

## 관동맥이 정상인 좌심실 비대 환자에서 관동맥 혈류에 영향을 미치는 요인에 관한 연구

이호준 · 임도선 · 임홍의 · 신성희 · 오영재 · 황교승  
김영훈 · 서홍석 · 심완주 · 오동주 · 노영무

### Relations among Coronary Flow Reserve, Left Ventricular Mass and Diastolic Function in Patients with Chest Pain and Normal Coronary Angiograms

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#### ABSTRACT

**Background and Purpose** : Left ventricular hypertrophy (LVH) is a well known cardiovascular risk factor, independent of hypertension, even in the absence of epicardial coronary artery disease. Possible mechanisms have been proposed, including increased LV mass, reduced coronary flow reserve (CFR) and diastolic filling abnormalities. However, the relations among LV hypertrophy, diastolic function, hypertension and coronary flow reserve (CFR) in patients with chest pain and normal coronary angiograms have not been well defined. **Subjects and Method** : Twenty-six patients with chest pain and normal coronary angiograms were included. LV mass, isovolumic relaxation time (IVRT), deceleration time (DT) and E/A ratio were assessed by 2-D echo-cardiography. Coronary blood flow velocity before and after intracoronary adenosine were measured using intracoronary Doppler wire (FloWire). CFR was defined as ratio of peak flow velocity after adenosine to baseline flow velocity. Subjects were divided into 4 groups according to presence of LVH and hypertension and the parameters were compared among groups. **Results** : CFR was lower ( $p < 0.01$ ) in the groups with either hypertension or LVH or both than in the groups without them. The decrement in CFR was not linearly related to the degree of LVH ( $r = 0.31$ ,  $p = 0.135$ ). Although there were modest increment in IVRT and DT and decrement in E/A ratio in the groups with hypertension or LVH or both, there was no statistical significance. **Conclusion** : These findings suggest that the underlying mechanism of impaired CFR in patients with LVH or hypertension may be the consequence of primary coronary microvascular lesion rather than the process of left ventricular hypertrophy. (**Korean Circulation J 2000;30(3):287-294**)

**KEY WORDS** : Hypertension · Left ventricular hypertrophy · Coronary flow reserve · Diastolic function.

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서 론

5)

2

1

가

가 가 1-4)

3~5

가

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5-7)

가

대상 및 방법

대 상

가

7)

26

43~61 ( 54.1  
11 (Table 1).

, Vogt

12

95 mmHg

가 12 mm  
가

6)8)

Laine

가

가

- 1 (group 1, n=10),
- 2 (group 2, n=8),
- 3 (group 3, n=4),
- 4 (group 4, n=4)

가

가

, isovolumic relaxation time(IVRT), de-  
celeration time(DT),

9)

가

10)11)

좌심실 질량의 측정

가 ,

2

Penn Me -

thod<sup>12)13)</sup> [ 1.04(LV internal diameter + LV septal thickness + posterior wall thickness)<sup>3</sup> - (LV internal diameter)<sup>3</sup> - 13.6 ]

관동맥 혈류예비능의 측정

Doppler wire(FloWire)

(av -

erage diastolic and systolic velocity)

(APV : average peak velocity)

(coronary flow reserve : CFR)

adenosine

가 (adenosine/baseline av -

erage peak velocity ratio : CFR = APVh/APVb)

좌심 이완 기능의 평가

E/A , DT, IVRT

통 계

SPSS Windows PC

±

student t - test

Pearson

p

0.05

결 과

대조군과 좌심실비대군에서의 관동맥 혈류와 좌심실 이완기능 변수의 변화

가 14

(53.8%, 8, 6)

가

12 (46.2%, 7 5)

가

120.0 ± 20.3 gm/m<sup>2</sup>,

87.4 ± 15.0 gm/m<sup>2</sup>

(p< 0.05)

(Table

1). Adenosine

가

2.17 ± 0.26, 2.73 ± 0.67 mmHg/ml/min (p<0.01).

IVRT, DT

83.9 ± 12.5 msec, 164.4 ± 95.0 msec

73.1 ± 11.3 msec, 140.7 ± 71.5 msec

E/A ratio 0.978 ± 0.291,

1.13 ± 0.414

(Table 2).

대조군과 고혈압군에서 관동맥 혈류와 좌심 이완기능 변수의 변화

8 (40%,

5, 3)

18 (60%,

가 (adenosine/baseline av -

9 9)

105.3 ±

9.4 mmHg,

79.4 ± 9.2 mmHg(p<0.05)

(Table 3).

