, as left ventricular aneurysm affects left ventricular volume and ventricular repolarization and as aneurysmectomy by volume reduction could improve ventricular repolarization and QTd, patients with LV aneurysm were excluded from our study.

The limitation of present study is the small sample size that may affect the results and it warrants a study with larger number of patients.

This study demonstrated that CABG has favorable effect on early post operative QTd only in few patients with CAD (two vessel disease) while it does not influence QTd in those with one and three vessels disease.

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