Effect of primary Coronary revascularization on myocardial performance

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Abstract

Background: Several randomized trials performed in the era of Effect of primary Coronary revascularization on myocardial performance. **Methods:** This prospective study included 50 consecutive patients with acute myocardial infarction. All patients underwent primary PCI and QTC was calculated from ECG mannually. **Results:** The current study shows statistically significant decrease of QTD and c QTD after the procedure, Also the study demonstrates that significant myocardial electrical stabilization, as assessed by c QTD, is still obtainable with successful reperfusion (TIMI 3 flow) of occluded IRA. **Conclusion:** The study provides that in patients undergoing early successful primary PCI leading to progressive shortening of QTD.

Key words: STEMI, ECG, QTC

Introduction

We aimed to explore the clinical effect of coronary perfusion on QT interval dispersion in patients with acute myocardial infarction (MI) after primary PCI. All patients signed an informed consent and the study was approved by the local ethics committee. Key inclusion criteria were: Patients who were presented within first three hours of myocardial infarction (characteristic chest pain lasting for at least 30 minutes, not responsive to nitrates, with a new, or presumed new ST segment elevation in 2 or more contiguous leads of at least 2mm at the J point in leads V2-V3 or 1mm in other leads, or those with new LBBB). Key exclusion criteria were: Patients who were taking drugs that modify the QT interval, Patients who had a congenital long QT syndrome, Patients who had an interventricular conduction delay or atrioventricular block, Atrial fibrillation, Pacemaker rhythm, A previous coronary bypass surgery was excluded from the study, Advanced renal and liver disease, Patients with cardiogenic shock, Active bleeding and

anemic patients, Patients with acute non STEMI. and All patients with < TIMI 3 after primary PCI.

Methods

Baseline evaluation

All patients had review of medical history on admission to emergency department including analysis of demographic data (age, sex), presence of risk factors of coronary atherosclerosis, associated co morbidities, general and cardiac examination, 12 leads ECG which was performed immediately on admission and every 6 h during the first 24 h, and once daily until discharge, routine laboratory investigations including cardiac biomarkers (Troponin I & CK-MB) and history of intake of drugs affecting QT interval.

Coronary angiography and PPCI

Aspirin (300 mg loading ,then 75 mg maintenance) and clopidogrel (600 mg loading, then 150 mg/day maintenance for one week, then 75 mg/day for one year) were given on admission and after PPCI. Un-fractionated heparin (UFH) of 10000 units bolus dose was given after sheath insertion. The procedure was done according to the standard technique for coronary angiography and PCI. Trans femoral approach was done in all patients using 6 Fr sheaths. Diagnostic coronary angiography was done to explore non-infarct related artery. XB or Judkin left guide catheters used during PPCI. Aspiration catheters and glycoproteins inhibitors (GPI) were used in lesions with heavy thrombus burden and or impaired TIMI flow after PPCI. Bare metal or drug eluting stent were used, its size and length was detected by the operator.

Echocardiography

Transthoracic echo was done at hospital stay. Using General Electric System Vivid-3machine with (2.5-5) MHZ probe. Two dimensional echo, M-Mode, Doppler and Simpson's methods were performed to obtain measurements of LV volumes, ejection fraction, segmental wall motion abnormality and mitral regurgitation according to recommendation of American society of echocardiography.

Electrocardiogram

Twelve-leads surface ECG on admission and after primary PCI. ECG will be coded and analyzed blindly for QT interval; corrected QT and QT dispersion by one observer. The QT interval will be measured from the onset of the QRS complex to the end of the T wave. The end of the T wave was defined as a return to the isoelectric line and when U waves are present, the end of the T

wave will be taken as the nadir between the T and U waves. If the end of the T wave is not clear in a particular lead then it will be excluded from analysis; for any particular ECG.

QTD and the corrected QT interval dispersion were defined as the difference between the maximum and minimum QT and the corrected QT intervals, respectively. The QT interval was measured in all leads. The corrected QT interval was calculated with the Bazett formula.

Study protocol

50 patients presented to the National Heart Institute with acute ST segment elevation myocardial infarction (STEMI) and was treated with primary percutaneous coronary intervention (1ry PCI).

