

본태성 고혈압 환자에서 주·야간 혈압 변동과 좌심실 질량의 비교 연구

이충근 · 허경무 · 박관웅 · 윤채중 · 정종훈 · 이승일 · 장경식 · 홍순표

= Abstract =

Interrelationship between Left Ventricular Mass and Diurnal Variations of Blood Pressure in Patients with Essential Hypertension

Choong Keun Lee, M.D., Gyoung Mu Her, M.D., Gwan Eung Park, M.D.,
Chai Jung Yoon, M.D., Jong Hoon Chung, M.D., Seung Ill Lee, M.D.,
Kyung Sik Jang, M.D., Soon Pyo Hong, M.D.

Department of Internal Medicine, Chosun University Hospital, Kwangju, Korea

Background : In hypertensive patients, the left ventricular hypertrophy(LVH) is very important as an independent risk factor along with developing complications. The present study was attempted to assess whether LVH assessed by echocardiography is related to diurnal variations of blood pressure in patients with essential hypertension.

Methods : After 24hr ambulatory blood pressure monitoring, echocardiographic parameters were investigated in 30 healthy normotensive subjects and 17 patients with diurnal variation of blood pressure and 19 patients without diurnal variation respectively.

Results : Left ventricular mass index was higher in essential hypertensive patients than normotensive subjects. In patients without nocturnal fall in systolic blood pressure, left ventricular mass tended to be higher than in patients with a nocturnal fall without statistic significance. In the hypertensive patients with nocturnal fall, there was a correlation between LVMI and changes in systolic blood pressure, but no correlation between left ventricular mass index and changes in diastolic blood pressure. In the hypertensive patients without nocturnal fall, changes of both systolic and diastolic pressure did not affect LVMI.

Conclusion : It is suggested strongly that left ventricular hypertrophy may occur highly in the hypertensive patients without nocturnal(diurnal) variation in blood pressure and may be associated with changes in diastolic and systolic blood pressure. But in hypertensive patient with nocturnal fall, left ventricular hypertrophy may be associated with changes in systolic blood pressure.

KEY WORDS : Hypertension · Left ventricular mass index(LVMI).

서 론

가
, 가 (diurnal rhy -

thm)

.

,

20 30mmHg

1).

2),

3),

4),

5),

6),

7),

8),

9)

.

가

가

10).

가

가

,

.

± 6cm, 1.72 ± 0.08M², Group 1 17 (: 10, : 7), 43 ± 16, 65 ± 10kg, 163 ± 7cm, 1.70 ± 0.09M², Group 2 19 (: 5, : 14), 54 ± 11, 63 ± 7kg, 160 ± 7cm, 1.65 ± 0.11M² (Table 1).

2. 방법

(Group 1 Group 2)

TM-2420 Blood Pressure
Monitor(A and D Engineering, Inc. U.S.A.)

6 10 15

 10

 6 30 .

가 35 200 ,

160mmHg 40mmHg ,

 60mmHg 280mmHg ,

 가 10mmHg

 150mmHg

error .

연구 대상 및 방법

1. 대 상

Figure 1 shows the changes in systolic blood pressure (SBP) and diastolic blood pressure (DBP) during the study period. The SBP and DBP were significantly lower in Group 1 compared to Group 2 at all time points (p < 0.05). The mean SBP and DBP values are shown in Table 1.

Time Point	Group 1 Mean SBP (mmHg)	Group 1 Mean DBP (mmHg)	Group 2 Mean SBP (mmHg)	Group 2 Mean DBP (mmHg)
Baseline	90 ± 10	60 ± 8	140 ± 15	90 ± 12
24 h	85 ± 9	58 ± 7	135 ± 14	88 ± 11
30 days	82 ± 8	55 ± 6	132 ± 13	85 ± 10
140 mmHg	80 ± 7	53 ± 5	130 ± 12	83 ± 9

The results indicate that the treatment protocol used in Group 1 was effective in reducing blood pressure levels over the study period. The differences between the two groups were statistically significant throughout the study.

up 2)

M - mode

3

.

