

급성심근경색증에서 심박수변화지수에 관한 연구

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= Abstract =

Studies on Heart Rate Variability in Patients with Acute Myocardial Infarction

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Background : Heart rate variability(HRV) represents one of the methods of examining the function of autonomic nervous system. Many patients with acute myocardial infarction show evidence of autonomic disturbance during the acute phase of the attack and reduced heart rate variability is a significant predictor of mortality in patients after acute myocardial infarction.

Method : The study groups included 25 patients admitted to our hospital with acute myocardial infarction and 23 age matched control group. Heart rate variability(time domain measures : mean NN, SDNN, SDANN, SD, rMSSD, pNN50 and frequency domain measures : TF, LF, HF) was measured from 24 hour Holter recording and wall motion score index(WMSI) was calculated from echocardiography in both groups. Jeopardy score(JS) and ejection fraction(EF) were calculated from coronary angiogram and left ventricular cineangiogram. In patients, HRV, echocardiography and coronary angiography were taken at a mean of 9 ± 4 , 4.3 ± 2.9 , and 13 ± 6 days after admission.

Results :

1) HRV(time domain measures : SDNN, SDANN, SD, rMSSD, pNN50 and frequency domain measures : TF, LF, HF) except mean heart rate was significantly decreased in patients with acute myocardial infarction(AMI)($p < 0.001$).

2) The angiographic EF and echocardiographic WMSI showed significant negative correlation in patients with AMI($r = -0.49$, $p < 0.05$).

3) The EF was significantly related with mean heart rate($r = 0.52$, $p < 0.05$), SD($r = 0.45$, $p < 0.05$), TF($r = 0.46$, $p < 0.05$) and LF($r = 0.50$, $p < 0.05$) in patients with AMI.

4) There was no correlation among the JS, WMSI, and HRV in patients with AMI.

Conclusion : These findings support that the autonomic control of the heart was pathologically changed in patients with AMI and among the HRV measurements, mean NN, SD, TF and LF were closely related with left ventricular function.

KEY WORDS : Heart rate variability · Acute myocardial infarction · LV function.

2. 방 법

1) 심박수 변화지수 분석

Marquette Ma-
rquette's 24-hour ambulatory Series 8000 Ho-
lter Marquette
Electronics software version 002A program
5).

(frequency domain measures) (total fr -
equency power, TF), (low frequency power,
LF), (high frequency power, HF)
(time - domain measures) mean
NN, SDNN, SDANN, SD, rMSSD, pNN50

(1) (frequency - domain measure)

FFT
(Fast Fourier Transform)

3 frequency - domain

(Total frequency power, TF), {ln(ms
2/Hz)} : 0.01 1.00Hz

(Low frequency power, LF), $\{\ln(\text{ms}^2/\text{Hz})\}$: 0.04 0.15Hz

(High frequency power, HF), $\{\ln(\text{ms}^2/\text{Hz})\}$: 0.15 0.40Hz

(2) (time - domain measure)

Time - domain R

6 time - domain

mean NN, (ms) : 24

R - R

SDNN, (ms) : 24
R - R
SDANN, (ms) : 24 5
5 R - R
SD, (ms) : 24 5
5 R - R
rMSSD, (ms) : R - R
pNN50, (%) : R - R
50 ms

2) 각 지수와의 상관관계

3) 심혈관 조영술

Califf 6)

6
70%
2 12
30 °
area - length method

4) 심초음파

Edwards 7)
1

11
(1 = , 2 = , 3 =
, 4 =) 8).

