

## 관동맥 재개통 후 QTc간격분산의 감소 : 정량적으로 측정된 심근 허혈의 호전 정도와의 연관성

박상선<sup>1</sup> · 최기준<sup>1</sup> · 남기병<sup>1</sup> · 이철환<sup>1</sup> · 홍명기<sup>1</sup>  
박성욱<sup>1</sup> · 박승정<sup>1</sup> · 신중우<sup>2</sup> · 문대혁<sup>2</sup> · 김유호<sup>1</sup>

### Decreased QTc Dispersion after Coronary Revascularization : Relationships with the Quantitative Degree of Improvement in Myocardial Ischemia

Sang-Sun Park, MD<sup>1</sup>, Gi-Byoung Nam, MD<sup>1</sup>, Kee-Joon Choi, MD<sup>1</sup>, Cheol-Whan Lee, MD<sup>1</sup>,  
Myeong-Ki Hong, MD<sup>1</sup>, Seong-Wook Park, MD<sup>1</sup>, Seung-Jung Park, MD<sup>1</sup>,  
Jung-Woo Shin, MD<sup>2</sup>, Dae-Hyuk Moon, MD<sup>2</sup> and You-Ho Kim, MD<sup>1</sup>

<sup>1</sup>Department of Internal Medicine, <sup>2</sup>Nuclear Medicine, Asan Medical Center, Ulsan University,  
College of Medicine, Seoul, Korea

#### ABSTRACT

**Object and Methods :** Thirty-four patients (mean age :  $58.1 \pm 8.3$  years, M : F = 21 : 13) with angina in the absence of previous myocardial infarction, who underwent percutaneous coronary intervention (stenting and/or balloon PTCA, n = 25) or coronary arterial bypass grafting (CABG, n = 9) were evaluated to assess the relationships between the degree of improvement in myocardial dipyridamole TI-201 SPECT and the degree of decrease in QTc dispersion after coronary revascularization. QTc dispersions were measured manually using digitizer by a single observer from ECGs printed at 25 mm/sec, 1 day before, immediately, 1 day, and 1 month after the revascularization procedure. Myocardial TI-201 SPECTs were performed before and 1 month after the revascularization and ischemic indices were measured in all cases. **Results :** Mean QTc dispersion was  $51.4 \pm 17.0$  msec before revascularization,  $42.6 \pm 15.1$  msec immediately after,  $45.6 \pm 19.3$  msec 1 day after and  $37.4 \pm 11.6$  msec 1 month after revascularization. The decrease of QTc dispersion immediate ( $p = 0.001$ ) and 1 month ( $p < 0.001$ ) after revascularization, were statistically significant. Mean TI-201 SPECT ischemic index measured before the revascularization ( $7.8 \pm 5.9$ ) was significantly higher ( $p < 0.001$ ) than the one measured 1 month after the revascularization ( $1.5 \pm 2.8$ ). But, in ischemic index (ischemic index before revascularization - ischemic index 1 month after revascularization), there was no significant difference between the patients with decrease in QTc dispersion after revascularization ( $6.2 \pm 6.3$ , n = 27) and the patients without decrease in QTc dispersion ( $6.6 \pm 5.2$ , n = 7). There was no statistically significant correlation between QTc (QTc dispersion before revascularization - QTc dispersion 1 month after revascularization) and ischemic index in total subjects. **Conclusion :** QTc dispersions decrease after successful coronary revascularizations in patients with angina, but considering the relationships between the changes of QTc dispersions and ischemic indices in myocardial dipyridamole TI-201 SPECT, the degree of decrease in QTc dispersion after coronary revascularization does not have the relationships with the quantitative degree of improvement in myocardial ischemia. (Korean Circulation J 2000;30(8):998-1003)

**KEY WORDS :** QTc dispersion · Coronary revascularization · TI-201 SPECT.

: 2000 3 6  
: 2000 7 15  
: , 138 - 736 388 - 1  
: (02) 2224 - 3150 · : (02) 486 - 5918 E - mail : youho@www.amc.seoul.kr

(coronary arterial bypass grafting, CABG)

서 론

1985 Mirvis<sup>1)</sup> 24 1 12 24 . QT

QT 가 25 mm/sec

2-6) 12 digitizer(UD - 1212R graphic tablet, Wacom, USA)

QT 12 QT

QT 가가 (msec) QT (msec)

7-9) 10) 11) U 가 T U

12) 13)14) 15) 2)6)27-31)