가

parameter

Ame -

rican Society of Echocardiography(ASE)

Table 1. Clinical characteristics of normotensive and hypertensive subjects with nocturnal fall of blood pressure >10% (group 1) or <10% (group 2)

	Normotensive subjects	Hypertensive subjects	
		group 1	group 2
Number(M/F)	20/10	10/7	5/14
Age(years \pm SD)	39 \pm 13	43 \pm 16	54 \pm 11
Weight(kg \pm SD)	63 \pm 9	65 \pm 10	63 \pm 7
Height(cm \pm SD)	16 \pm 76	163 \pm 7	160 \pm 7
B.S.A.(m ²)	1.72 \pm 0.08	1.70 \pm 0.09	1.65 \pm 0.11
Values are mean \pm S.D.			

leading edge to leading edge
Devereux¹³⁾
(g) = 1.04([+
+]³ -³) × 0.8 +
0.6/) , Dubois¹⁴⁾
(m²) = 0.007184 × [(Kg)] 0.425 ×
[(cm)]^{0.725} .

결 과

1. 정상대조군과 본태성 고혈압군(Group 1과 Group 2)의 24시간 혈압 동태

24 , 116.1 ± 13.3mmHg, 123.9 ± 16.9mmHg, 109.4 ± 9.7mmHg , 24 , 71.5 ± 11.0mmHg, 77.6 ± 14.2mmHg, 66.1 ± 5.7mmHg . 11.3 ± 8.8%, 14.8 ± 9.8% . Group 1 24 , 146.6 ± 12.3mmHg, 158.2 ± 18.8mmHg, 135.2 ± 20.0mmHg 24 , 92.5 ± 11.1 mmHg, 100.4 ± 12.3mmHg, 85.3 ± 10.1mmHg . 14.5 ± 5.4% 15.1 ± 5.4% . Group 2 24 , 148.2 ± 12.0 mmHg, 154.3 ± 19.1mm Hg, 142.1 ± 17.1mmHg , 24 , 92.2 ± 14.2mmHg, 91.2 ± 12.2mmHg, 93.3 ± 15.3mmHg . 7.7 ± 10.2%, 2.3 ± 12.2% (Table 2). (Group 1 Group 2) 24 ,

Group 1 Group 2

Table 2. Comparison of 24 ambulatory blood pressure levels in normotensive and hypertensive subjects with nocturnal fall of blood pressure > 10%(group 1) or < 10%(group 2)

	Normotensive subjects	Hypertensive objects	
		group 1	group 2
Ambulatory 24-h mean(mmHg)			
Systolic	116.1 ± 13.3	146.2 ± 12.3*	144.2 ± 12.0*
Diastolic	71.5 ± 11.0	92.5 ± 11.1*	92.2 ± 14.2*
Day time mean(mmHg)			
Systolic	123.9 ± 16.9	158.2 ± 18.8*	154.3 ± 19.1*
Diastolic	77.6 ± 14.2	100.4 ± 12.3*	91.2 ± 12.2*
Night time mean(mmHg)			
Systolic	109.4 ± 9.7	135.2 ± 20.0*,**	142.1 ± 17.1*
Diastolic	66.1 ± 5.7	85.39 ± 10.1*,**	93.3 ± 15.3*
Day-night difference(%)			
Systolic	11.3 ± 8.8	14.5 ± 5.4*,**	7.7 ± 10.2*
Diastolic	14.8 ± 9.8	15.1 ± 5.4**	2.3 ± 12.2*

Values are mean ± S.D.

Day time : 6 : 00AM-8 : 00PM

Night time : 8 : 00PM-6 : 00AM

*p<0.001 vs. normotensive subjects

**p<0.001 vs. hypertensive group 2

2. 정상대조군과 본태성 고혈압 환자의 M-mode 심초음파 소견에 의한 좌심실 질량 지표

87.8 ± 12.8g/M², Group 1 125.8 ± 29.7g/M², Group 2가 148.3 ± 47.1g/M² (Group 1 Group 2) 가 Group 1 Group 2 가 (Fig. 1, Table 3).

3. 정상대조군에서 주·야간 혈압 변동폭과 좌심실 질량 지표

(r=0.02) 가 (r = - 0.01) (Fig. 2 - 1, 2).

4. 본태성 고혈압 환자중 Group 1의 주·야간 혈압 변동폭과 좌심실 질량 지표

10%

Group 1

($r = -0.47$)

가

($r = 0.12$)

(Fig. 3-1, 2).

5. 본태성 고혈압 환자중 Group 2의 주·야간 혈압 변동폭과 좌심실 질량 지표

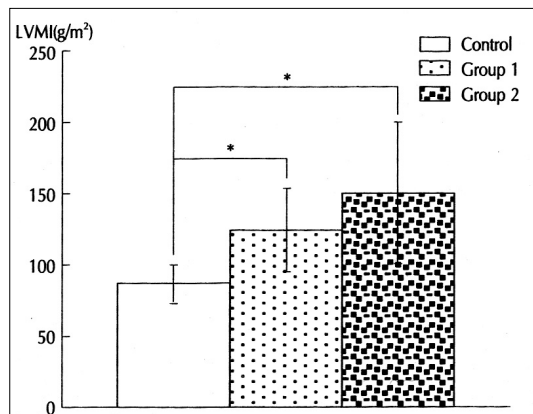


Fig. 1. Mean value of left ventricular mass and left ventricular mass index in normotensive and hypertensive subject with nocturnal fall of blood pressure > 10% (Group 1) or < 0% (Group 2), * : $p < 0.05$, LVMI : left ventricular mass index.

