

고혈압 환자에서 승모판륜의 간헐파 도플러조직속도 (Pulsed Wave Doppler Tissue Velocity)를 이용한 좌심실 이완기능의 평가

나득영¹ · 이동철¹ · 박건욱¹ · 이내희² · 조구영² · 김유호² · 박종훈²

Assessment of Diastolic Function Using Mitral Annulus Velocity by Doppler Tissue Velocity in the Patients with Hypertension

Deuk Young Nah, MD¹, Dong Chul Lee, MD¹, Keun Uk Park, MD¹, Nae Hee Lee, MD², Goo Yeong Cho, MD², You Ho Kim, MD² and Chong Hun Park, MD²

¹Department of Internal Medicine, Kyung-Ju Hospital, Dongguk Medical Center, University of Dongguk, Kyung-Ju, ²Division of Cardiology, Department of Internal Medicine, Asan Medical Center, University of Ulsan, Seoul, Korea

ABSTRACT

Background and Objectives : Mitral annulus velocity measured by doppler tissue imaging (DTI) has been used as a method of evaluation of the left ventricular diastolic function. This study was aimed to evaluate the left ventricular diastolic function using the mitral annulus velocity measured by DTI in the patients with hypertension. **Methods and Subjects :** One hundred twenty nine patients with blood pressure above 140/90 mmHg and age sex matched 123 normotensive subjects were studied. For measuring the mitral annulus velocities by DTI, we used the 2.5 MHz probe (Sequoia, Accuson) in apical four chamber view with the sample volume at the septal portion of the mitral annulus. **Results :** Mitral annular velocities were easily obtained from all subjects. In the hypertension group, mitral annulus E'velocity was significantly lower than normotensive controls (5.4 ± 1.3 cm/sec vs 6.5 ± 1.8 cm/sec, $p < 0.001$) and mitral annulus A' velocity was significantly higher than normotensive controls (8.6 ± 1.4 cm/sec vs 7.9 ± 1.1 cm/sec, $p < 0.001$). In comparison with patients with normal LVMI (LV mass index in hypertension group and subjects with normal LVMI in normotensive controls, mitral annulus E'velocity was reduced in patients with normal LVMI in hypertension group compared with subjects with normal LVMI in normotensive controls (5.6 ± 1.4 cm/sec vs 6.7 ± 1.8 cm/sec, $p < 0.001$). **Conclusion :** Mitral annulus velocity measured by DTI could be used as one of the parameters in evaluating the early changes of left ventricular diastolic function in the patient with hypertension. (Korean Circulation J 2000;30(9):1117-1124)

KEY WORDS : Hypertension · Diastolic dysfunction · Mitral annulus velocity.

| | | | |
|----------------------------|--|--|---------------|
| 서론 | 2.5 MHz | M | |
| 가 | | 6) | |
| (mitral inflow velocities) | 가 | (LVIDd), (IVSTd) | |
| | 가 | (PWTd), Dev - | |
| | ereux 7) | | |
| | | (left ventricle mass index) | |
| | | (m ²) | |
| | (preloading condition), | | |
| | | (gm) = 1.04[(IVSDd + LVIDd + PWTd) ³ | |
| | 가 | - (LVIDd) ³] 0.8 + 0.6 | |
| 가 1)2) | | IVSTd : InterVentricular Septal Thickness mea - | |
| (Pulse wave doppler) | (Do - | sured at end - diastole | |
| ppler tissue imaging) | | LVIDd : Left Ventricular end diastolic Internal Di - | |
| | | mension | |
| | 3)4) | PWTd : Posterior Wall Thickness measured at | |
| | | end - diastole | |
| 가 5)가 | Koren ⁸⁾ Levy ⁹⁾ | | |
| | | 가 125 g/m ² | |
| 가 | | | |
| (Doppler tissue imaging) | | | |
| 가 | | | |
| 대상 및 방법 | | | |
| 대 상 | | Relative Wall Thickness = (2PWTd/LVIDd) 100% | |
| | | 가 <125 g/m ² | |
| | 가 <0.45 | , 가 <125 g/m ² | |
| | 가 0.45 | | |
| 40 | (Concentric remodeling), | 가 125 | |
| g/m ² | 가 <0.45 | | |
| 129 | (Eccentric LVH), | 가 125 g | |
| | 가 0.45 | | |
| 40 | (Concentric LVH) | | |
| 10 | | M | |
| 123 | | | |
| 140 | | | |
| mmHg | 90 mmHg | | sample volume |
| 방 법 | | | |
| | (peak E velocity) | | |
| Acuson | (peak A velocity) | E/A | |
| Sequoia | | | |
| , M | ratio | | |

