급성 심근경색증에서 경색심근의 관류정도와 12유도 심전도상 R파, ST절, QRS평점과의 관계

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박창규 · 김영훈 · 서홍석 · 심완주 · 오동주 · 노영무

Significance of ST Segment, R Wave, Q Wave and QRS Score for Assessing Myocardial Perfusion in Acute Myocardial Infarction

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ABSTRACT

Background and Objectives　　The restoration of infarct-related coronary artery (IRA) patency in acute myocar-dial infarction (AMI) linked to a significant improvement in survival. Because of microvascular and cellular injury, patent IRA does not always represent successful reperfusion. With progress of myocardial ischemia, standard 12 lead ECG shows evolutional changes of ST-segment, R wave and Q wave. But their relations to my-ocardial perfusion were uncertain. **Methods**　　Total 41 patients of the first anterior wall AMI were enrolled and serial ECGs were taken to measure sum of ST-segment elevation (ΣST), sum of Q wave (ΣQ), sum of R wave (ΣR), and QRS score (QRSs) proposed by Selvester in each patients before thrombolytic therapy (i), after co-ronary angiography at 90 minutes of thrombolytic therapy (a), and before discharge (d). Myocardial contrast echocardiography was performed within 10 days of AMI to estimate opacification score (OS) and opacification index (OI) in segments of LAD territory. We investigate the relation between evolution of ECG changes and perfusion status of infarcted myocardium. **Results**　　1) There was no relation between OI and ΣST, but ΣR and QRSs showed significant relation with OI before discharge (r=0.59, - 0.33, p<0.05, respectively), post throm-bolytic therapy (r=0.51, - 0.61, p<0.05), and baseline ECG (r=0.53, - 0.51, p<0.05). 2) The number of segments with OS (0.5) showed no singificant relation to the degree of ΣST and ΣQ, but number of segments with OS (0) showed singinficant relation to that of ΣR and QRSs (r of ΣRi, ΣRa, ΣRd vs number of segments with OS (0)=- 0.59, - 0.66, - 0.43, p<0.05, QRSi, QRSa, QRSd vs number of segments with OS (0)=0.58, 0.58, 0.57, p<0.05). **Conclusion**　　These findings suggest that the ECG changes of R wave and QRS scores could be useful markers of perfusion state in thrombolytic era. **(Korean Circulation J 1998;28(10)：1707-1716)**

KEY WORDS　　Acute myocardial infarction · Myocardial perfusion · ECG · Myocardial contrast-echocar-diography.

서 론

.[1-7]

,

.

(No Reflow' phenom-
enon) [8-10]

.[11]

(myocardial contrast echocardiogr-
aphy, MCE), (magnetic resonance
imaging, MRI),
(positron emission tomography, PET) .

.

12 ST
, Q , R

.[12-14]

,

.

12

대상 및 방법

연구 대상

1995 2 1997 8

(anterior wall AMI)

2

41 .

nitroglycerin
30

12 2
0.1 mV ST
2 0.2 mV ST
.

, ,

, W-P-W ,

.

관동맥 조영술 및 심근 조영 심초음파도 검사의 시행

ST 90 Seldinger
29 7 10
.

, TIMI
TIMI 2
TIMI 3 TIMI 3
. 41
12 90 ,
29 7 10
. hexabrix
Sonicator(Heat system, U.S.A)
4 2 3
cc, 2 cc
. Hewlett-Packard
Sonos 1500
gain 1/2 inch

.

(left anterior descending artery)

7 (Fig. 1)

. ,

0,

1, 0.5

(Opacification Score, OS)

(Opacification Index, OI)

.

심전도 검사

15

20 12 ST

(base- line ECG, i)

90 (Post-
angiographic ECG, a) (Pre-
discharge ECG, d) .

ST

(degree of ST elevation) (STi, STa,
STd, mV), Q (depth of Q wave) (Qi,
Qa, Qd, mV), R (height of R wave) (
Ri, Ra, Rd, mV), Selvester QRS
(QRSi, QRSa, QRSd)

.

ST V1 V6 PR segment
J 0.06 Q
R aVR
.

QRS Selvester[16] QRS
(scoring system) V1 V6
R , Q , Q , R , S
13
QRS (Table 1).

통계처리

SPSS program
± .

paired t- test, unpaired t- test, ANOVA,
(correlation analysis), (regression anal-
ysis) p 0.05
.
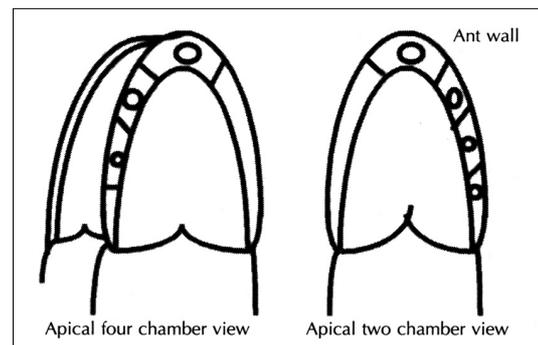
Fig. 1. Observed segments in LAD territory.

