

## 재관류 치료를 받은 급성심근경색증 환자에서 시간 경과에 따른 경색심근의 심근관류 변화

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### Temporal Changes of Myocardial Capillary Flow after Attempted Reperfusion in Acute Myocardial Infarction

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#### ABSTRACT

**Background and Objectives :** As lack of myocardial perfusion was demonstrated Microvascular function after reperfusion of infarct related artery (IRA) can be changed in convalescent stage for several possible mechanisms such as hyperemia and microvascular stunning. Therefore, myocardial contrast echocardiography (MCE) performed early stage after reperfusion of IRA may cause over or underestimation of the extent of myocardial necrosis. The aims of the study were to demonstrate the temporal changes of myocardial perfusion after revascularization of IRA and to explore the association of late changes of myocardial capillary flow with contractile recovery. **Methods :** MCE was performed 5-7days after the attack of acute myocardial infarction (AMI) in 21 patients (M : F = 17 : 4, age :  $58 \pm 12$  yrs) who underwent successful reperfusion of IRA. MCE was graded by semi-quantitative score (0 : no opacification, 0.5 : partial opacification, 1 : homogenous opacification) by 16 segment model. Every patient underwent 1-2 months follow up 2D echocardiography and MCE. Improvement of wall motion score more than 1 at follow up was considered to have contractile recovery. **Results :** Thirtyone of 71 initially akinetic segments were scored as 1, 30 segments as 0.5 and 10 segments as 0 after attempted reperfusion. Twelve of 30 segments with score of 0.5 and 5 of 10 segments with score of 0 showed late improvement of MCE score to 1 and 0.5. Only 1 of 30 segments with score of 0.5 got worse to score of 0. Every segment with late improvement from 0.5 to 1 showed contractile recovery, whereas none of 5 segments with late improvement from 0 to 0.5 showed contractile recovery. There was no significant difference of predictive value between early and late MCE ( $p = ns$ ). **Conclusion :** Temporal changes of myocardial perfusion from 1 week to 2 months in AMI were mainly progressive improvement caused by recovery of microvascular function from stunning rather than progressive microvascular damage or reactive hyperemia. However, it may not significantly affect the validity of MCE in predicting contractile recovery. (**Korean Circulation J 1999;29(10):1043-1052**)

**KEY WORDS :** Temporal changes · Myocardial capillary flow · Myocardial contrast echocardiography.

: 1999 5 29  
: 1999 9 1  
: , 400 - 103 3가 7 - 206  
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## 서 론

### 가 방 법

가

Hewlett pack -  
ard HP 2500, 2.5 MHz transducer

American Society of Echocardiography

16 (1 : normal, 2 : mild  
hypokinesia, 3 : severe hypokinesia, 4 : akinesia, 5 :  
dyskinesia)

가

2-4)

가

1)5)6)

5~7

Seldinger

Sheath

Judkins

가

가

7)

8)9)

(react -

Ta -

ive hyperemia)<sup>10)</sup>

garno projector

Caliper

가 가

50%

### 대상 및 방법

대 상

1996 8

1998 8

5~7

50%

TIMI 3

1~2

가 가

21

Heat System - Ultrasonics)

Sonicator(W - 380

sonicat -

sonicated

ed Hexabrix

Hexabrix 3 cc

nitroglycerine

30

2 mm

ST

creatine kinase

MB isoforms가 3

가

3

2

nicated Hexabrix

so -

가

gain video tape  
(0 : no opacification, 0.5 : heterogenous opacification, 1 : homogenous opacification)  
가

0 , 0.5 1

1~2

가

1~2

TIMI 3

가

가 1

**Table 1.** Baseline characteristics

Mean $\pm$ SD			
Age	58 $\pm$ 12	Treatment	
M : F	17 : 4	Direct PTCA	2
Risk factors		Delayed PTCA	15
Hypertension (%)	6 (29)	UK	4
Diabetes mellitus (%)	4 (19)	Infarct related artery	
Smoking (%)	16 (76)	LAD	12
TG (mg/dl)	132 $\pm$ 54	LCX	6
T.chol (mg/dl)	185 $\pm$ 24	RCA	3
HDL (mg/dl)	42 $\pm$ 9	Intervention	
Peak CK (IU/L)	2253 $\pm$ 1840	Stent	8
Peak CKMB (ng/ml)	235 $\pm$ 203	Balloon	11

TG : triglyceride, T.chol : total cholesterol, HDL : high density lipoprotein cholesterol, CK : creatine kinase, PTCA : percutaneous transluminal coronary angioplasty, UK : urokinase, LAD : left anterior descending artery, LCX : left circumflex artery, RCA : right coronary artery

19

(11 )

(8 )

(Table 1).