Statistical analysis

Data are presented as mean+ SD for continuous data and as number (%) for categorical data. Between groups analysis was done using student t-test for continuous data and by Chi-square test for qualitative data. Level of evidence was detected to be significant at P value <0.05. Data were collected and analyzed by SPSS (version 17, USA, IL).

Results

Study population

The mean age was 50 ± 11.4 years, 73% were males and 27% female, 33%had diabetes, 38% had hypertension, 29 % had dyslipidemia, 47 % were smokers, 20% had positive family history of CAD.

Time from symptom onset to admission and Door to balloon time

The mean time was 2.07 ± 0.77 hours. The mean time was 80.2 ± 38.5 minutes in all patients.

Echocardiography

The EF of 100 patients ranged between 40 to 70 %with a mean 49.83 ± 7.99%.

QT dispersion

QTD before 1ry PCI shows mean 0.070 ± 0.027 while after 1ry PCI shows mean 0.060 ± 0.026 but for c QTD before 1ry PCI shows mean 0.008 ± 0.003 while after 1ry PCI shows mean 0.007 ± 0.004 (Table 1).

Table (1): Descriptive for QTD and c QTD before and after 1ry PCI

	Mean	SD
(Before)QTD	0.070	0.027
(Before)c QTD	0.008	0.003
(After)QTD	0.060	0.026
(After)c QTD	0.007	0.004

Significant correlation was found between QTD, c QTD before and after 1ry PCI among studied group, with QTD (P-value 0.002) while cQTD is more significant (P-value 0.001). These data are shown in (Table 2) and (Fig. 1).

Table (2): Comparison between QTD, c QTD before and after 1ry PCI

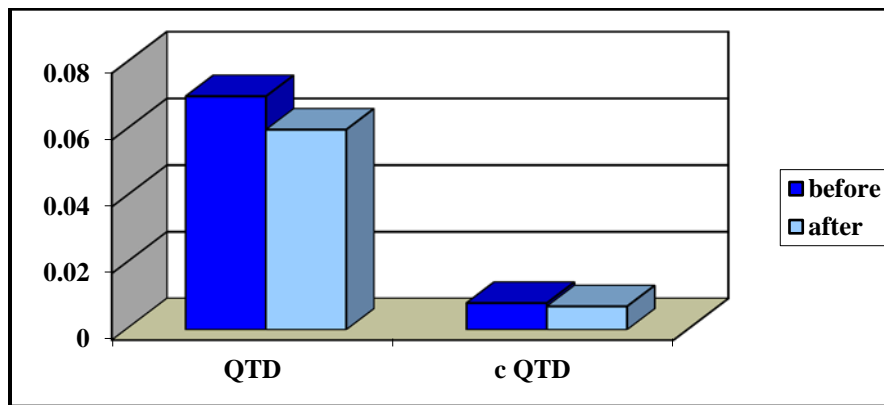|	Before		After		Paired t-test	
	Mean	SD	Mean	SD	t	p-value
QTD	0.070	0.027	0.060	0.026	3.262	0.002
c QTD	0.008	0.003	0.007	0.004	4.555	0.001

Figure (1): Comparison between QTD, c QTD before and after 1ry PCI.

Relations between QTD to other variables

There was no significant correlation found between gender with QTD and c QTD among studied group. These data are shown in (Table 3) and (Fig.2).

Table (3): Relation between gender with QTD and c QTD

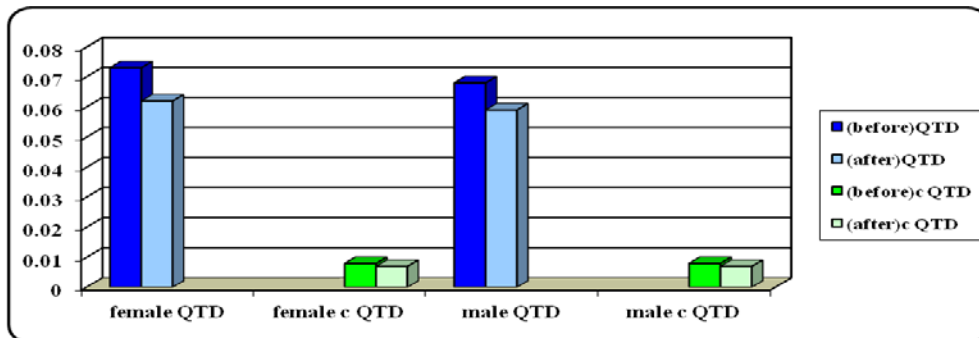|	Female		Male		Mann Whitney test	
	Mean	SD	Mean	SD	Z	p-value
(Before)QTD	0.073	0.035	0.068	0.023	-0.452	0.651
(Before) c QTD	0.008	0.004	0.008	0.004	-0.454	0.650
(After) QTD	0.062	0.028	0.059	0.025	-0.474	0.635
(After) c QTD	0.007	0.004	0.007	0.003	-0.346	0.729