5) 통계분석

SPSS
linear reg -
ression
t - test , p 0.05
unpaired

결 과

mean NN 856.2 ± 101.8ms, SDNN
136.7 ± 30.9ms, SDANN 126.0 ± 28.8ms, SD
51.4 ± 13.2ms, rMSSD 31.6 ± 12.7ms, pNN50
9.8 ± 7.6%, TF 6.79 ± 0.62 ln(ms²/Hz), LF
5.63 ± 0.74 ln(ms²/Hz), HF 4.71 ± 0.63 ln(ms²/Hz)
mean NN
835.8 ± 101.3ms, SDNN 83.3 ± 37.9ms, SD -
ANN 75.5 ± 37.5ms, SD 32.9 ± 12.1ms, rMSSD

Table 1. Heart rate variability in control and acute myocardial infarction(AMI) and other known postinfarction risk variables

	Control group (n=23)	AMI* group (n=25)
mean NN (ms)	856.2 ± 101.8	835.8 ± 101.3 †
SDNN (ms)	136.7 ± 30.9	83.3 ± 37.9 †
SDANN (ms)	126.0 ± 28.8	75.5 ± 37.5 †
SD (ms)	51.4 ± 13.2	32.9 ± 12.1 †
rMSSD (ms)	31.6 ± 12.7	21.2 ± 7.3 †
pNN50 (%)	9.8 ± 7.6	3.2 ± 3.2 †
TF (Ln(ms ² /HZ)	6.79 ± 0.62	5.82 ± 0.95 †
LF (Ln(ms ² /HZ)	5.63 ± 0.74	4.49 ± 1.16 †
HF (Ln(ms ² /HZ)	4.71 ± 0.63	3.72 ± 0.9 †
JS(jeopardy score)	-	3.52 ± 3.65 †
EF	-	51.48 ± 11.76
(ejection fraction ; %)	-	16.42 ± 2.76
WMSI	-	-
(wall motion score index)	-	-

† p 0.001 versus control, † NS

*AMI : Acute myocardial infarction

mean NN : mean of all RR intervals between normal beats

SDNN : standard deviation of all normal RR intervals in the entire 24-hour recording

SDANN : standard deviation of the average normal RR intervals in all 5-minute segments of the entire 24-hour recording

SD : mean of the standard deviations of all normal RR intervals in all 5-minute segments of the entire 24-hour recording

rMSSD : the square root of the mean of the sum of the squares of differences between adjacent normal RR intervals over the entire 24-hour recording

pNN50 : percent of differences between adjacent normal RR that are >50 ms over the entire 24-hour recording

TF : total frequency power, LF : low frequency power, HF : high frequency power

21.2 ± 7.3 ms, pNN50 3.2 ± 3.2%, TF 5.82 ± 0.95 ln(ms²/Hz), LF 4.49 ± 1.16 ln(ms²/Hz), HF 3.72 ± 0.90 ln(ms²/Hz) . mean NN

(p<0.001) (Table 1, Fig. 1 - 2).

3.52 ± 3.65,

51.48 ± 11.76%, 16.4

± 2.76

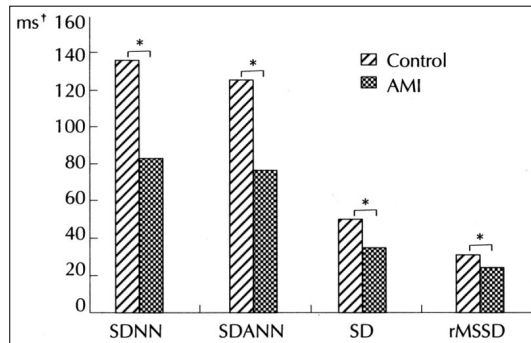


Fig. 1. Comparison of heart rate variability between control and patients with acute myocardial infarction.