재관류후 경색심근내 관류변화 와 수축능 회복

$\pm$  ,  
Kappa (5~7 ) (1~2 )

Fisher's exact test . p  
value가 0.05

71 5  
~7 가  
1 가 31 (44%), 0.5가 30 (43%),  
0 10 (13%) 가 1

31 1~2 1

31

0.5 30

## 결 과

임상적 특성

21 ( : =17 : 4, : 58  $\pm$  12  
) 가 12 , 가

6 , 3 .  
(direct PTCA)

2 , 4  
15 가

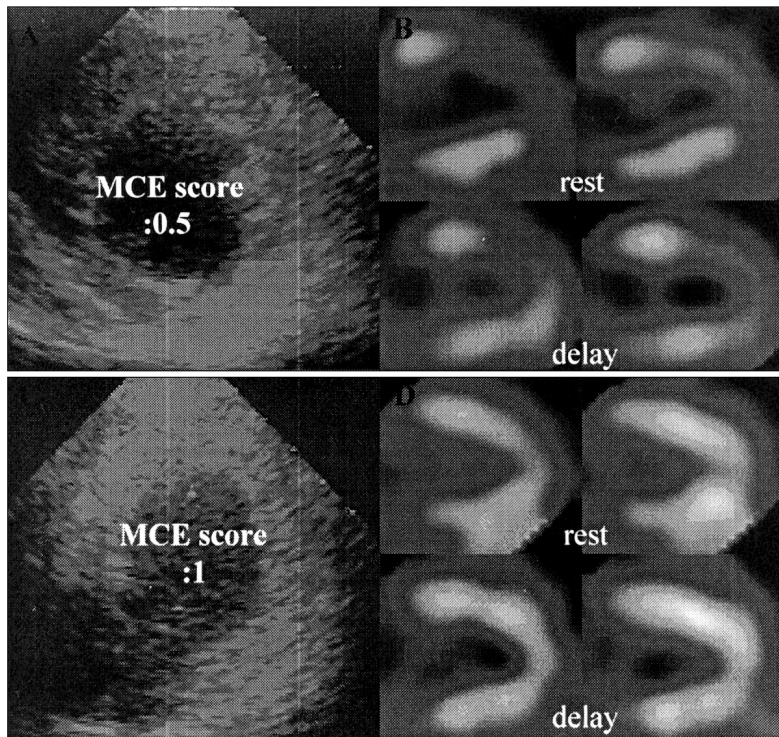
5~7

2

12 1, 1  
0 가 17  
0.5 . 0.5 1  
12 (Fig. 1) 0.5 가 17

11  
, 0.5 가 17 6  
0.5 0 1 (Fig. 2)

5 0 가 10  
(50%) 0.5 5



**Fig. 1.** Improvement of myocardial perfusion in the case with anterior AMI. A : Early MCE showing partial enhancement of anterior segment (arrow), B : Early SPECT showing moderately decreased TI-201 uptake of anterior segment at rest with reversibility at delayed stage (arrow), C : Late MCE showing improvement of contrast enhancement to score of 1 (arrow), D : Late SPECT showing normalized TI-201 uptake both at rest and delayed image (arrow). AMI : acute myocardial infarct, MCE : myocardial contrast echocardiography, SPECT : rest/ 24hr delayed TI-201 SPECT.

10

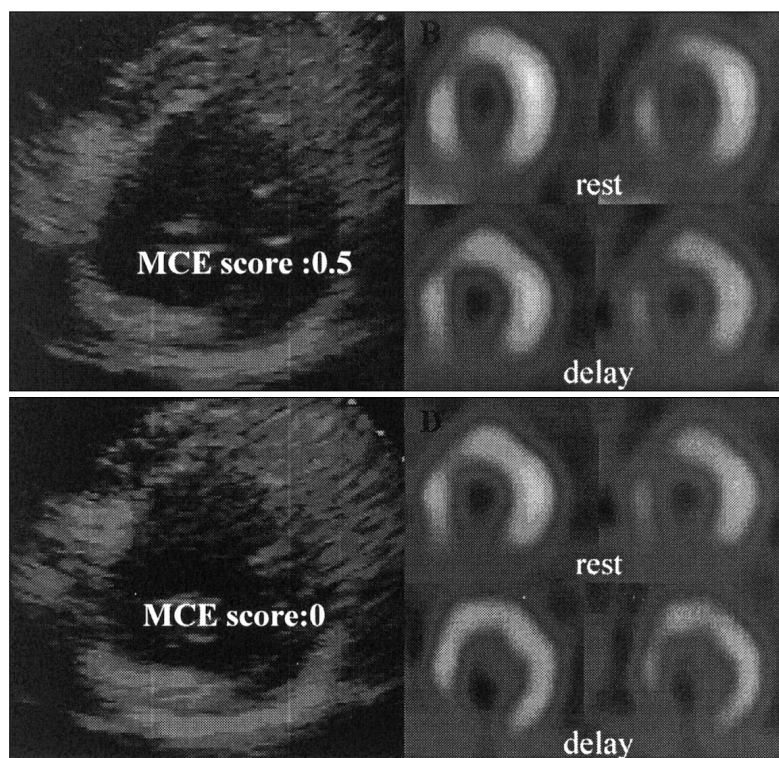
33 (66%)

