

고혈압 환자에서 자율 신경 기능의 일내 변동

권재구 · 김철우 · 강효종 · 채민수 · 안혜숙 · 최원규 윤광식
최창균 · 장덕환 · 이창원 · 이홍순 · 유수웅

= Abstract =

Circadian Variation of Cardiac Autonomic Function in Hypertensive Subjects

Jae Goo Kwon, M.D., Cheol Woo Kim, M.D., Hyo Jong Kang, M.D.,
Min Su Chae, M.D., Hye Sook Ahn, M.D., Won Gyu Choi, M.D.,
Kwang Sig Yun, M.D., Chang Keun Choi, M.D., Duk Whan Jang, M.D.,
Chang Won Lee, M.D., Hong Soon Lee, M.D., Soo Woong Yoo, M.D.

Department of Internal Medicine, National Medical Center, Seoul, Korea

Background : We addressed the problem of the circadian changes in neural control of the circulation in ambulant hypertensive subjects. With spectral analysis of heart rate variability the tonic sympathetic and vagal activities and their changes are respectively assessed by the power of 0.050 - 0.015Hz(low frequency, LF) and 0.150 -0.350Hz(respiratory linked, high frequency, HF) components of the spectrum of the beat by beat variability of RR interval.

Methods : Heart rate variability(HRV) and its circadian rhythm were evaluated in 15 patients with hypertension. By using 24-h Holter monitoring, HRV and its spectral components were measured. Finding were compared with 15 age-matched normal controls.

Results : The 24-hour plot of the SDs revealed that heart rate variability was significantly lower in the hypertensive patients, and the differences reached statistical significance during hours 2, 3, 9, 13, 16, 18, 19, and 23($p < 0.05$). Spectral analysis showed that power in the high-frequency range (0.150 to 0.350Hz) was lower among the hypertensive patients than among the normal controls during 22 of 24 hours but that the difference was statistically significant only during 2 hours($p < 0.05$). Power in the low frequency range (0.050 to 0.150Hz) was low at night, increased in the morning, and high during the day among controls ; this circadian rhythm was absent among hypertensive patients.

Conclusion : Among hypertensive patients, HRV is decreased with a partial withdrawal of parasympathetic tone, and the circadian rhythm of sympathetic/parasympathetic tone is altered.

KEY WORDS : Hypertension · Spectral analysis · Heart rate variability · Sympathetic activity · Parasympathetic activity.

서 론

1),
2), 3,4), 5,6)
7) 가 가

1). , 8),
가 (fibrinolytic activity)가 ,
(platelet aggregability) ,
(fibrinogen plasma concentration)가
9,10).
Time
domain index Frequency domain index가 11,12).
Time domain index R-R

13), Frequency domain index Low
frequency component(0.050~0.150Hz) High fr -
equency component(0.150~0.350Hz) Po -
wer spectral analysis component
가 14).

Time
domain analysis Frequency domain analysis

대상 및 방법

1. 대 상

1994 3 1995 5
15 15
5
(JNC - V) 140mmHg ,
90mmHg ,
3
49 ± 5 , 8 ,
7 49 ± 5 ,
6 , 9

2. 방 법

Del Mar Avionics Tape Re -
corder 24 Holter monitoring
, Model 563 Stratascan Holter Analysis
System
R - R Interval Trend ,
, 256 R - R Time
Domain Analysis R - R R - R
Frequency Domain Analysis
Low Frequency(0.050~0.150Hz), High Frequency
(0.150~0.350Hz), Total Frequency(0.017~0.500
Hz), LF/HF Ratio 24
0~6 AM, 6~12 AM, 12~6 PM, 6~12 PM 4

3. 통계적 처리

± ,
paired t test 5%
p 가

결 과

40
60 ,
R - R 가 (Fig. 1).
(6 6)
가 6 3 4
가
R - R (SD)

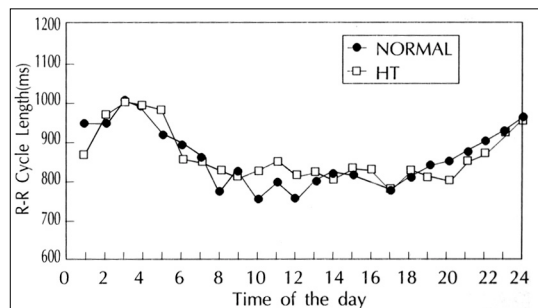


Fig. 1. Hourly mean R-R intervals in normal controls and hypertensive patients(HT).