Figure (2): Relation between gender with QTD and c QTD.

There was significant correlation found between QTD, c QTD and smoking patients, as shows before 1ry PCI statistically significant difference between (QTD, c QTD) and smoker, (P-value were: 0.008, 0.006) consecutively while after 1ry PCI shows (QTD, c QTD) and smoker, (P-value were: 0.001, 0.004) consecutively. These data are shown in (Table 4).

Table (4): Relation between smoking with QTD and c QTD

	Non Smokers n = 39		Smokers n = 61		Mann Whitney test	
	Mean	SD	Mean	SD	Z	p-value
(Before)QTD	0.057	0.034	0.073	0.029	-2.663	0.008
(Before)c QTD	0.007	0.004	0.009	0.003	-2.755	0.006
(After)QTD	0.049	0.017	0.070	0.029	-3.459	0.001
(After)c QTD	0.005	0.002	0.008	0.003	-2.900	0.004

Also there was significant correlation found between QTD, c QTD and diabetic patients, as shows before 1ry PCI statistically significant difference between (QTD, c QTD) and diabetic patients, (P-value were: 0.019, 0.006) consecutively while after 1ry PCI shows (QTD, c QTD) and diabetic patients, (P-value were: 0.003, 0.005) consecutively. These data are shown in (Table 5).

Table (5): Relation between diabetes with QTD and c QTD

	Non diabetic n = 52		Diabetic n = 48		Mann-Whitney test	
	Mean	SD	Mean	SD	Z	P-value
(Before)QTD	0.061	0.030	0.075	0.029	-2.369	0.019
(Before)c QTD	0.007	0.004	0.009	0.003	-2.158	0.006
(After)QTD	0.051	0.026	0.068	0.018	-3.02	0.003
(After)c QTD	0.005	0.003	0.007	0.002	-2.804	0.005

consecutively while after 1ry PCI shows (QTD, c QTD) and hypertension patients, (P-value were: 0.003, 0.005) consecutively. These data are shown in (Table 6).

Table (6): Relation between hypertension with QTD and c QTD

	Not hypertensive n = 61		Hypertensive n = 39		Mann Whitney test	
	Mean	SD	Mean	SD	Z	p-value
(Before)QTD	0.057	0.018	0.072	0.037	-2.709	0.008
(Before)c QTD	0.006	0.004	0.008	0.004	-2.445	0.006
(After)QTD	0.042	0.030	0.061	0.020	-3.016	0.003
(After)c QTD	0.005	0.003	0.007	0.002	-2.697	0.005

But there was no significant correlation found between QTD, c QTD and past history of MI. These data are shown in (Table 7).

Table (7): Relation between past history of MI with QTD and c QTD

	No Past history of MI		With past history of MI		Mann Whitney test	
	Mean	SD	Mean	SD	Z	p-value
(Before)QTD	0.068	0.021	0.073	0.037	-0.028	0.978
(Before)c QTD	0.008	0.003	0.009	0.004	-0.823	0.410
(After)QTD	0.060	0.029	0.059	0.020	-0.322	0.748
(After)c QTD	0.007	0.004	0.007	0.002	-1.479	0.139