sample volume

(Peak

E velocity) E'

(Peak A velocity)

A' E'/A' ratio

M - mode

E' A' tracing

time velocity integral r = 0.98

Rodriguez¹³⁾

E' A' tracing time velocity integral

통 계

SPSS package Student's

t - test chi - square test

Pearson correl -

ation test

p 0.05

결 과

129

123 252

52 ± 6 51 ± 7

(127 ± 23 g/m² vs 106 ± 19 g/m², p < 0.001). Koren

가 125 g/m² 가

17) 125

g/m²

129

66 51% (Table 1),

33 , 33

(concentric remodeling)

19 (Table 2).

Table 1. Clinical characteristics of study subjects

| | Hypertensives (n = 129) | Controls (n = 123) | p value |
|-----------------------------------|----------------------------|-----------------------|-----------|
| Age | 52 ± 6 | 1 ± 7 | NS |
| Male/Female | 59/70 | 71/52 | NS |
| BP (mmHg) | | | |
| Systolic BP | 152 | 124 | p < 0.001 |
| Diastolic BP | 98 | 78 | p < 0.001 |
| LV mass index (g/m ²) | 127 ± 23 | 106 ± 19 | p < 0.001 |
| LVH (%) | 51 | 11 | p < 0.001 |

BP : Blood pressure, LV : left ventricle, LVH : left ventricular hypertrophy

Table 2. Prevalence of pattern of ventricular geometry in subjects

| | Hypertensives (n = 129) | Controls (n = 123) | p value |
|------------------------|----------------------------|-----------------------|-----------|
| Normal | 44(34%) | 107(87%) | p < 0.001 |
| Concentric remodeling | 19(15%) | 3(3%) | p < 0.001 |
| Eccentric hypertrophy | 33(26%) | 7(6%) | p < 0.001 |
| Concentric hypertrophy | 33(26%) | 6(5%) | p < 0.001 |

Table 3. Echocardiographic characteristics of study subjects

| | Hypertensives (n = 129) | Controls (n = 123) | p value |
|---------------|----------------------------|-----------------------|-----------|
| EF (%) | 63 ± 3 | 63 ± 3 | NS |
| DT (msec) | 194 ± 32 | 184 ± 28 | p < 0.05 |
| LA size (mm) | 36 ± 4 | 33 ± 4 | p < 0.001 |
| Mitral inflow | | | |
| E (cm/sec) | 57.2 ± 12.9 | 54.0 ± 12.7 | p < 0.05 |
| A (cm/sec) | 66.3 ± 11.6 | 55.3 ± 11.6 | p < 0.001 |
| E/A | 0.8 ± 0.2 | 1.0 ± 0.2 | p < 0.01 |
| DTI | | | |
| Eann (cm/sec) | 5.4 ± 1.3 | 6.5 ± 1.8 | p < 0.001 |
| Aann (cm/sec) | 8.6 ± 1.4 | 7.9 ± 1.1 | p < 0.001 |
| Eann/Aann | 0.6 ± 0.1 | 0.8 ± 0.2 | p < 0.001 |
| DTI-TVI | | | |
| Eann (mm) | 5.8 ± 1.7 | 7.5 ± 2.4 | p < 0.001 |
| Aann (mm) | 8.1 ± 1.6 | 7.1 ± 1.6 | p < 0.001 |
| Eann/Aann | 0.8 ± 0.2 | 1.0 ± 0.2 | p < 0.001 |

EF : ejection fraction, DT : deceleration time, LA : left atrium, E : early rapid filling, A : atrial contraction, DTI : doppler tissue imaging, ann : mitral annulus, TVI : time velocity integral

(194 ± 32 vs 184 ± 28 ms, $p=0.015$).
 36 ± 4 mm
 33 ± 4 mm

($p<0.001$)(Table 3).