QTc (corrected QT dispersion, QTc) Bazett (QTc(msec) = QT(ms - ec)/RR(sec))<sup>32)</sup>

QT 가 3)6)16-18)

QT 가 19)20) Tarabey 1

21) 2 TI - 201 SPECT

ST 가 QT , de Bruyne<sup>8)</sup> 4 0.56 mg/kg

QT 가 3 111 MBq(3 mCi)

22-26) QT Yunus<sup>23)</sup> 4 TI - 201 3

QT 가 (ischemic index)

QT 가 (Bull's eye)

QT 9

TI - 201

가

100%

## 대상 및 방법

1998 7 10

TI - 201

TI - 201 )/

TI - 201 ] × 100

QRS

120 msec , 8 100) (Fig. 1).<sup>33)</sup>

QT 가 34 QTc ±

. 34 25 (ba - SPSS , paired t - test

loon PTCA and/or stenting) , 9 independent sample test QTc

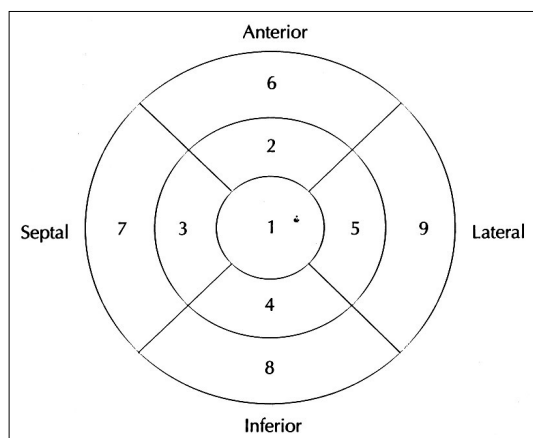
correlation ,  
0.05 p .

결 과

34 58.1 ± 8.3 ,  
가 21 , 가 13 .  
QTc 51.4 ± 17.0  
msec, 42.6 ± 15.1 msec, 24  
45.6 ± 19.3 msec, 1 37.4 ± 11.6 msec  
QTc  
(p=0.001), 24  
, 1

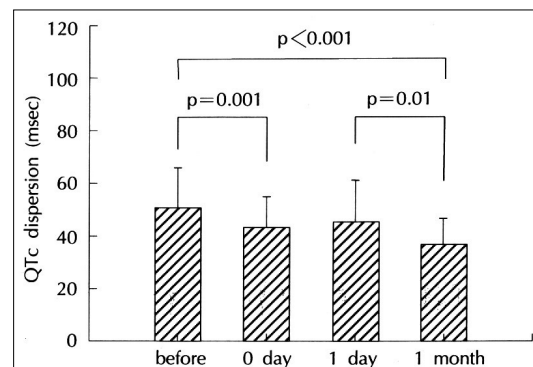
24 (p<0.001, p=0.01)(Fig. 2).

7.8 ± 5.9,  
1 1.5 ± 2.8 , 1  
(p<0.001)(Fig. 3).  
1 QTc  
34 27 , QTc  
(  
1 ) 6.2 ± 6.3,  
QTc (n=7)

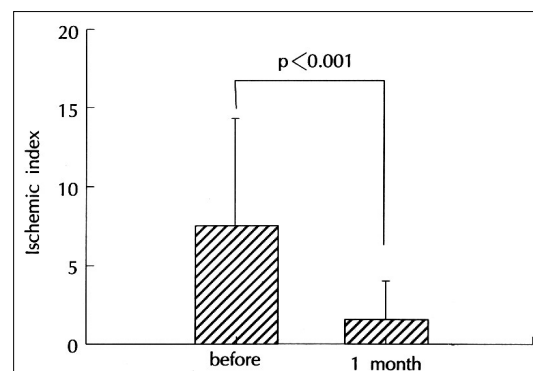


**Fig. 1.** The diagram of bull's eye polar map. Myocardium was divided into nine segments for measurement of rate of relative thallium uptake and washout. Segment 1 indicates apex ; 2, apicalanterior ; 3, apicalseptal ; 4, apicalinferior ; 5, apicallateral ; 6, basal anterior ; 7, basalseptal ; 8, basalinferior ; 9, basallateral.