2, 6, 9, 15, 16, 18, 20, 22 (p < 0.05, Fig. 2).
가
가
(Low Frequency, LF)

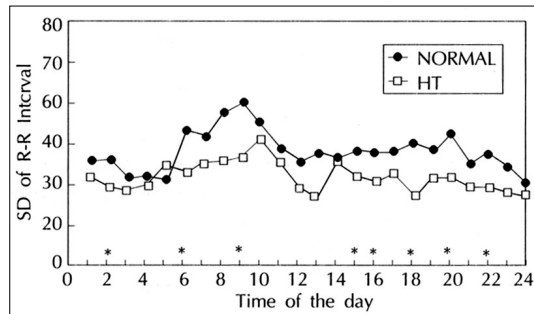


Fig. 2. Hourly standard deviation(SD) of the R-R intervals in normal controls and hypertensive patients. *indicates statistically significant differences.

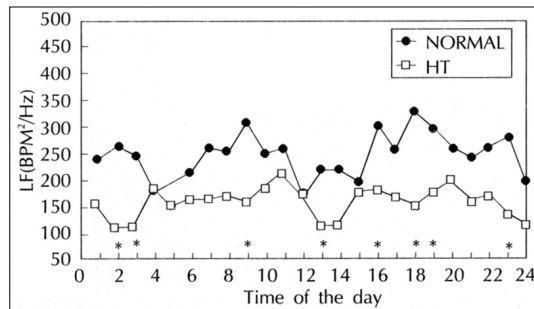


Fig. 3. Spectral analysis derived power of low-frequency(LF) component in normal controls and hypertensive patients. *indicates statistically significant differences.

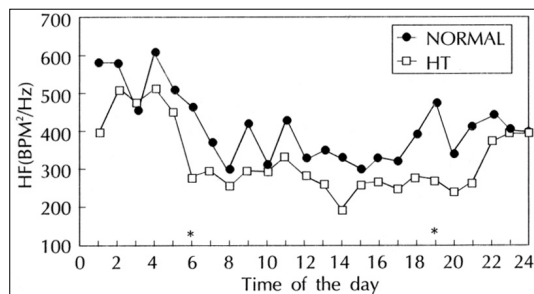


Fig. 4. Spectral analysis derived power of high-frequency(HF) component in normal controls and hypertensive patients. *indicates statistically significant differences.

2, 3, 9, 13, 16, 18, 19, 23 (p < 0.05, Fig. 3).
가
(9 [158 ± 81 vs 307 ± 186BPM²/Hz] 18 [151 ± 96 vs 329 ± 187BPM²/Hz]).

가
(High Frequency, HF)
6, 9
(p < 0.05, Fig. 4).
12 5

LF/HF

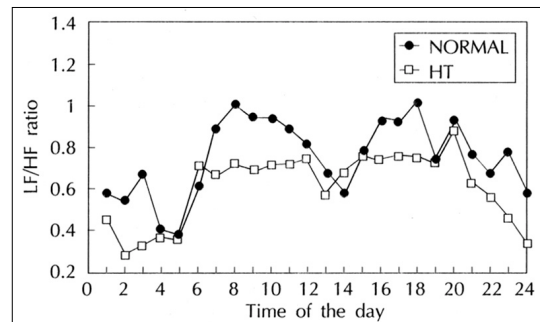


Fig. 5. Hourly mean R-R intervals in normal controls and hypertensive patients(HT).