Table 1. QRS scoring system in Anterior wall acute myocardial infarction

V_1(2)	Any Q	**(1)	V_4(3)	Q 20ms	(1)	R/S 0.5	(2)
	Q or S 1.8mV	(1)		R/Q 0.5	(2)	R/S 1	(1)
V_2(1)	Any Q	(1)		R/Q 1	(1)	R 0.7mV	(1)
	R 10ms	(1)		Notched R	(1)		
	R 0.1mV	(1)	V_5(3)	Q 30ms	(1)	R/S 1	(2)
	R RV_1mV	(1)		R/Q 1	(2)	R/S 2	(1)
V_3(1)	Any Q	(1)		R/Q 2	(1)	R 0.7mV	(1)
	R 20ms	(1)		Notched R	(1)		
	R 0.2mV	(1)	V_6(3)	Q 30ms(1)		R/S 1	(2)
				R/Q 1	(2)	R/S 3	(1)
				R/Q 3	(1)	R 0.6mV	(1)
				Notched R	(1)		

* score limit for each lead, ** score for each criteria   Total 13 points

결　　과

대상환자의 특성

41　　　　　35

55　　.

18 ,　　 29 ,　 6 ,　　　　　17

.

5.5± 9.3　　　　　　　　 6

33　　　 ,　　 8

6　　 15　　　　　　　　　 .

90

TIMI 3　　　　　 34

, TIMI 2　 2 , TIMI 1　 1 , TIMI 0　 4

TIMI 2　　 7

TIMI 3　　　　　　 .

5.5± 4.5

0.75± 0.15　　.

ST절의 상승 및 Q파크기의 합계와 경색심근의 관류 정도의 관계

4.7± 5.0　　 , 90

9.4± 5.8　 ,　　　　　　 7.2

± 2.1　　 . ST　　　　 STi　　 STa

STd　　　　　　　 (p　 0.04, 0.032,

respe- ctively),　 STa　　 STd

(　STi　　STa·　 STd 1.59±

1.07 mV　 0.819± 0.715 mV　 0.64± 0.39 mV). Q

(　Qi)　　 2.18±

1.79 mV, 90　　　　　 (　Qa)　　 3.37± 2.14

mV,　　　　　 (　Qd)　　 3.59± 2.10

mV　 Q　　　　　　　　　　 (p

0.042, 0.04),　 Qa　　 Qd

(Fig. 2).

ST,　 Q

(r of　 STi,　 STa,

STd vs OI　- 0.35, - 0.04, - 0.07, p> 0.05, r of

Qi,　 Qa,　 Qd vs OI　 0.24, 0.02, - 0.08, p> 0.05,

respectively).
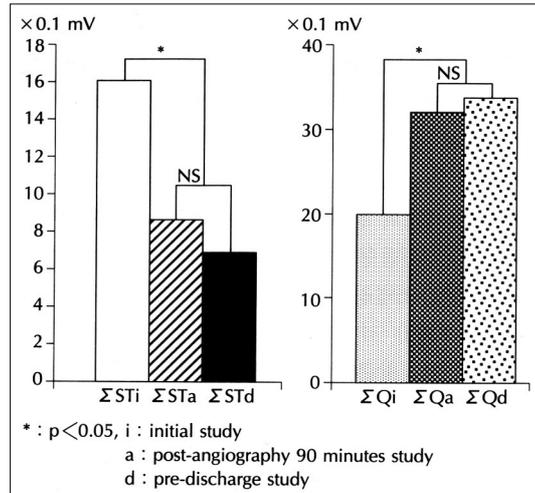


Fig. 2. Changes of　 ST and　 Q.
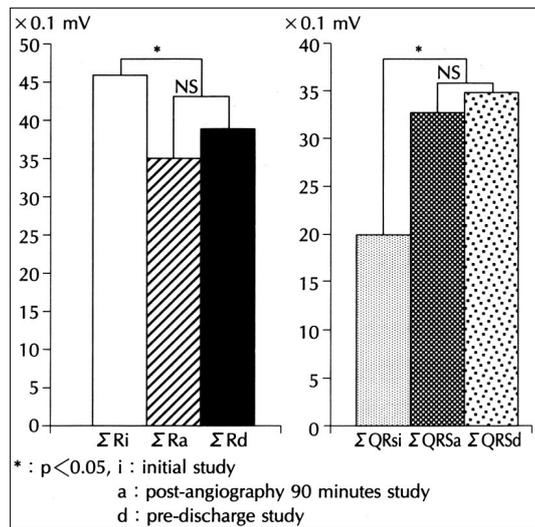

Fig. 3. Change of　 R and QRSs.

