

## 급성심근경색증의 예후측정에 있어 Troponin-T의 임상적 의의 : Troponin-T 지연최고치가 심근경색후 심혈관계사건을 예측할 수 있을까?

두영철 · 박우정 · 최종형 · 홍경순 · 한규록  
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### The Prognostic Significance of Troponin-T in Patients with Acute Myocardial Infarction : Can Late Peak Concentration of Troponin-T after Myocardial Infarction Predict Cardiovascular Events?

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#### ABSTRACT

**Backgrounds and Objectives :** It has been demonstrated that the estimated infarct size is a prognostic variable which significantly influences the short-term and long-term prognosis after an acute myocardial infarction (AMI). Recently, the late peak level of troponin-T has been determined as a reliable and simple non-invasive method for estimation of infarct size. This study was performed to determine whether the late peak level of troponin-T can be used to predict cardiovascular events during in-hospital stay and out-patient follow-up in patients with AMI. **Materials and Method :** The study was comprised 100 patients (male 91, mean age  $57 \pm 1$  years) with AMI and thrombolysis which was initiated within 6 hours after the onset of symptoms. The late peak concentration of troponin-T was defined as a more larger level between 48 and 72 hours after thrombolysis. We investigated the factors influencing on the late peak level of troponin-T and assessed the relation of the late peak level and cardiovascular events. **Results :** 1) The late peak level of troponin-T was significantly correlated with the peak creatine kinase (CK) level, ( $r = 0.69$ ,  $p = 0.0001$ ) but not ejection fraction of left ventricle (LVEF) at 7 days after AMI. The late peak level of troponin-T was significantly higher in patients with LVEF of  $<40\%$  at 7 days after AMI ( $13.49 \pm 3.62$  vs.  $6.44 \pm 0.72$ ,  $p = 0.035$ ) but not different by location of AMI and reperfusion status. 2) During clinical follow-up at a mean duration of 27 months, 1 cardiac death, 10 congestive heart failure, 8 recurrent infarction, and 20 post-myocardial infarction angina were occurred. 3) In patients who occurred cardiac events during in-hospital stay,

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the peak level of CK ( $4377 \pm 938$  vs.  $2661 \pm 234$ ,  $p = 0.001$ ) and TIMI forward flow grade  $<3$  ( $5/13$  vs.  $6/55$ ,  $p = 0.022$ ) were significantly higher, but the late peak level of troponin-T ( $8.69 \pm 1.22$  vs.  $6.91 \pm 0.79$ ,  $p = 0.021$ ) and the peak level of troponin-T ( $21.09 \pm 2.29$  vs.  $13.28 \pm 1.37$ ,  $p = 0.021$ ) were significantly higher in patients who occurred cardiac events during out-patient follow-up. On multi-variate analysis by logistic regression, the late peak level of troponin-T was predicted the cardiac events during clinical follow-up (CI 1.022 -1.196,  $p = 0.022$ ). **Conclusions** : The late peak level of troponin-T is significantly correlated with peak CK level and higher in patients with LVEF of  $<40\%$  at 7 days after AMI and in patients who occurred cardiac events during clinical follow-up. These results suggest that the late peak level of troponin-T is a simple and useful non-invasive method to predict the cardiac events during clinical follow-up in patients with acute myocardial infarction. (**Korean Circulation J 2000;30(3):279-286**)

**KEY WORDS** : Acute myocardial infarction · Late peak troponin-T · Cardiac events.

서론

troponin - T

ponin - T

6

가 가

100

troponin - T (late peak level)

가

1)2)

CK CK - MB

Thallium - 201 SPECT

3 - 8)

가

9 - 11)

대상 및 방법

대상환자

1994 9 1998 7

6

CK, CK - MB

가

24

가

6 - 8)12)

troponin - T가

13 - 15)

가 16)17)

ponin - T

가

troponin - T

가

12)18)

가

troponin - T

19)

방법

방 법

: Troponin - T

60 , 90 , 3, 6, 12, 18, 24, 48

72

Boehringer Man -

nheim ES300 Immunoassay

0.1 ng/ml

oponin - T

(late peak level of troponin - T)

nin - T) 48 72

CK 가 12

troponin - T

chi -

square test, unpaired t - test

multi - variate analysis logistic regression analy - sis

Troponin - T CK

p 0.05

결 과

100 90 (90%)

가 , Killip

70 , 20 , 5 , 5

58 , 39 , 3

t - PA가 43 , urokinase가 57

126(±

9) , 57

(±5)

185(±10) 7

50% (Table 1).