승모판륜속도

57 ± 13 cm/sec 54 ± 13
 cm/sec ($p<0.05$).
 E'

(5.4 ± 1.3 cm/sec vs 6.5 ± 1.8 cm/sec,
 $p<0.001$)(Fig. 1), A'
 (8.6 ± 1.4 cm/sec vs 7.9 ± 1.1 cm/sec,
 $p<0.001$)(Fig. 2). E'/A'

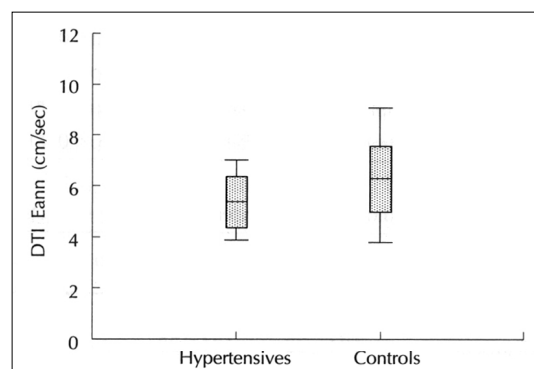


Fig. 1. Comparison of DTI Eann between hypertensives and controls.

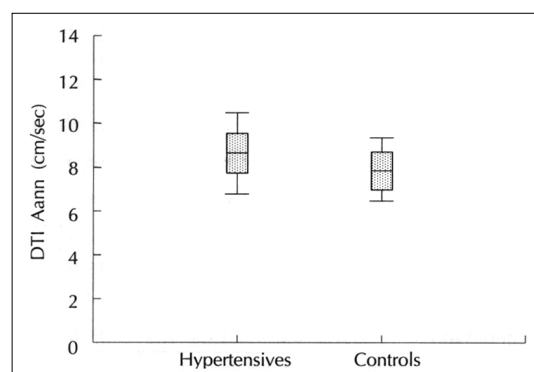


Fig. 2. Comparison of DTI Aann between hypertensives and controls.

(0.6 ± 0.1 vs 0.8 ± 0.1 , $p<0.001$)(Table 3).

승모판 유입혈류속도와 승모판륜 속도와의 상관관계
 E'

가

가

(r =

0.35, $p<0.05$).

A'

($r=0.33$, $p<0.05$, $r=0.46$, $p<0.05$).

(E/A)

E'/A'

($r=0.70$, $p<0.001$, $r=0.46$, $p<0.05$).

간헐파 도플러 조직영상을 이용한 승모판륜의 변위측정

(5.8 ± 1.7 mm vs 7.5 ± 2.4 mm, $p<0.001$)(Fig. 3),
 (8.1 ± 1.6 mm vs 7.1 ± 1.6 mm, $p<0.001$)(Table 3).

($58 \pm 2\%$ vs $51 \pm 1\%$, $p<0.001$).

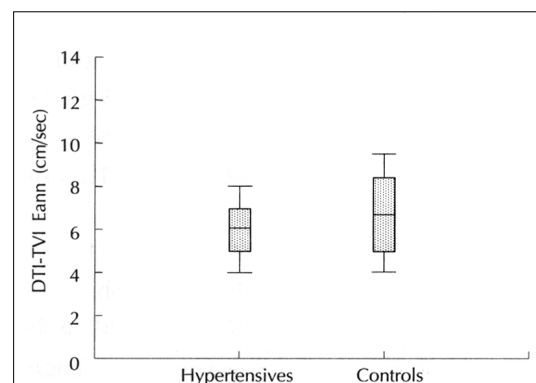


Fig. 3. Comparison of DTI Eann between hypertensives and controls.

(DTI - TVI E' vs E' ; r=0.87, p<0.001, DTI - TVI A' vs A' ; r=0.69, p<0.001, DTI - TVI E'/A' vs E'/A' ; r=0.88, p<0.001).