Table 1. Time domain measurements(mean of hourly values) in hypertensive patients compared with age-matched normal controls

		Patients	Controls	p value
R-P interval(msec)				
0 - 6	AM	958 ± 135*†	946 ± 145*†	NS
6 - 12	AM	827 ± 138	795 ± 151	NS
12 - 6	PM	816 ± 156	804 ± 130	NS
6 - 12	PM	870 ± 165	890 ± 145	NS
SD				
0 - 6	AM	41.2 ± 9.3†	45.0 ± 14.0*†	<0.05
0 - 12	AM	45.5 ± 9.8§	53.3 ± 13.9§	<0.01
12 - 6	PM	40.6 ± 9.8	48.4 ± 10.8	<0.01
6 - 12	PM	39.5 ± 9.3	46.5 ± 12.1	<0.01

SD=Standard deviation

§ 0 - 6 AM vs. 12 - 6 PM ; 0 - 6 AM vs. 6 - 12 AM ;

† 0 - 6 AM vs. 6 - 12 PM ; * 6 - 12 AM vs. 12 - 6 PM ;

12 - 6 PM vs. 6 - 12 PM(p < 0.05)

Table 2. Frequency domain measurements(mean of hourly values) in hypertensive patients compared with age-matched normal controls

	Patients	Controls	p value
Low-frequency (BPM ² /Hz)			
0 - 6 AM	143 ± 85 [†]	214 ± 153 [†]	<0.01
6 - 12 AM	176 ± 113	249 ± 148	<0.01
12 - 6 PM	150 ± 105	253 ± 170	<0.01
6 - 12 PM	159 ± 136	255 ± 171	<0.01
High-frequency(BPM ² /Hz)			
0 - 6 AM	445 ± 266* [†]	540 ± 360* [†]	NS
6 - 12 AM	297 ± 183	365 ± 263	NS
12 - 6 PM	254 ± 179	343 ± 196	<0.01
6 - 12 PM	329 ± 249	419 ± 262	<0.05
LF/HF ratio			
0 - 6 AM	0.42 ± 0.29* [†]	0.53 ± 0.45* [†]	NS
6 - 12 AM	0.71 ± 0.44	0.91 ± 0.62	<0.05
12 - 6 PM	0.71 ± 0.36	0.82 ± 0.45	NS
6 - 12 PM	0.60 ± 0.37	0.74 ± 0.50	<0.05
Total-frequency			
(BPM ² /Hz)	1078 ± 490	1407 ± 610	0.01

Low-frequency=0.05Hz ; High-frequency=0.15 - 0.35 Hz ; Total-frequency=0.017 - 0.500Hz
[§] 0 - 6 AM vs. 12 - 6 PM ; [†] 0 - 6 AM vs. 6 - 12 AM ;
[†] 0 - 6 AM vs. 6 - 12 PM ; *6 - 12 AM vs. 12 - 6 PM ;
12 - 6 PM vs. 6 - 12 PM(p<0.05)

(Fig. 5).

8 6

가

6

4

. Time domain analysis

R - R

(0~6AM)

(6~12AM)

(p<0.05),

R - R

가 (p<

0.05, Table 1). Frequency domain analysis

가 (143 ±

85 vs 176 ± 113BPM²/Hz, p<0.05)(Table 2).

가

(p<0.05), LF/HF

가

(p<0.05). Total Frequency

(1407 ± 610 vs 1078 ± 490BPM²

/Hz, p<0.05).

고 안

가

11)

가

40

60

Time domain analysis

Frequency domain

analysis 가

Time domain

analysis

R - R

R -

R

. R - R

ier transform

Power spectral analysis

Frequency component

(0.15~0.150Hz)

(0.150~0.350Hz)

가

R - R

가

. Simon ¹⁵⁾

R - R

가

가

가

가

¹⁶⁾

가

17) .

가

Raffaello 18) R - R

가

R - R

가

Bigger 19) 가

Power spectral analysis

가가

요 약

가

REM

연구목적 :

Simon 15)

가

가

index Time domain index Frequency domain index가

Power spectral analysis

가

Power spectral analysis

analysis Gu -

zzeti 20) 20

1994 3 1995 5

15 15

Del Mar Avionics

Tape Recorder 24 Holter monitoring , Model 563 Stratascan Holter Analysis System

24 Holter monitoring

Power spectral analysis

가

가

Passive tilting

가가 Furlan 21)

결 과 :

1) R - R (SD)

2 , 6 , 9 , 15 , 16 , 20 ,

22 (p<0.05)

2) (Low Frequency, LF)

2 , 3 , 9 , 13 , 16

Total Frequency가 , 18 , 19 , 23

Total Frequency (p<0.05).

3) (High Frequency, HF)

6, 19

($p < 0.05$).

결론 :

가

Power spectral analysis

가가 가

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