Troponin - T 가 troponin - T (r =0.6882, p=0.0001), CK (r=0.4016, p=0.0001)

7 (r = -0.0638, p=0.587)

(Figs. 1 and 2).

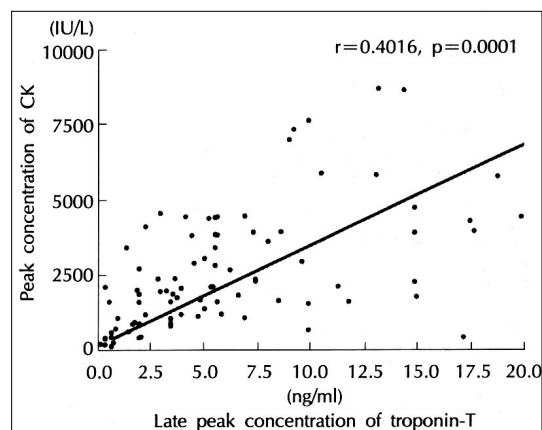
( ; 8.20±0.91 vs. ; 6.00±0.97, p=0.163)

( ; 7.40±

**Table 1.** Clinical characteristics of subjects (n = 100)

Age (year)	57 ± 1
Sex (M/F)	91/9
Thrombolysis	
t-PA/Urokinase	43/57
Location of Infarction	
Anterior/Inferior/Lateral	58/39/3
Killip classification	
/ / /	70/20/5/5
Time to treatment (min)	
From the onset of Sx to ER visit	126 ± 9
From ER visit to thrombolysis	57 ± 7
Total time to thrombolysis	185 ± 10
LVEF at 7 days after thrombolysis	50 ± 2
Coronary risk factors	
Hypertension	32
Diabetes	19
Smoking	64
Hyperlipidemia	24

t-PA : tissue-type plasminogen activator, Sx : symptom, ER : emergency room, LVEF : left ventricular ejection fraction



**Fig. 1.** Correlation between the late peak concentration of troponin-T and peak concentration of creatine kinase (r=0.4016, p=0.0001).

0.71 vs. ; 6.77 ± 2.12, p=0.899)

troponin - T 가

7 40%

troponin - T 가 (13.49 ± 3.62 vs. 6.44 ± 0.72, p=0.035)(Table 2, Fig. 3).

6 ( ) vs.  $6.91 \pm 0.79$ ,  $p=0.756$ ) 가 .

1 , 10 7

27(5 59) 1 , (26.3  $\pm$  1.6 vs. 28.5  $\pm$  2.6 ,  $p=$

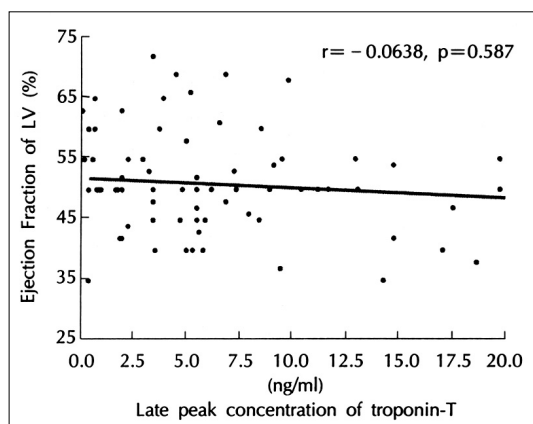
10 , 8 0.52).

20 (Table 3). troponin - T (9.03  $\pm$  1.14 vs. 5.71  $\pm$  0.80,  $p=0.021$ ) troponin - T (21.09  $\pm$  2.29 vs. 13.28  $\pm$  1.37,  $p=0.021$ )가 . Logistic regression multivariate analysis troponin - T (CI 1.022 1.196,  $p<0.05$ ) (Table 4).