(: DTI - TVI E' vs E' ; r=0.80, p<0.001, DTI - TVI A' vs A' ; r=0.72, p<0.001, DTI - TVI E'/A' vs E'/A' ; r=0.75, p<0.001, : DTI - TVI E' vs E' ; r=0.89, p<0.001, DTI - TVI A' vs A' ; r=0.61, p<0.001, DTI - TVI E'/A' vs E'/A' ; r=0.89, p<0.001).

정상 좌심실 질량지수를 갖는 고혈압환자군과 정상혈압군 사이의 승모판륜 속도와 승모판륜의 변위측정 비교

63

110

Table 4. Clinical and echocardiographic characteristics of normal left ventricular mass subjects in hypertension group and normal left ventricular mass subjects in control group

| | Normal LV mass In Hypertensives (n=63) | Normal LV mass In Controls (n=110) | p value |
|--------------------------------------|--|--|---------|
| Age | 53±5 | 51±7 | NS |
| LV mass index (g/m ²) | 103±14 | 100±13 | NS |
| EF (%) | 64±2 | 63±3 | NS |
| DT (msec) | 185±29 | 185±29 | NS |
| LA size(mm) | 35±4 | 32±5 | p<0.01 |
| Mitral inflow | | | |
| E (cm/sec) | 58.2±13.7 | 54.2±12.8 | NS |
| A (cm/sec) | 66.3±12.2 | 54.5±11.5 | p<0.001 |
| E/A | 0.8±0.2 | 1.0±0.3 | p<0.01 |
| DTI | | | |
| Eann (cm/sec) | 5.6±1.4 | 6.7±1.8 | p<0.001 |
| Aann (cm/sec) | 8.8±1.4 | 8.0±1.1 | p<0.001 |
| Eann/Aann | 0.6±0.2 | 0.8±0.2 | p<0.001 |
| DTI-TVI | | | |
| Eann (mm) | 5.9±1.7 | 7.4±2.3 | p<0.001 |
| Aann (mm) | 8.2±1.4 | 7.2±1.6 | p<0.001 |
| Eann/Aann | 0.7±0.3 | 1.0±0.4 | p<0.001 |

BP : blood pressure, LV : left ventricle, EF : ejection fraction, DT : deceleration time, LA : left atrium, E : early rapid filling, A : atrial contraction, DTI : doppler tissue imaging, ann : mitral annulus, TVI : time velocity integral

E'
(5.6±1.4 cm/sec vs 6.7±1.8 cm/sec, p<0.001)
A'
(8.8±1.4 cm/sec vs 8.0±1.1 cm/sec, p<0.001).

(5.9±1.7 mm vs 7.4±2.3 mm, p<0.001),
(8.2±1.4 mm vs 7.2±1.6 mm, p<0.001)(Table 4).

승모판 혈류 양상이 정상인 고혈압환자군과 정상혈압군에서 승모판륜 속도 비교

가 1.1 150 ms
240 ms 17 ,
42 .

Table 5. Mitral annulus velocity of study subjects with normal mitral inflow pattern

| | Hypertensives (n=17) | Controls (n=42) | p value |
|---------------|-------------------------|--------------------|---------|
| DTI | | | |
| Eann (cm/sec) | 6.4±1.3 | 7.9±1.3 | p<0.001 |
| Aann (cm/sec) | 8.5±1.0 | 7.8±1.1 | p<0.05 |
| Eann/Aann | 0.8±0.1 | 1.0±0.1 | p<0.001 |

DTI : doppler tissue imaging, ann : mitral annulus

Table 6. Mitral annulus velocity of study subjects between the ages of 40 and 49 years

| | Hypertensives (n=65) | Controls (n=61) | p value |
|---------------|-------------------------|--------------------|---------|
| Age | 46±3 | 45±3 | NS |
| DTI | | | |
| Eann (cm/sec) | 5.8±1.4 | 7.3±1.7 | p<0.001 |
| Aann (cm/sec) | 8.6±1.4 | 7.9±1.1 | p<0.005 |
| Eann/Aann | 0.6±0.1 | 0.9±0.2 | p<0.001 |