*p<0.001, †ms : milisecond, SDNN : standard deviation of all normal RR intervals in the entire 24-hour recording, SDANN : standard deviation of the average normal RR intervals in all 5-minute segments of the entire 24-hour recording, SD : mean of the standard deviations of all normal RR intervals in all 5-minute segments of the entire 24-hour recording, rMSSD : the square root of the mean of the sum of the squares of differences between adjacent normal RR intervals over the entire 24-hour recording

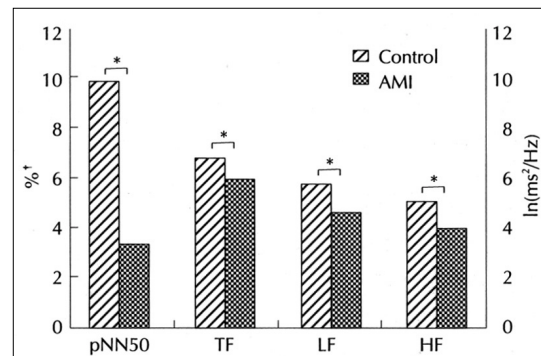


Fig. 2. Comparison of heart rate variability between control and patients with acute myocardial infarction.

*p<0.001, †pNN50(%) : NN50 count divided by the total number of all NN intervalTF : total frequency power, LF : low frequency power, HF : high frequency power

Table 2. Correlation among measures of heart rate variability in patients with acute myocardial infarction

	JS	EF	WMSI	meanNN	SDNN	SDANN	SD	rMSSD	pNN50	TF	LF	HF
JS	1.00											
EF	-0.16	1.00										
WMSI	-0.04	-0.49*	1.00									
meanNN	0.15	0.52*	0.09	1.00								
SDNN	0.00	0.36	-0.30	0.40	1.00							
SDANN	-0.04	0.34	-0.33	0.34	0.99	1.00						
SD	0.14	0.45*	-0.15	0.59*	0.77	0.70†	1.00					
rMSSD	0.30	0.29	-0.14	0.70†	0.52*	0.44*	0.71	1.00				
pNN50	0.29	0.11	-0.31	0.38	0.51*	0.45*	0.55†	0.88	1.00			
TF	0.15	0.46*	-0.26	0.57*	0.69†	0.62†	0.90	0.72	0.56†	1.00		
LF	0.04	0.50*	-0.25	0.51*	0.67†	0.60†	0.89	0.61†	0.43*	0.97	1.00	
HF	0.33	0.34	-0.15	0.68†	0.61†	0.53*	0.77	0.88	0.75	0.86	0.76	1.00

2-tailed significance : *p<0.05, †p<0.01, ‡p<0.001

JS : jeopardy score, ; EF : ejection fraction ; WMSI : wall motion score index ; mean NN : mean of all RR intervals between normal beats

SDNN : standard deviation of all normal RR intervals in the entire 24-hour recording ; SDANN : standard deviation of the average normal RR intervals in all 5-minute segments of the entire 24-hour recording ; SD : mean of the standard deviations of all normal RR intervals in all 5-minute segments of the entire 24-hour recording ; rMSSD : the square root of the mean of the sum of the squares of differences between adjacent normal RR intervals over the entire 24-hour recording ; pNN50 : percent of differences between adjacent normal RR that are >50 ms over the entire 24-hour recording ; TF : total frequency power, LF : low frequency power, HF : high frequency power

(Table 2).

(r = -

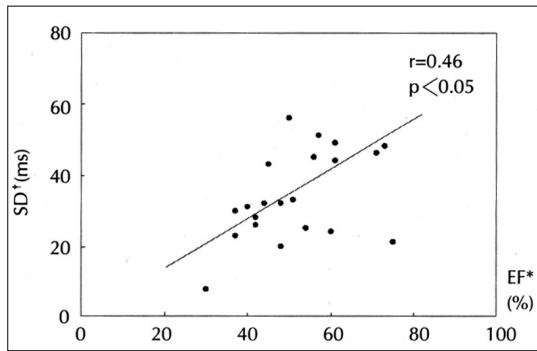


Fig. 3. The correlation between EF and SD in patients with acute myocardial infarction.
*EF : ejection fraction
‡SD : mean of the standard deviations of all normal RR intervals in all 5-minute segments of the entire 24-hour recording