There was no significant correlation found between LAD, LCX and RCA in QTD and c QTD before 1ry PCI while after 1ry PCI there was correlation found between LAD, LCX and RCA in QTD and c QTD (P-value were: 0.000, 0.000) (Figure 3).
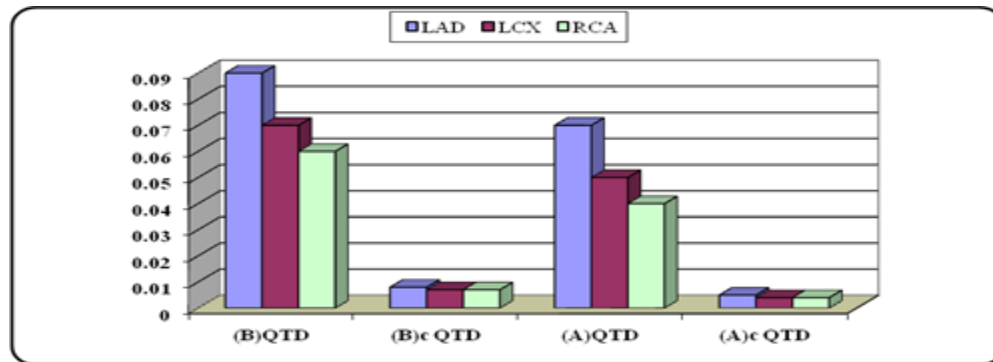
Figure (3): Relation between culprit lesions in QTD and corrected QTD.

Discussion

The purpose of the reperfusion strategy in the treatment of STEMI is to ensure an early and sustained reperfusion of myocardial territory at risk[1]. QTD is defined as the difference between the minimum and maximum QT values in a 12-lead ECG. This dispersion reflects regional variation of the ventricular repolarization, which may cause ventricular re-entry and severe ventricular arrhythmias[2]. Acute ischemia decreases the resting membrane potential, produces cellular uncoupling and shortens the action potential duration[3].

The current study included 50 consecutive patients undergoing primary percutaneous coronary intervention after acute myocardial infarction all patients had Twelve-lead surface ECG on admission and after primary PCI the QTD and the c QTD were measured using Bazett formula. Studies have shown that in ischemic heart disease QTD is increased and this increase correlated to the duration and severity of ischemia and/or presence of scar tissue[4].

Therefore it was suggested that QTD could be used as a promising noninvasive parameter predicting ischemic injury and ventricular arrhythmias in patients with acute or chronic ischemia[5,6]. The current study shows that the risk factors had a significant correlation with QTD value.

The relation between QTD, c QTD and smoking was statistically significant. QTD and c QTD were increase in smokers as compaired to non smokers before and after the procedure. Also the study shows a relation between smokers and QTD, c QTD before the procedure statistically significant and more significant after the procedure. Smoking consists of many chemicals as nicotine which has well known acute and chronic cardiovascular effects, mainly through sympathetic activation. Nicotine blocks multiple types of potassium ion currents involved in the repolarization process and increases the propensity toward arrhythmias[6]. The relation between QTD, c QTD and diabetics was statistically significant. QTD and c QTD increase in diabetic patients than non diabetic before and after procedure. Also the study shows a relation between diabetics patients and QTD, c QTD before the procedure statistically significant and more significant after the procedure. These results were concordant with those reported by Veglio[7] and Robillon[8]. QTD increased in diabetic patients due to hyperglycaemia may produce ventricular instability by increased sympathetic activity, increased cytosolic calcium content in myocytes or both[9]. Insulin stimulates sympathetic activity and diabetes is known to be associated with impaired parasympathetic cardiac control. This is reflected in a reduced ability to regulate heart rate as well as a reduction in heart rate variability associated cardiovascular complications of diabetes[10,11]. The current study shows statistically significant decrease of QTD and c QTD after the procedure, confirming the result of Ilkay[12] and Emine Bilena[13]. Also the study demonstrates that significant myocardial electrical stabilization, as assessed by c QTD, is still obtainable with successful reperfusion (TIMI 3 flow) of occluded IRA with mean age (53.3±6.3) years. Diabetic patients were higher 48% while hypertension patients were 39% and smokers were 61% as will all are successful recanalization of IRA was achieved.

Conclusion

The study provides that in patients undergoing early successful primary PCI leading to progressive shortening of QTD.

Recommendation

Is that QTD could be used as a promising noninvasive parameter of successful reperfusion in the treatment of STEMI.

Study limitation

- Small sample size.

- Short follow up period.

- Single centre study.

- The c QTD was measured manually

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