(Fig. 3).

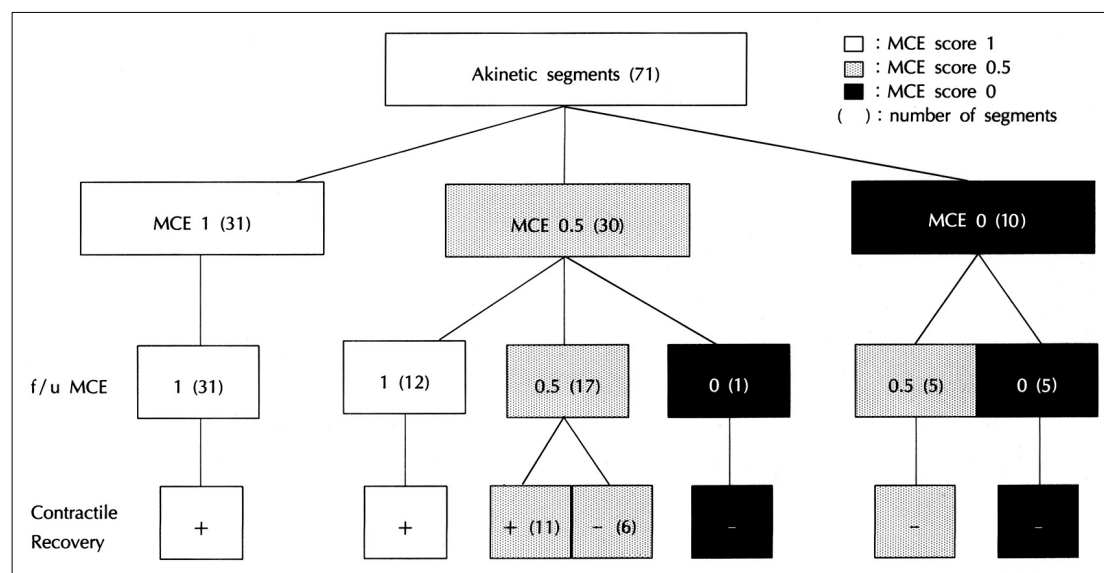
경색관련 관동맥의 재관류 시기에 따른 수축능 회복

생존심근의 예측

5~7				1				0.5			
								, 0			
21				5~7							
				0.57				100%,			
				5				59%,			
				, 1				90%, Kappa			
				0.5				0.6			
1				가							
								1~2			
(100%)				21				100%,			
								35%,			
50				15				83%,			
				(34%)				100%,			
								85%, Ka -			
								0.45(p<0.05)			
								(p>0.05, Fisher exact test)(Table 2and 3).			



**Fig. 2.** Deterioration of myocardial perfusion in the case with inferior AMI. A : Early MCE showing partial enhancement of inferior segment (arrow), B : Early SPECT showing slightly decreased TI-201 uptake of inferior segment at rest with reverse distribution at delayed stage (arrow), C : Late MCE showing worsened contrast enhancement to score of 0 (arrow), D : Late SPECT showing worsened TI-201 uptake both at rest and delayed image (arrow). AMI : acute myocardial infarct, MCE : myocardial contrast echocardiography, SPECT : rest/24hr delayed TI-201 SPECT.



**Fig. 3.** Schematic diagram showing temporal changes of myocardial perfusion in relation to contractile recovery. MCE : myocardial contrast echocardiography, + : segments with contractile recovery at follow up echocardiography, - : segments without contractile recovery at follow up echocardiography.