Adenosine

가

Table 1. Baseline characteristics of patients

	Non LVH group (n = 14)	LVH group (n = 12)
Age (year)	52.9 ± 11	55.3 ± 10
Sex (M/F)	8/6	7/5
Smoking	25.6%	22.2%
Cholesterol (mg/dl)	182.2 ± 39	184.4 ± 18
Diabetes mellitus	26.7%	25%
MAP (mmHg)	89.2 ± 11	90.9 ± 7.2
Heart rate (bpm)	81	82
LVMI (gm/cm <sup>2</sup> )	87.4 ± 15.0	120.0 ± 20.3*

MAP : Mean Arterial Pressure \* <0.05

Table 2. Coronary flow and diastolic parameters

	Non LVH group (n = 14)	LVH group (n = 12)
APVb (cm/sec)	26.4 ± 7.1	28.5 ± 7.8
APVh (cm/sec)	69.3 ± 15.7	63.0 ± 26.7
CFR	2.73 ± 0.67	2.17 ± 0.26*
IVRT (msec)	73.1 ± 11.3	83.9 ± 12.5
DT (msec)	140.7 ± 71.5	164.4 ± 95.0
EA ratio	1.13 ± 0.414	0.978 ± 0.291

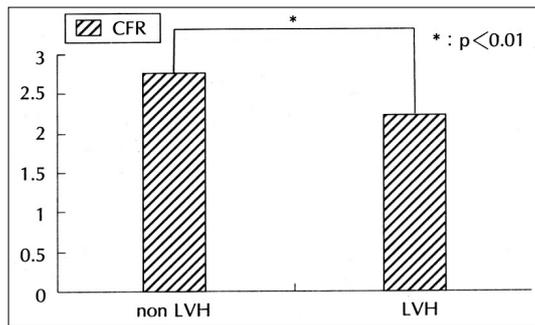
LVMI : Left ventricular mass index, AVPb : Average peak velocity, b = before adenosine, h = after adenosine, CFR : Coronary flow reserve, IVRT : Isovolumic relaxation time, DT : Deceleration time

2.18 ± 0.3, 2.70 ± 0.5  
 (p < 0.01). IVRT  
 DT 85.4 ± 16.3 msec, 170.2  
 ± 57 msec 77.2 ± 8.8 msec, 149.4 ± 52  
 msec E/A ratio 1.0 ±  
 0.32, 1.1 ± 0.37  
 (Table 4).

**Table 3.** Baseline characteristics of patients

	Normotensives (n = 18)	Hypertensives (n = 18)
Age (year)	53.6 ± 11	54.6 ± 9
Sex (M/F)	9/9	5/3
Smoking (%)	24.0	16.6
Cholesterol (mg/dl)	180.7 ± 25	183.9 ± 33
Diabetes (%)	16.7	33.3
MAP (mmHg)	79.4 ± 9.2	105.3 ± 9.4*
Heart Rate (bpm)	80	82

\*p < 0.05 MAP : mean arterial pressure



**Fig. 1.** Coronary flow reserve in patients with LVH and in patients without LVH.

**Table 5.** Baseline characteristics of patients

	Group 1 (n = 10)	Group 2 (n = 8)	Group 3 (n = 4)	Group 4 (n = 4)
Age (year)	51.4 ± 11	55.8 ± 11	54.4 ± 11	54.8 ± 8
Sex (M/F)	5/5	4/4	3/1	3/1
Smoking	40%	22.2%	11.1%	22.2%
Cholesterol (mg/dl)	181.6 ± 40	179.8 ± 10	184.8 ± 38	189 ± 27
DM	33.3%	33.3%	16.7%	16.7%
MAP (mg/dl)	78.8 ± 12	80.0 ± 6.4	104.75 ± 9.8*	105.8 ± 8.8*
HR (bpm)	82	79	81	84
BSA (kg/m <sup>2</sup> )	1.52 ± 0.13	1.76 ± 0.2	1.55 ± 0.17	1.79 ± 0.14
LVMI (gm/m <sup>2</sup> )	84.5 ± 18.8	117.1 ± 17.8*	88.2 ± 11.0	122.9 ± 22.8*

\* : < 0.01 Group 1 : HTN (-), LVH (-) Group 2 : HTN (-), LVH (+)  
 Group 3 : HTN (+), LVH (-) Group 4 : HTN (+), LVH (+)  
 DM : Diabetes Mellitus, MAP : Mean Arterial Pressure, HR : Heart Rate  
 BSA : Body Surface Area, LVMI : Left Ventricular Mass Index

대조군, 좌심실비대가 없는 고혈압군, 고혈압이 없는 좌  
 심실비대군과 고혈압과 좌심실비대가 있는 군에서 관동  
 맥 혈류와 좌심실 이완기능 변수의 변화

2 (group 2),  
 3 (group 3),  
 4 (group 4)  
 가 1 10 (38.5%,  
 5, 5), 가 2 8  
 (30.8%, 4, 4), 가  
 3 4 (15.4%, 3, 1),  
 4 4 (15.4%, 3, 1)  
 , ,  
 (Table 5).