Table 3. Echocardiographic findings in normotensive and hypertensive subjects with nocturnal fall of blood pressure > 10% (group 1) or < 10% (group 2)

	Normotensive subjects	Hypertensive subjects	
		group 1	group 2
IVSTd(cm) :	0.93 ± 0.2	1.16 ± 0.3**	1.21 ± 0.3**
PWTd(cm) :	0.81 ± 0.1	0.95 ± 0.1*	1.03 ± 0.2*
LVIDd(cm) :	4.9 ± 0.4	5.2 ± 0.7	5.4 ± 0.6
LVM(g) :	150.9 ± 36.4	213.2 ± 57.4**	245.5 ± 86.4**
LVMI(g/m²) :	87.8 ± 12.8	125.8 ± 29.7**	148.3 ± 47.1**
Shortening fraction(%) :	38.4 ± 6	35.9 ± 6	37.3 ± 5
Ejection fraction(%) :	66.8 ± 7	67.2 ± 8	64.5 ± 6

Values mean ± S.D.

Abbreviations :

IVSTd=interventricular septal wall thickness(diastolic) ;

PWTd=left ventricular posterior wall thickness(diastolic) ;

LVIDd=left ventricular internal dimension(diastolic) ;

RWT=relative wall thickness ;

LVM=left ventricular mass ;

LVMI=left ventricular mass index

* $p < 0.01$, versus normotensive subjects

** $p < 0.001$, versus normotensive subjects

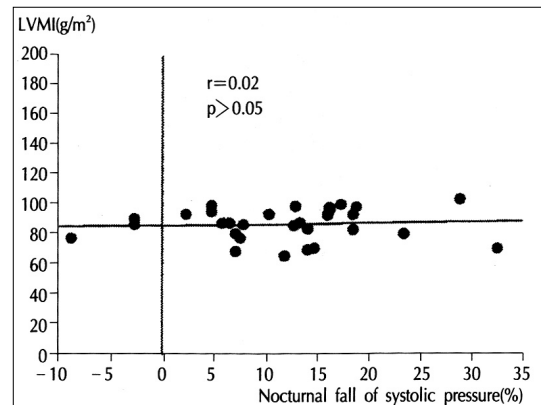


Fig. 2-1. Correlation between percentage of nocturnal fall of systolic blood pressure and LVMI in normotensive subjects, LVMI : left ventricular mass index.

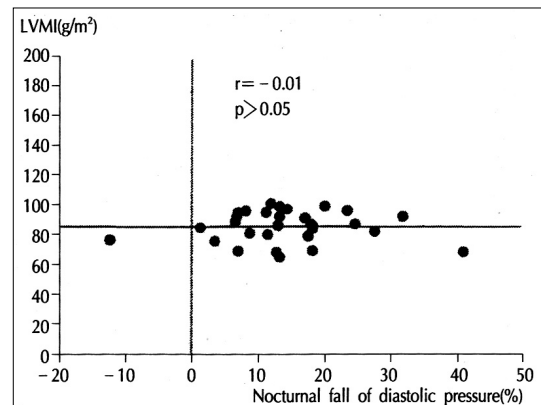


Fig. 2-2. Correlation between percentage of nocturnal fall of diastolic blood pressure and LVMI in normotensive subjects, LVMI : left ventricular mass index.

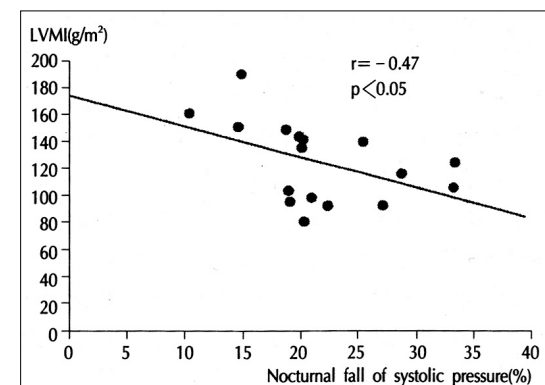


Fig. 3-1. Correlation between percentage of nocturnal fall of systolic blood pressure and LVMI in hypertensive patients(Group 1), LVMI : left ventricular mass index.