**Table 2.** Accuracy of early and late MCE for prediction of contractile recovery

	Early		Late	
	MCE ( + )	MCE ( - )	MCE ( + )	MCE ( - )
Contractile recovery ( + )	54	0	54	0
Contractile recovery ( - )	7	10	11	6
Agreement	90%		85%	
Kappa	0.69 (p<0.001)		0.45 (p<0.05)	

Early MCE : MCE performed 5-7days after AMI, Late : 1-2months after AMI, MCE ( + ) : segments with score of 0.5 or 1, MCE ( - ) : segments with score of 0, Contractile recovery ( + ) : segments with contractile recovery, Contractile recovery ( - ) : segments without contractile recovery, AMI : acute myocardial infarction, MCE : myocardial contrast echocardiography

**Table 3.** Comparison of validity between early and late MCE

	Early MCE	late MCE	P
Sensitivity (%)	100	100	Ns
Specificity (%)	59	35	ns
Positive predictability (%)	89	83	Ns
Negative predictability (%)	100	100	Ns

ns : not significant,  $p>0.05$  (by Fisher's exact test)  
Early MCE : MCE performed 5-7days after AMI, Late  
MCE : 1-2months after AMI, AMI : acute myocardial  
infarction, MCE : myocardial contrast echocardiogra-  
phy

고 안

가 가

,

가 가 가

가

가 (Positron emission to -  
mography), thallium -  
201 SPECT (SPECT), 가

가 (risk area) 2)

가 3)4)

가 1)5)6)

가 7)

가 8)9)

peremia)<sup>10)</sup> (reactive hy -

시간경과에 따른 경색심근 내 관류 변화

Villanueva<sup>10)</sup>

15

45

(reactive hyperemia)

가 가

Ambrosio<sup>8)</sup> Jeremy<sup>9)</sup> 4

(oxygen free radical),

,

Ito<sup>6)</sup> 45

direct PTCA

1

15 (33%) no-reflow ,

30 (67%)

no-reflow

1 가

no-reflow가

30 23 (77%)

, 7 (23%) 가

5~7

71 31 (44%)

1, 30 (43%)

0.5 87% . Ito <sup>1)</sup>  
13% 10 no - reflow (TIMI 3)가  
0.5 30 1  
0.5 0 가 “no - reflow ”  
12 0.5 1  
0 10 Ito  
5 (50%) 0.5  
6)8 - 10) no - reflow 10  
no - reflow  
가  
가 가  
가 5~7  
direct PTCA  
(reactive hyperemia) 21 0.5  
(progr - 1 (10  
essive microvascular damage) 0%) 50 17  
5~7 가 (34%)  
5~7 1~2 33 (66%)  
가  
Bolli<sup>13)</sup> Triana <sup>14)</sup>  
5~7  
가  
(stunning)  
가  
가  
심근 수축능 회복의 예측 Kloner <sup>11)</sup>  
1~2 1 31 0.5  
0.5 30 가 17 6 0 0.5  
12 가 5  
17 6  
0.5 가 가  
17 11  
1 Armstrong <sup>12)</sup>  
0 10

가 (100% vs 100%), (59% vs 35%), (89% vs 83%), (100% vs 100%), (90% vs 85%) (p>0.05).  
5~7 1~2

Illiceto <sup>15)</sup> (recent myocardial infarction)

10

0%, 46% , Bolognese <sup>16)</sup>

5~7

direct PTCA

96%, 18%

연구의 제한점

가

가

5~7

가

가

. Czitrom <sup>17)</sup>

0.5 1

5~7

가

9

30%, 42

37%

1

가

58%, 63%

가

0.5

가 가

1~2

0.5

<sup>18)</sup>

0.5

가

SP -

가

ECT

SPECT

(

94%,

81%)

<sup>19)</sup>

5~7

1~2

5~7

1~2

59% 35%

가

Ra -

가

gosta <sup>5)</sup>

1

4

, Ito <sup>6)</sup>

1

(5~7 )

(1~2 )



5~7 1~2

가

요 약

가

연구배경 :

가

가

가

중심 단어 :

감사문

재료 및 방법 :

1996 8 1998 8

1~2

가 가

21

결 과 :

71

1

31 (44%)

1

0

10

(13%)

5

0.5

5

0

0.5

30

(43%)

12

1

17

0.5

가

1

0

(5~7 )

(1~2 )

(100% vs 100%),

(59% vs 35%),

(89% vs 83%),

(100% vs 10

0%),

(90% vs 85%)

가

(p>0.05).

결 론 :

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