7

TIMI 3 (8/13 vs. 49/55,  $p=0.02$ )가

troponin - T (8.69  $\pm$  1.22



**Fig. 2.** Correlation between the late peak concentration of troponin-T and ejection fraction of left ventricle at 7 days after thrombolysis ( $r = -0.0638$ ,  $p = 0.587$ ).

## 고 안

가  
1)2) CK CK - MB

1

가

3 - 11)

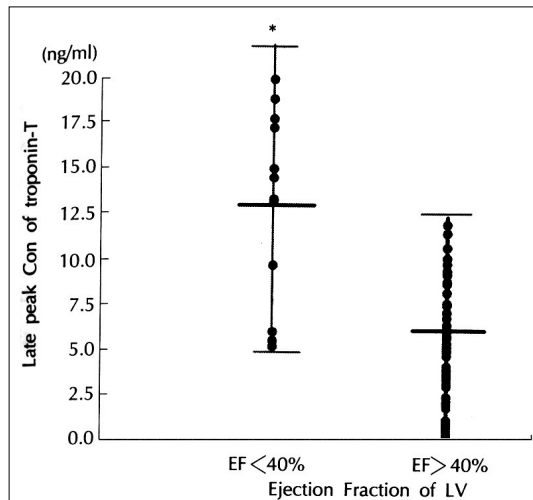
가 가

CK, CK - MB

**Table 2.** The late peak concentration of troponin

Sex	Male (n = 91)	Female (n = 9)	P value
	7.03 $\pm$ 0.67	10.38 $\pm$ 3.04	0.075
Reperfusion state	Successful (n = 90)	Failed (n = 10)	P value
	7.40 $\pm$ 0.71	6.77 $\pm$ 2.12	0.899
Infarction site	Anterior (n = 58)	Non-anterior (n = 42)	P value
	8.20 $\pm$ 0.91	6.00 $\pm$ 0.97	0.163
EF at 7 days	< 40% (n = 12)	40% (n = 75)	P value
	13.49 $\pm$ 3.62	6.44 $\pm$ 0.72	0.035
In-hospital death	Survival (n = 94)	Death (n = 6)	P value
	7.09 $\pm$ 0.69	11.13 $\pm$ 2.87	0.718
Time from the onset of Sx to thrombolysis	3h (n = 56)	> 3h (n = 44)	P value
	7.31 $\pm$ 0.98	7.36 $\pm$ 0.88	0.151
Risk factors	DM ( + ) (n = 19)	DM ( - ) (n = 81)	P value
	7.03 $\pm$ 1.98	7.40 $\pm$ 0.69	0.231
	HT ( + ) (n = 31)	HT ( - ) (n = 69)	P value
	8.44 $\pm$ 1.29	6.83 $\pm$ 0.78	0.112

EF : ejection fraction, Sx : symptom, DM : diabetes mellitus, HT : hypertension



**Fig. 3.** The late peak concentration of troponin-T by left ventricular function (Ejection fraction <40% vs. 40%) \*p<0.05.

**Table 3.** Cardiac events during in-hospital stay and clinical follow-up

In-hospital (n = 100)	
Death (cardiac cause)	6
CHF (pulmonary edema)	1
Ventricular tachycardia	10
Re-infarction	7
Clinical follow-up* (n = 94)	
Death	1
CHF	10
Recurrent infarction	8
Post-MI angina	20

CHF : congestive heart failure, MI : myocardial infarction

\*Duration of follow-up ; 27 ± 2 (5 - 59) months

가  
24  
가  
6 - 8)12)  
Thallium - 201 SPECT  
가 가  
가 가  
(6% )  
가  
9)10)

가  
troponin - T  
13 - 15)  
Troponin - T 6%  
94%  
troponin - T가  
가  
troponin - T 72 96  
48 plateau phase  
19)  
가  
large time win -  
dow 가 troponin - T  
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troponin - T 가  
40%  
Omura 12)  
nin - T 가  
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ponin - T  
CK 7  
가  
40%  
T 가  
troponin -  
tr -  
troponin -  
CK  
TIMI 3