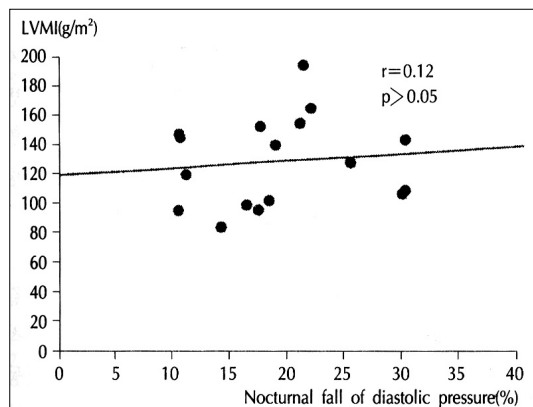


Fig. 3-2. Correlation between percentage of nocturnal diastolic blood pressure and LVMI in hypertensive patients (Group 1), LVMI : left ventricular mass index.

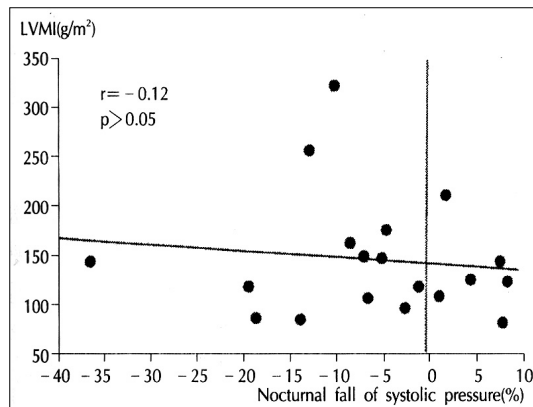


Fig. 4-1. Correlation between percentage of nocturnal systolic blood pressure and LVMI in hypertensive patients(Group 2), LVMI : left ventricular mass index.

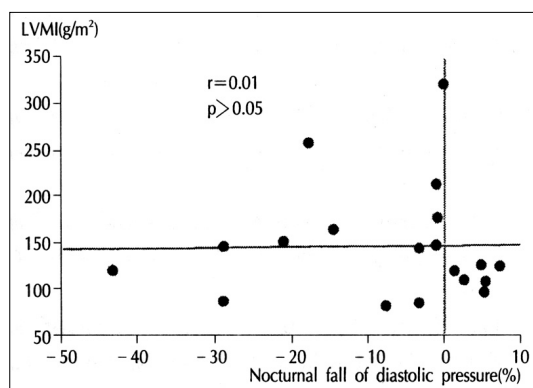


Fig. 4-2. Correlation between percentage of nocturnal fall of distolic blood pressure and LVMI in hypertensive patients (Group 2), LVMI : left ventricular mass index.

Group 2
($r = -0.12$)

($r = 0.01$) (Fig. 4 - 1, 2).

고 안

10%

11)

180mmHg 12

50% 가 16)

가 12)

24

가 24)

38% 가가 가

necropsy 22,23)

M - mode

10%

10%

가 16), Devereux 18)

Drayer 19) 가 , Rowlands 20)

Smith 21)

가 Group 가

가

25)

가 가 19

가

결 과 :

M - mode , 가

가

가

10% Group 1, 10%

Group 2 , 가

(Group 2)

(Group 1)

Group 2 가 결 론 :

, Group 1 가

가 Group 2 가 ,

가

10%

References

- 1) Pickering TG, Harshfield GA, Kleinert HD, Blank S, Laragh JH : *Blood pressure during normal daily activities, sleep, and exercise. JANA* 247 : 992-996, 1982
- 2) Shaw DB, Knapp MS, Davies DH : *Variations in blood pressure in hypertensives during sleep. Lancet* 1 : 797-798, 1982
- 3) Guilleminault C, Tillkian A, Dement W : *The sleep apnea syndromes. Annu Rev Med* 27 : 465-484, 1976
- 4) Imai Y, Abe K, Miura Y, Nihei M, Sasaki S, Minami N, Munakata M, Taira N, Sekino H, Yamakoshi K, Toshimaga K : *Hypertensive episodes and circadian fluctuation of blood pressure in patients with pheochromocytoma : Studies by longterm monitoring based on a volume-oscillometric method. J Hypertens* 6 : 9-15, 1988
- 5) Redman CWG, Beilin LJ, Bonnar J : *Reversed diurnal blood pressure rhythm in hypertensive pregnancies. Clin Sci Mol Med* 51 : 687s-689, 1976
- 6) Munakata M, Imai Y, Abe K, Sasaki S, Minami N, Sekino H, Yoshimaga K : *Involvement of the hypothalamus-pituitary- adrenal axis in the control of circadian blood pressure rhythm. J Hypertens* 6 (suppl 4) : S44-S46, 1988
- 7) Reeves RA, Shapiro AP, Thompson ME, Johnsen AM : *Loss of nocturnal decline in blood pressure after cardiac*