R파고의 감소 및 QRS 평점과 조영지수의 관계

R　　　　　　　 Ri　 Ra　　 Rd 4.70± 2.22　 3.5

6± 1.46　 3.59± 2.10 mV　　　　　　 R

90

QRS　　　　　　　　 (QRSi)

4.58± 2.53,　　　　　　 (QRSa) 6.0± 2.26,

(QRSd) 6.36± 2.42

QRS　　　　　　　　 (p< 0.05, Fig. 3).

R

QRS　　　　　　　　　　 R

Table 2. Correlation between R, QRSs and perfusion status

		R	Ra	Rd	QRSi	QRSa	QRSd
OI	r=	0.53	0.51	0.59	- 0.51	- 0.61	- 0.33
No of OS(0)		- 0.59	- 0.66	- 0.43	0.58	0.58	0.57
No of OS(0.5)		NS	NS	NS	NS	NS	NS

OI opacification index   i initial study   OS opacification score
a post-angiography 90 minutes study   QRS QRS score   d pre-discharge study
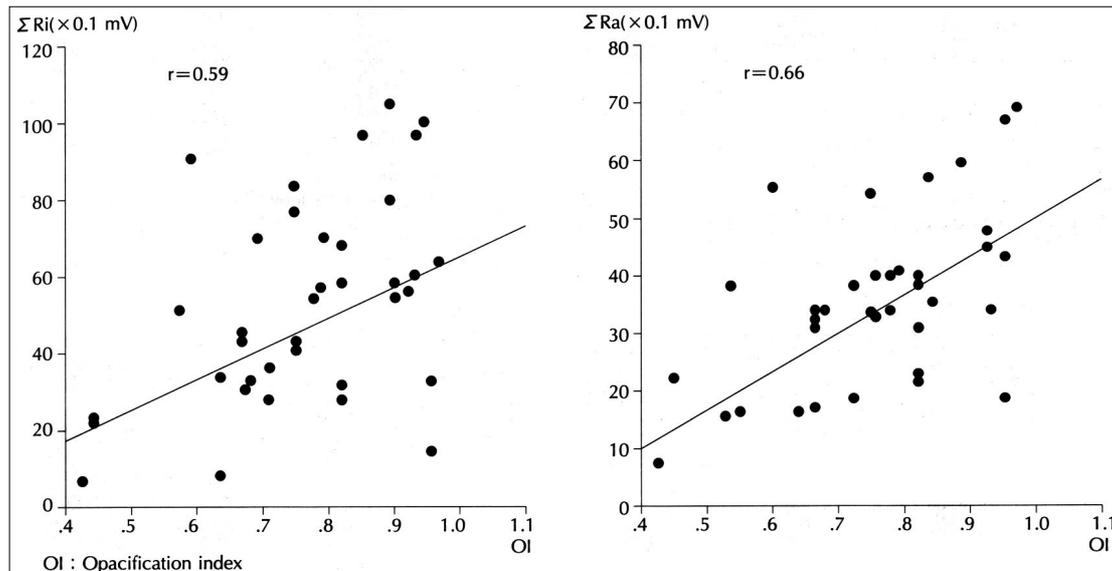
Fig. 4. Regression analysis between OI and R.

QRS   Ri,   0   (A , n 7),
a, d   QRSi, a, d   0   (B , n
    R   QRS   (Table 2, Fig. 4).   23), 3   7   (C , n 11)
                                            R   QRS
R   QRS   0   .
    0.5   .   Fig. 5
   0   R, QRS   R   A   C
                                      (5.8± 3.2 mV vs 3.2± 1.8 mV, p< 0.
     0.5,   01).
                 (Table 2),   (4.7± 1.6 mV vs 3.5± 0.8
mV, p< 0.05),
                     (4.2± 1.4 mV vs 3.0± 2.1 mV, p> 0.05).
           .   R   A
                       R   ,   ,

조영점수에 따른 R파고의 총합과 QRS평점의 변화   5.8± 3.2 mV, 4.6± 1.7 mV, 4.2± 1.5 mV
                                  , B   C
                     0.5   90   R
                       (B   5.1± 1.5 mV vs 3.5± 0.8 mV, p

Fig. 5. Comparision of ∑R between groups.

*p : <0.05,
No of OS (0) ; number of segments with opacification score 0
A군 (OS : 0) ; patients without segments of opacification score 0
B군 (OS : 1-2) ; patients with one or two segments of opacification score 0
C군 (OS : 3-7) ; patients with three to seven segments of opacification score 0
NS : No Significance

Fig. 6. Sequential changes of ∑R within a specific group.