**Table 4.** The clinical and laboratory data by cardiac events during in-hospital stay and clinical follow-up

	Cardiac events ( + )	Cardiac events ( - )	P value
In-hospital			
Age (year)	58 ± 3	56 ± 1	0.080
Blood pressure (mmHg)			
Systolic	117 ± 6	138 ± 3	0.444
Diastolic	74 ± 4	86 ± 2	0.950
Heart rate	76 ± 5	76 ± 2	0.288
CK peak (IU/L) †	4377 ± 938	2661 ± 2343	0.0001
Troponin peak (ng/ml)	17.20 ± 2.61	16.51 ± 1.48	0.550
Troponin late peak	8.69 ± 1.22	6.91 ± 0.79	0.756
TIMI 3 flow at 7 days*	8/13	49/55	0.020
EF at 7 days (%)	58 ± 3	56 ± 1	0.080
Clinical follow-up			
Age (year)	60 ± 2	53 ± 1	0.787
Blood pressure (mmHg)			
Systolic	130 ± 5	138 ± 4	0.944
Diastolic	80 ± 3	86 ± 2	0.544
Heart rate	77 ± 3	74 ± 3	0.739
CK peak (IU/L)	3810 ± 597	2628 ± 301	0.065
Troponin peak (ng/ml)*	21.09 ± 2.29	13.28 ± 1.37	0.021
Troponin late peak*	9.03 ± 1.14	5.71 ± 0.80	0.021
Extent of disease			
SVD/MVD	10/15	23/19	0.551
PTCA ( + )	15	22	0.616
TMT ( + ) at discharge	5/12	16/39	0.999
TIMI 3 flow at 7 days	21/25	36/42	0.203
EF at 7 days (%)	52 ± 2	52 ± 1	0.632
Successful reperfusion	38/39	47/55	0.052
Smoking †	19/39	45/55	0.0007
Diabetes	21/39	32/55	0.676

CK : creatine kinase, SVD/MVD : single/multi-vessel disease, PTCA : percutaneous transluminal coronary angioplasty, TMT : treadmill test, TIMI : thrombolysis in myocardial infarction, EF : ejection fraction

troponin - T

6

90%가

troponin - T

가

본 연구의 제한점

가

6

90%

troponin - T

가

Killip

가

troponin - T

대상 및 방법 :

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6 100

가 ( 91 , 57 ) tr -

plateau phase 가

가

가

Troponin - T

48 72

가 tr -

결 과 :

1) 100 90 (90%)

가 , Killip

70 , 20 , 5 , 5

tro - 58 , 39 , 3

ponin - T 가 7

가 50%

tr - 2) Troponin - T 가 troponin - T

( $r=0.6882$ ,  $p=0.0001$ ), CK ( $r=0.4016$ ,  $p=0.0001$ )

가 7 ( $r= -0.0638$ ,  $p=0.587$ )

troponin - T

troponin - T

가 7

40% tro -

ponin - T 가 ( $13.49 \pm 3.62$  vs.  $6.44 \pm 0.72$ ,  $p=0.035$ ).

3)

6 ( )

가 1 , 10 7

27(5 59) 1

CK, CKMB Thallium SPECT가 , 10 , 8

20

가 , 4)

CK ( $4377 \pm 938$  vs.  $2661 \pm 2343$ ,  $p=0.0001$ )

가 7

TIMI 3 ( $8/13$  vs.  $49/55$ ,  $p=0.02$ )가

troponin - T

troponin - T

troponin - T

가

troponin - T (9.03 ± 1.14 vs. 5.71 ± 0.80, p=0.021) troponin - T (21.09 ± 2.29 vs. 13.28 ± 1.37, p=0.021)가 . Logistic regression multi - variate analysis troponin - T (CI 1.022 1.196, p<0.05)

결 론 :

Troponin - T CK 7  
40%  
Troponin - T 가  
troponin - T  
가  
troponin - T

중심 단어 : Troponin - T

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