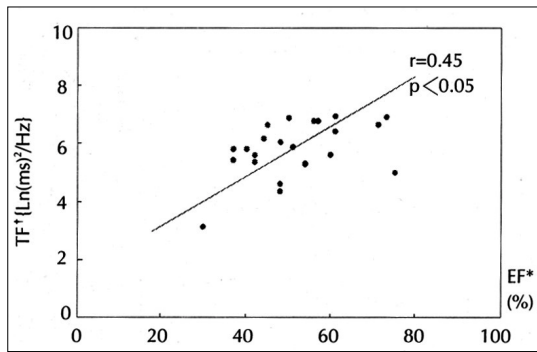


Fig. 4. The correlation between EF and TF in patients with acute myocardial infarction.
*EF : ejection fraction
‡TF : total frequency power

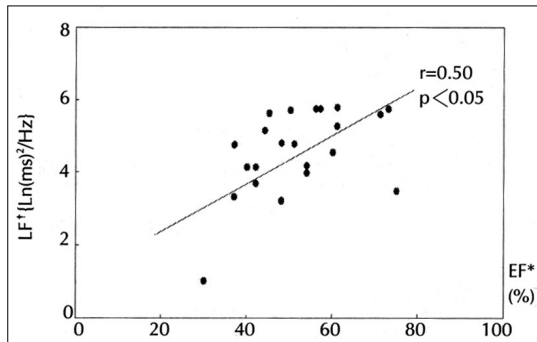


Fig. 5. The correlation between EF and LF in patients with acute myocardial infarction.
*EF : ejection fraction, ‡LF : low frequency power

0.49, $p<0.05$),

mean NN($r=0.52$, $p<0.05$), SD($r=0.45$, $p<0.05$), TF($r=0.46$, $p<0.05$), LF($r=0.50$, $p<0.05$) (Fig. 3 - 5).

Table 2
SDNN, SDA
NN, SD, rMSSD, pNN50, TF, LF, HF
SDNN SDANN
가 ($r=0.99$, $p<0.001$)
SD TF, LF rMSSD pNN50, HF , TF LF, HF

고 안

(Heart rate variability, HRV)

가

Wolf ¹⁰⁾ (respiratory sinus arrhythmia)

가 1,2,11,12) . 가 , 가 22,23) 가 3,8,24) . 가 1-3,13) . 가 가 , (negative) 가 가 HF 가 LF 가 11) . Bigger 12) time - domain fre - Malliani^{14,15)}, Schwartz¹⁶⁾ quency - domain HF TF 25 - 27) LF 가 12,17 - 20) 가 Lom - bardi¹¹⁾ TF 가 가 , 1) 가 5.63 가 , 25 14 (56%) $\pm 0.74 \ln(\text{ms}^2/\text{Hz})$, - 가 LF 가 가 , - LF 가 27 - 32) 가 17,18) . scop - Bigger^{17,18)} olamine^{33 - 35)} 가 time - domain freq - uency - domain 가 가 8) 12,19 - 21) , 가 가 SD, TF, LF . , 가

요 약

결 론 :

연구배경 :

가

가

mean NN, SD, TF, LF

24

가

감사의 글

가 가

방 법 :

24

25

(: 17, : 8, 53 : 38 77)

23 (: 10, : 13, 53 : 32

74)

9 ± 4

4.3 ± 2.9

13 ± 6 . 24

Marquette's 24 - hour ambulatory

Series 8000 Holter

Marquette Electronics software version 002A

결 과 :

1) 25 (: = 17 : 8, 53)

(meanNN)

SDNN, SDANN, SD, rMSSD, pNN50, TF, LF, HF

(: = 10 : 13, 53)

(p<0.001).

2)

(negative)

(r = - 0.49, p<0.05).

3)

(meanNN)(r=0.52, p<0.05), SD(r=0.45, p<0.05),

TF(r=0.46, p<0.05), LF(r=0.50, p<0.05)

4)

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