요 약

연구배경 :

, 24

방 법 :

24

30 ,

17 ,

- transplantation. *Circulation* 73 : 401-408, 1986
- 8) Mann S, Altman DG, Raftery EB, Bannister R : *Circadian variation of blood pressure in autonomic failure. Circulation* 68 : 477-483, 1983
 - 9) Caruana M, Lahiri A, Cashman PMM, Altman DG, Raftery EB : *Effects of chronic congestive heart failure secondary to coronary artery disease on the circadian rhythm of blood pressure and heart rate. Am J Cardiol* 62 : 755-759, 1988
 - 10) Verdecchia P, Schillaci G, Guerrieri M, Gatteschi C, Benemio G, Boldrini F, Porcellati C : *Circadian blood pressure changes and left ventricular hypertrophy in essential hypertension. Circulation* 81 : 528-536, 1990
 - 11) Dunn FG, McLenachan J, Isles CG, et al : *Left ventricular hypertrophy and mortality in hypertension : an analysis of data from the Glasgow Blood Pressure Clinic. J Hypertension* 8 : 775-782, 1990
 - 12) O'Brien E, Sheridan J, O'Malley K : *Dippers and non-dippers. Lancet* 2 : 397-400, 1988
 - 13) Raftery EB : *Understanding hypertension : The contribution of direct ambulatory blood pressure monitoring, in Weber MA, Drayer JIM (eds) : Ambulatory Blood Pressure Monitoring. Darmstadt, Steinkopff, p105-116, 1984*
 - 14) Devereux RB, et al : *Echocardiographic assessment of left ventricular hypertrophy : Comparison to necropsy findings. Am J Cardiol* 57 : 450-458, 1986
 - 15) Dubois EF : *Basal Metabolism in Health and Disease. Philadelphia, Lea & Febiger, 1936*
 - 16) Kannel WB, Gordon T, Offutt D : *Left ventricular hypertrophy by electrocardiogram. Prevalence, incidence and mortality in the Framingham Study. Ann Intern Med* 71 : 89-105, 1969
 - 17) Verdecchia P, Schillaci G, Guerrieri M, et al : *Circadian blood pressure and left ventricular hypertrophy in essential hypertension. Circulation* 81 : 528-536, 1990
 - 18) Devereux RB, Pickering TG, Harshfield GA, Kleinert HD, Denby L, Clark L, Pregibon D, Jason M, Kleinert B, Borer JS, Laragh JH : *Left ventricular hypertrophy in patients with hypertension : Importance of blood pressure response to regularly recurring stress. Circulation* 68 : 470-476, 1983
 - 19) Drayer JIM, Weber MA, De Young JL : *BP as a determinant of cardiac left ventricular muscle mass. Arch Intern Med* 143 : 90-92, 1983
 - 20) Rowlands DB, Glover DR, Ireland MA, McLeay RAB, Stallard TJ, Watson RDS, Littler WA : *Assessment of left ventricular mass and its response to antihypertensive treatment. Lancet* 1 : 467-470, 1982
 - 21) Smith VE, White WB, Karimeddini MK, McCabe EJ, Katz AM : *Lowest not highest blood pressure may determine left ventricular filling (abstract). Circulation* 74 (suppl II) : II-290A, 1984
 - 22) Devereux RB, Reichek N : *Echocardiographic determination of left ventricular mass in man. Anatomic validation of the method. Circulation* 55 : 613-618, 1977
 - 23) Devereux RB, Alonso DR, Lutas EM, Gottlieb GJ, Campo E, Sachs I, Reichek N : *Echocardiographic assessment of left ventricular hypertrophy : Comparison to necropsy findings. Am J Cardiol* 57 : 450-458, 1986
 - 24) Carr AA, Prisant M, Watkins LO : *Detection of hypertensive left ventricular hypertrophy. Hypertension* 7 : 948-954, 1985
 - 25) Verdecchia, et al : *Circadian blood pressure changes and left ventricular hypertrophy in essential hypertension. Circulation* 81 : 528-536, 1990