Adenosine

가  
 1 3.1 ± 0.59 ,  
 가 2 , 3 , 4

**Table 4.** Coronary flow and diastolic parameters

	Normotensives	Hypertensives
LVMI (gm/m <sup>2</sup> )	108.8 ± 18.3	105.6 ± 16.9
APVb (cm/sec)	25.4 ± 8.0	29.4 ± 12.5
APVh (cm/sec)	68.3 ± 18.5	62.8 ± 23.5
CFR	2.70 ± 0.5	2.18 ± 0.3*
IVRT (msec)	77.2 ± 8.8	85.4 ± 16.3
DT (msec)	149.4 ± 52	170.2 ± 57
E/A ratio	1.1 ± 0.37	1.0 ± 0.32

LVMI : Left ventricular mass index, AVPb : Average  
 peak velocity b = before adenosine h = after adenosine  
 CFR : Coronary flow reserve \* : p < 0.01  
 IVRT : Isovolumic relaxation time, DT : Deceleration time

2.19 ± 0.31, 2.19 ± 0.22, 2.17 ± 0.37

(p < 0.05).

IVRT, DT 68.7

± 6.79 msec, 2, 3, 4 85.7 ± 9.8 msec,  
84.2 ± 20.1 msec, 86.5 ± 12.5 msec

E/A ratio 1.17 ± 0.46, 2, 3, 4  
1.01 ± 0.27 1.02 ± 0.39, 0.97 ± 0.25

(Table 6, Figs. 3, 4 and 5).

관동맥 예비능과 좌심실 비대 정도와 상관관계

가 (r = -0.307, p = 0.135, Fig. 6).

고 찰

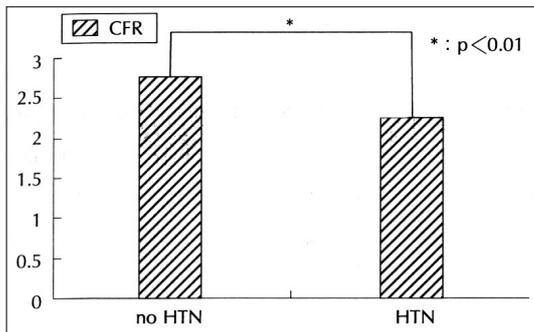


Fig. 2. Coronary flow in patients with hypertension (HTN) and in patients without hypertension.

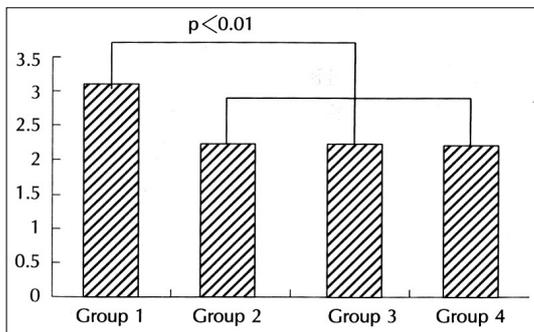


Fig. 3. Coronary flow reserve.

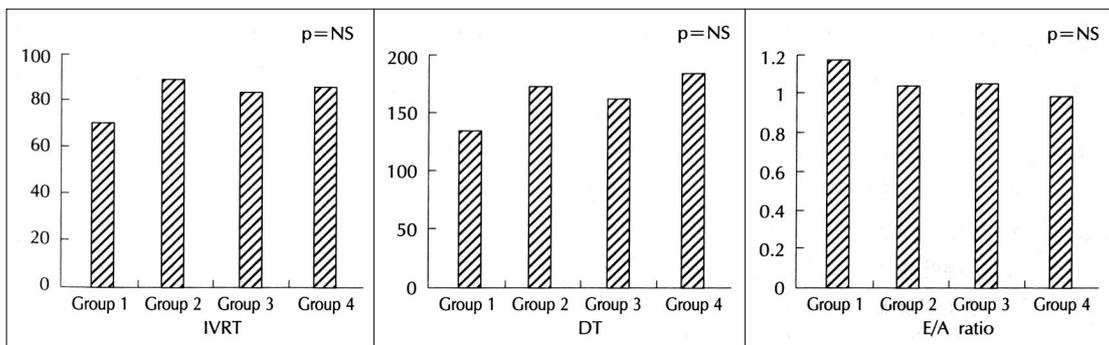


Fig. 4. Parameters of diastolic function.

가  
sulin, in-  
zyme, angiotensin - converting en-  
zyme 가, 가, 가

가  
14)15) 가

좌심실 비대 환자의 관동맥 혈류와 좌심실 이완기 변화  
와의 관계

가  
가  
가,  
16)



가 가

.<sup>24)25)</sup>

4

연구의 제한점

E/A , DT, IVRT

가

가

가

St - ruer<sup>23)</sup>

가

가

IVRT, E/A ,

DT

가

가

가

고혈압 및 좌심실비대환자에서의 혈류예비능

가

가

, 26

가

가

가

가

.<sup>21)26)</sup>

가

adenosine

가

가

E/A , DT, IVRT

가

요약 및 결론

Panza <sup>27)</sup>

가

IVRT, DT, E/A

가

중심 단어 :

감사문

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