*p : <0.05,
i : initial study, a : post-angiography 90 minutes study
d : pre-discharge study

Fig. 7. Comparision of QRSs between groups.

*p : <0.05, QRSs : QRS score
i : initial study,
a : post-angiography 90 minutes study,
d : pre-discharge study

Fig. 8. Sequential changes of QRSs within a specific group.

*p : <0.05, i : initial study,
a : post-angiography 90 minutes study,
d : pre-discharge study

0.035, C   3.2± 1.8 mV vs 2.3± 0.9 mV, p 0.046)
        (Fig. 6).

    QRS   0
            C   A   B
                    (C   B   6.2± 1.1
3.5± 0.7, p 0.07, C   A   6.2± 1.1 3.3± 1.0, p
0.068),   C
B   A   QRS
(C   vs B   7.3± 1.9 vs 6.3± 1.5, p 0.035, C vs
B   7.3± 1.9 vs 4.0± 2.5, p 0.041),
      C   7.7± 2.0   A   4.4± 2.5
(p 0.021)   (Fig. 7).
            QRS   A
                QRS

(3.5± 2.0 vs 4.8± 2.3, p 0.03), B
        90
    QRS   (3.9± 1.9 vs 6.5± 1.5, 6.8
± 1.4, p 0.05).   C   ,
        ,   QRS   6.1± 1.7, 7.5± 1.3,
8.1± 0.9   (Fig. 8).

ST절의 하강정도에 따른 심근관류정도의 비교

        ST

                6

33

ST 50%   .

(n 24)   ST절 및 Q파의 변화와 관류지수와의 관계

(n 9)   .

50%   ST

                                                                (V1- V6)   ST

        (0.79± 0.13 vs 0.72± 0.15, p 0.17).   (ST)   [19)] ST

고 찰

                                                            .[13)]   Frits[20)]   ST   5

    ,   24   48

                                    ,   ST

                                                    2   ST

                                                            .

                                                                                    ST

                                                                            (sensitivi-

                                            ty)   (specificity)

        .[15)17)]   ST

                                                                .   ST

                                                    [8- 10)]

                                                                                                .

                        (microvascular dam-

gae)   .[11)]   TIMI 3   90

                                            TIMI 2

                                                                                    TIMI 3

                                                                        .

                                                    ST   90

            12   ST   ,

    Q   , R   .   ST

                                    ST   90

    , Q   R

                                    .[12- 14)]   Selv-   ST   50%

ester   QRS

                                                                    ST

                        [18)]   .   ST   50%

                    .

.[22]   ST   .   R

(transmural myocardial ischemia)   R

ST

ST   R   R

.   .

.   ST   Selvester   QRS   1

ST   3%

TIMI 3   TIMI 2   QRS

.   .

Q

QRS

(electrical negativity)   Q   QRS
window theory   vector
Q   vector concept
.[23]   Q   .

[24][25]   (no reflow phenomenon)
(reperfusion injury)

Q   .

Q

Q   4   6   TIMI 3

Q   R   QRS
.[26]   Q

,   Q   0   0.5

Q

.

R 파고 및 QRS 평점과 관류정도의 상관관계   .   ST   , Q , R
R   Q   90
(9.4± 5.8   )

.   R
90   .

.   R   결   론

Q

.   12

R QRS

요 약

연구배경 :

positron emission tomography(PET)

. 12 ST

Q , R , QRS (scoring system)

.

12

방 법 :

(anterior wall AMI)

TIMI 3 2

41 .

15 20

ST

(ECGi) 90

(ECGa),

(ECGd) . V1- V6

ST (ST), aVR

Q (Q), R (R)

Selvester QRS scoring system

QRS .

12 90

, 29 7 10

2 4

.

결 과 :

1) 41 55 ,

35 6 . ECGi,

ECGa, ECGd 4.7± 5.0 , 9.4±

5.8 , 7.2± 3.1 5.5

± 4.5 , 0.75± 0.15

.

2) ST Q

R (Ri, Ra, Rd, vs

OI r 0.53, 0.51, 0.59, p< 0.05) QRS (QRSi,

QRSa, QRSd vs OI r - 0.51, - 0.61, - 0.33, p< 0.05)

.

3) 0 (No of OS(O))

QRS R (r of

QRSi, QRSa, QRSd vs No of OS(0) 0.58, 0.58, 0.57,

p< 0.05 Ri, Ra, Rd vs No of OS(0) - 0.59,

- 0.66, - 0.43, p< 0.05) 0.5

.

4) 6 33

ST 50% (n 24)

(n 9)

(0.79± 0.13 vs 0.72± 0.15, p 0.17).

결 론 :

12

R QRS

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중심 단어 . . .

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