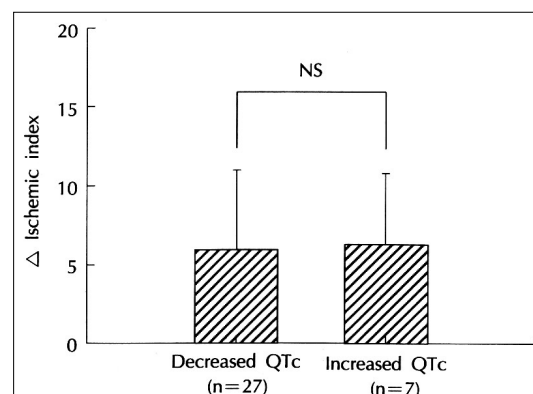
6.6 ± 5.2 , 가 (Fig.  
4). 1 가  
34 30 ,  
QTc ( QTc  
1 QTc ) 14.2



**Fig. 2.** Mean QTc dispersions, before, immediately (0 day), 1 day and 1 month after coronary revascularization in total subjects (n=34).



**Fig. 3.** Mean ischemic indices, before and 1 month after coronary revascularization in total subjects (n=34).



**Fig. 4.** Mean ischemic index in patients with or without decrease in QTc dispersion.

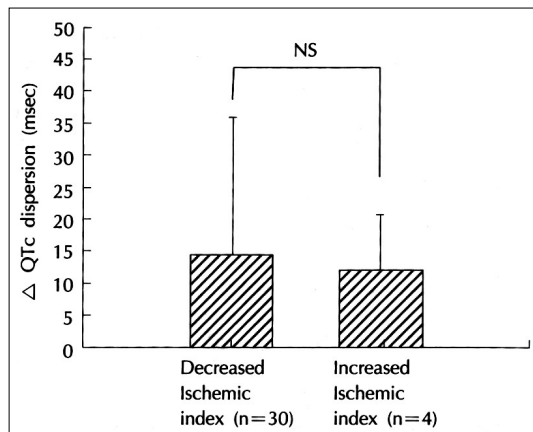


Fig. 5. Mean QTc dispersion in patients with or without improved ischemic index.

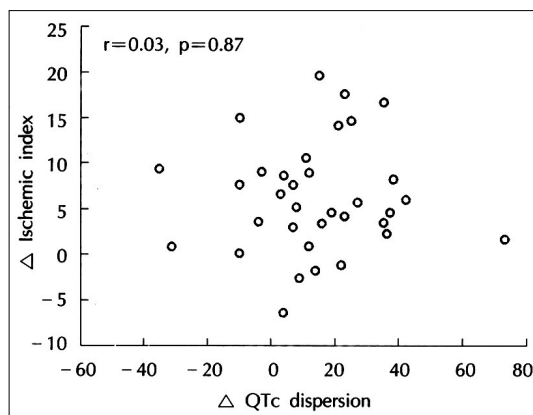


Fig. 6. Correlation between ischemic index and QTc dispersion in total subjects (n = 34).

± 22.3 msec, (n = 4) QTc  
 12.3 ± 7.7 msec  
 가 (Fig. 5).  
 QTc  
 (r = 0.03, p =  
 0.87)(Fig. 6).

고 찰

QTc

QTc  
 가 , 1 QTc

가 , QTc  
 Park <sup>27)</sup> QT  
 가 , Schneider  
 가 , Moreno  
 QT  
 QT  
 Kelly <sup>22)</sup>, Yunus <sup>23)</sup>, Han <sup>24)</sup>, Kim <sup>25)</sup>,  
 Choi <sup>26)</sup>, Han <sup>24)</sup> PTCA  
 21 ( 14 )  
 PTCA QTc 125.5  
 msec, PTCA 23 QTc  
 97.9 msec PTCA  
 , Kim <sup>25)</sup> QT  
 QT  
 22 - 26) QT  
 가 ,  
 Choi <sup>26)</sup> , 1  
 2 , 1 1 QTc 50.7 msec,  
 52.8 msec, 48.5 msec, 37.5 msec , QTc  
 1 가 1  
 1 1  
 Kelly <sup>22)</sup>  
 4 24  
 , 24 QT  
 4  
 , 24  
 가 , 1  
 24  
 Michelucci <sup>30)</sup> 30  
 60 QT 가  
 , 가  
 가 QT 가

Yunus<sup>23)</sup> 15  
 QT 24  
 ,  
 24  
 QT 가  
 , QTc  
 , QTc JT 가  
 가  
 , 가  
 가 , QT  
 1998 7 10  
 가  
 QT  
 QTc