DTI : doppler tissue imaging, ann : mitral annulus

Table 7. Mitral annulus velocity of study subjects between the ages of 50 and 59 years

| | Hypertensives (n=64) | Controls (n=62) | p value |
|---------------|-------------------------|--------------------|---------|
| Age | 56±3 | 55±3 | NS |
| DTI | | | |
| Eann (cm/sec) | 5.0±1.1 | 5.9±1.6 | p<0.005 |
| Aann (cm/sec) | 8.6±1.4 | 7.9±1.1 | p<0.005 |
| Eann/Aann | 0.6±0.1 | 0.8±0.2 | p<0.001 |

DTI : doppler tissue imaging, ann : mitral annulus

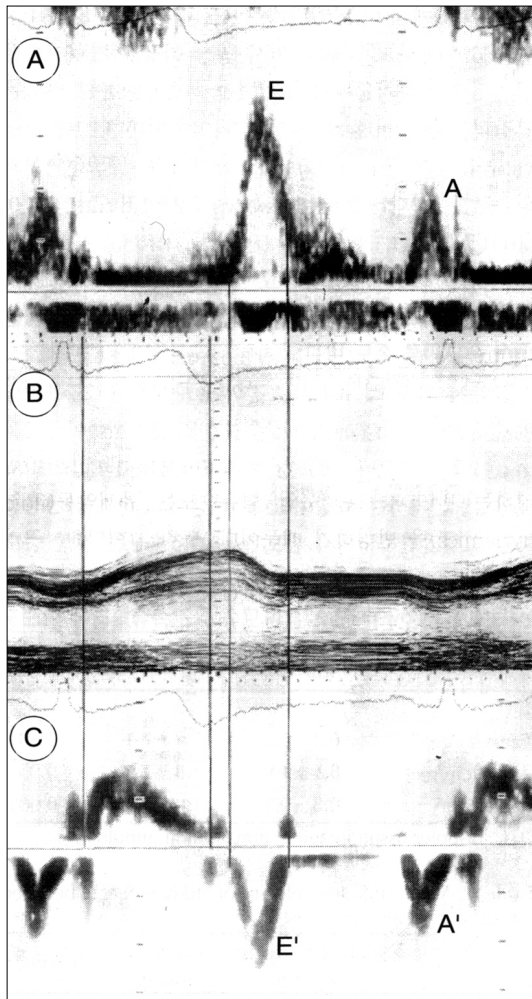


Fig. 4. A : Mitral inflow. B : M-mode mitral annulus excursion during diastol. C : mitral annulus motion.

E'
(6.4 ± 1.2 cm/sec vs 7.9 ± 1.3 cm/sec,
 $p < 0.001$) A'
(8.5 ± 1.0 cm/sec vs 7.8 ± 1.1 cm/sec, $p < 0.001$).
E'/A'
(0.8 ± 0.1 vs 1.0 ± 0.1 , $p < 0.001$)(Table 5).

40 50

(Table 6 and 7).

고 안

(LV geometry) 3가
(volume overload) 3가
10)
40
51
가 가
106 gm/M²
(sphincter - like motion) 3가
M mode
가 11)12) Gibson 13)
(recoil)
가 14)15)16)

(Fig. 4).

sample volume

. Sohn 17)

가
($r = 0.5$, $p < 0.005$).

가
. Sherif 18)

40 123
2.5 MHz (Sequ -
oia, Accuson) 4
sample volume

결 과 :

E'
(5.4 ± 1.3 cm/sec vs 6.5 ± 1.8 cm/sec,
p<0.001), A'
(8.6 ± 1.4 cm/sec vs 7.9 ± 1.1
cm/sec, p<0.001).
63 110
E'
(5.6 ± 1.4 cm/sec vs
 6.7 ± 1.8 cm/sec, p<0.001), A'
(8.8 ± 1.4
cm/sec vs 8.0 ± 1.1 cm/sec, p<0.001).

결 론 :

가

중심 단어 :

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