### 본 연구의 제한점

가  
 24 - 26)  
 QT  
 , T 가  
 T T 가 TP  
 , U 가 T U  
 2)6)27 - 31)  
 , QT  
 , QT  
 가 31)34)  
 , T 가 50V  
 ,<sup>8)</sup> U 가  
 7)9)15) T U 가  
 T TP  
 T<sup>3)</sup>  
 QT 35)  
 가  
 1 ,

가  
 36)가 , QT QRS  
 Park<sup>27)</sup> QT  
 가  
 결론  
 1998 7 10  
 가 34 QTc  
 ,  
 TI - 201 SPECT  
 QTc  
 가 , QTc  
 , QTc  
 가  
 중심 단어 : QTc , TI - 201 SPECT.

### REFERENCES

- 1) Mirvis DM. *Spatial variation of the QT intervals in normal persons and patients with acute myocardial infarction.* J Am Coll Cardiol 1985;5:625-31.
- 2) Day CP, McComb JM, Campbell RWF. *QT dispersion: An indication of arrhythmia risk in patients with long QT intervals.* Br Heart J 1990;63:342-4.
- 3) Hii JT, Wyse DG, Gillis AM, Duff HJ, Solylo MA, Mitchell LB. *Precordial QT interval dispersion as a marker of torsade de pointes: Disparate effects of class Ia antiarrhythmic drugs and amiodarone.* Circulation 1992;86:1376-82.
- 4) Dritsas A, Sbarouni E, Oakley CM, Cleland JGF. *Is QT interlead variability an arrhythmogenic marker?* Br Heart J 1992;68:116.
- 5) Pye M, Quinn AC, Cobbe SM. *QT interval dispersion: A non-invasive marker of susceptibility to arrhythmia in patients with sustained ventricular arrhythmias?* Br Heart J 1994;71:511-4.
- 6) Higham PD, Campbell RWF. *QT dispersion: Review.* Br Heart J 1994;71:508-10.

- 7) Ashikaga T, Nishizaki M, Arita M, Yamawake N, Kishi Y, Numano F, *et al.* Increased QT dispersion predicts lethal ventricular arrhythmias complicating coronary angioplasty. *Am J Cardiol* 1998;82:814-6.
- 8) de Bruyne MC, Hoes AW, Kors JA, Hofman A, van Bommel JH, Grobbee DE. QTc dispersion predict cardiac mortality in the elderly, the Rotterdam study. *Circulation* 1998;97:467-72.
- 9) Glancy JM, Garratt CJ, Woods KL, de Bono DP. QT dispersion and mortality after myocardial infarction. *Lancet* 1995;345:945-8.
- 10) Davey PP, Bateman J, Mulligan IP, Forfar C, Barlow C, Hart G. QT interval dispersion in chronic heart failure and left ventricular hypertrophy: Relation to autonomic nervous system and holter tape abnormalities. *Br Heart J* 1994;71:268-73.
- 11) Barr CS, Naas A, Freeman M, Lang CC, Struthers AD. QT dispersion and sudden unexpected death in chronic heart failure. *Lancet* 1994;343:327-9.
- 12) Gonska BD, Bethge KP, Figulla HR, Kereutzer H. Occurrence and clinical significance of endocardial late potentials and fractions in idiopathic dilated cardiomyopathy. *Br Heart J* 1988;59:39-46.
- 13) Dritsas A, Sbarouni E, Gilligan D, Nihoyannopoulos P, Oakley CM. QT-interval abnormalities in hypertrophic cardiomyopathy. *Clin Cardiol* 1992;15:739-42.
- 14) Buja G, Miorelli M, Turrini P, Melacini P, Nava A. Comparison of QT dispersion in hypertrophic cardiomyopathy between patients with and without ventricular arrhythmias and sudden death. *Am J Cardiol* 1993;72:973-6.
- 15) Suzuki M, Nishizaki M, Arita M, Ashikaga T, Yamawake N, Kakuta T, *et al.* Increased QT dispersion in patients with vasospastic angina. *Circulation* 1998;98:435-40.
- 16) Campbell RW, Furniss SS. Practical consideration in the use of sotalol for ventricular tachycardia and ventricular fibrillation Review. *Am J Cardiol* 1993;72:80A-85A.
- 17) Sedgwick ML, Rasmussen HS, Cobbe SM. Effects of the class antiarrhythmic drug dofetilide on ventricular monophasic action potential duration and QT interval dispersion in stable angina pectoris. *Am J Cardiol* 1992;70:1432-7.
- 18) Cui G, Sen L, Sager P, Uppal P, Singh BN. Effects of amiodarone, sotalol, and sotalol on QT dispersion. *Am J Cardiol* 1994;74:896-900.
- 19) Sporton SC, Taggart P, Sutton PM, Walker JM, Hardman SM. Acute ischemia: A dynamic influence on QT dispersion. *Lancet* 1997;349:306-9.
- 20) Stierle U, Giannitsis E, Sheikhzadeh A, Kruger D, Schmucker G, Mitusch R, *et al.* Relation between QT dispersion and the extent of myocardial ischemia in patients with three-vessel coronary artery disease. *Am J Cardiol* 1998;81:564-8.
- 21) Tarabey R, Sukenik D, Molnar J, Somberg JC. Effect of intracoronary balloon inflation at percutaneous transluminal coronary angioplasty on QT dispersion. *Am Heart J* 1998;135:519-22.
- 22) Kelly RF, Parillo JE, Hollenberg SM. Effect of coronary angioplasty on QT dispersion. *Am Heart J* 1997;134:399-405.
- 23) Yunus A, Gillis AM, Traboulsi M, Duff HJ, Wyse DG, Knudtson ML, *et al.* Effect of coronary angioplasty on precordial QT dispersion. *Am J Cardiol* 1997;79:1339-42.
- 24) Han HJ, Rho TH, Lee MY, Kim HY, Youn HJ, Kim JJ, *et al.* Change of QT dispersion following successful percutaneous transluminal coronary angioplasty (PTCA). *Korean Journal of Medicine* 1997;52:780-5.
- 25) Kim BS, Kang JH, Lee SW, Shim SC, Cho YK, Lee MH, *et al.* Effect of coronary angioplasty on QT and JT dispersion. *Korean Circulation J* 1998;28:1280-6.
- 26) Choi KJ, Lee IS, Lee SK, Hong MK, Park SW, Park SJ, *et al.* Change of QT dispersion following PTCA in angina patients. *Korean Circulation J* 1998;28:1487-92.
- 27) Park HN, Kim YH, Park SW, Lim DS, Park CG, Seo HS, *et al.* Diagnostic value of QT and JT dispersion in exercise ECG. *Korean Circulation J* 1995;25:560-7.
- 28) Schneider CA, Voth E, Baer FM, Horst M, Wagner R, Sechtem U. QT dispersion is determined by the extent of viable myocardium in patients with chronic Q-wave myocardial infarction. *Circulation* 1997;96:3913-20.
- 29) Moreno FL, Villanueva T, Karagounis LA, Anderson JL. Reduction in QT interval dispersion by successful thrombolytic therapy in acute myocardial infarction, TEAM-2 study Investigators. *Circulation* 1994;90:94-100.
- 30) Michelucci A, Padeletti L, Frati M, Mininni S, Chelucci A, Stochino ML, *et al.* Effects of ischemia and reperfusion on QT dispersion during coronary angioplasty. *PACE* 1996;19(Pt.II):1905-8.
- 31) Statters DJ, Malik M, Ward DE, Camm AJ. QT dispersion: Problems of methodology and clinical significance. *J Cardiovasc Electrophysiol* 1994;5:672-85.
- 32) Bazett HC. An analysis of the time-relations of electrocardiograms. *Heart* 1920;7:353-70.
- 33) Won KS, Moon DH, Ryu JS, Kang DH, Park SW, Kim YH, *et al.* Dipyridamole TI-201 SPECT in hypertrophic cardiomyopathy with asymmetric septal hypertrophy: Characteristics of perfusion abnormality and correlation with clinical parameters. *Korean Circulation J* 1999;29:465-72.
- 34) Vloka ME, Steinberg JS. QT dispersion: Current and future clinical role. *J Invas Cardiol* 1996;8:363-9.
- 35) Muller D, Abbushi O, Lamp F, Behrens S. QT analysis from 12-lead Holter monitoring-Evidence of circadian variation of the QT dispersion. *PACE* 1998;21:4(pt 1):946 (abstract).
- 36) Bhullar HK, Fothergill JC, Goddard WP, DeBono PP. Auto-mated measurement of QT interval dispersion from hard copy ECGs. *J Electrocardiol* 1993;26:321-31.