

정상인에서 도플러 조직 영상(Doppler Tissue Imaging)을 이용한 승모판륜 속도에 관한 연구

문찬일 · 최재웅 · 조용범 · 신원용 · 송창섭

Assessment of Normal Mitral Annulus Velocity Using Doppler Tissue Imaging

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ABSTRACT

Background and Objectives : The objective of this study was to establish the reference values of mitral annulus velocity using Doppler tissue imaging, which has been previously thought of as a new parameter of left ventricular diastolic function. Many parameters, including the mitral inflow, that have been used in the evaluation of left ventricular diastolic function are affected by several conditions, sometimes limiting the information they can provide about left ventricular diastolic function. The knowledge of mitral annulus velocity by Doppler tissue imaging will provide new guidelines for the evaluation of diastolic function. However, reference values in normal systems and changes according to age have not been fully evaluated.

Methods : We examined 246 patients lacking symptoms related to the either cardiac systolic or diastolic dysfunction, as well as 80 healthy volunteers, according to an age. Early (E) and late (A) transmitral flow velocity and the ratio of early to late peak velocity (E/A) were obtained by pulsed Doppler echocardiography. Early diastolic velocity of mitral annulus (E') and peak atrial systolic velocity of mitral annulus(A') were obtained from the medial (or septal) corner of the mitral annulus and subsequently from the lateral corner by Doppler tissue imaging. We obtained E', A' and the ratio of E' to A' (E'/A') and E/E' according to age.

Results : E' from the medial corner was the highest in subjects in their twenties and declined gradually and A' from the medial corner was the lowest in the same age group and gradually increased. The E'/A' ratio from the medial corner was the highest in subjects in their twenties, declined gradually and reversed in subjects in their forties. E', A' and E'/A' from the lateral corner were similar to the medial corner however the E'/A' was reversed in subjects in their fifties. The E/E' from the medial and lateral corner was the lowest in subjects in their twenties and gradually increased with age. In our comparison between the transmitral flow velocity and mitral annulus velocity, there was a good relationship between E/A and E'/A' ($p = 0.01$). **Conclusion :** We measured the reference values of mitral annulus velocity by Doppler tissue imaging and E/E', according to an age. (Korean Circulation J 2001;31(7):662-669)

KEY WORDS : Doppler tissue imaging · Left ventricular diastolic function.

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서론

AST, ALT가 1.5
가 30

(Doppler

Tissue Imaging - DTI)

246

80

가 20 10 6
(Table 1).

가

가

방 법

Acuson 128 XP/10c 2.5 MHz

가 4

sample volume

가 (E), (A) E A
(E/A), E 가 (AT), (DT),
(IVRT)

가 DTI DTI

가 4

sample volume

(E' of me-
dial corner - E' M)
(A' of
medial corner - A' M), E' M A' M (E' M/
A' M), E' M 가 (ATM), (DTM)

가 sample volume

(E' of lateral corner -
E' L),
(A' of lateral corner -
A' L), (E' L/A' L), E' L 가
(ATL), (DTL)

대상 및 방법

대 상

1998 3 2000 2

100 mm

3

140 mmHg , 90 mmHg ,
110 mg/dL

250 mg/dL , 통계 처리

200 mg/dL , (±)
(BUN >30 mg/dL) creatinine 2.0 mg/dL paired Student's t-

Table 1. Baseline clinical characteristics of study patients

	Age (yr)						Total (n=326)
	20 - 29 (n=49)	30 - 39 (n=40)	40 - 49 (n=83)	50 - 59 (n=61)	60 - 69 (n=65)	Over 69 (n=28)	
Sex (M : F)	14 : 35	21 : 19	43 : 40	33 : 28	25 : 40	14 : 14	150 : 176
Systolic BP (mmHg)	113 ± 10	111 ± 10	116 ± 8	119 ± 12	119 ± 9	118 ± 11	117 ± 10
Diastolic BP (mmHg)	72 ± 7	72 ± 8	74 ± 8	77 ± 7	76 ± 11	74 ± 9	75 ± 9
Heart rate (/min)	70.2± 6.5	72.9± 4.8	72.5± 5.3	72.0± 7.2	73.5± 5.1	72.9± 5.5	72 ± 6
WBC (× 10 ³ /mm ³)	7.5± 1.5	7.8± 1.9	6.8± 1.8	7.2± 1.6	7.7± 1.7	7.6± 1.6	7.4± 1.7
Hb (g/dL)	12.9± 1.9	12.8± 1.6	13.0± 1.4	12.9± 1.6	12.2± 1.3	12.5± 1.2	12.7± 1.5
Hct (%)	38.6± 4.9	38.0± 5.0	39.0± 4.7	39.3± 5.0	37.3± 4.2	38.1± 3.8	38.5± 4.6
Platelet (× 10 ³ /mm ³)	215 ± 38	216 ± 35	226 ± 60	238 ± 68	238 ± 63	276 ± 112	234 ± 66
AST (IU/L)	22.1± 5.3	22.1± 4.9	24.9± 5.7	23.8± 5.7	23.1± 10.2	19.8± 6.3	23.2± 6.9
ALT (IU/L)	17.9± 8.9	20.8± 10.6	23.8± 9.3	24.1± 9.5	23.4± 13.1	18.6± 7.8	22.4± 10.3
BUN (mg/dL)	13.0± 2.6	12.3± 3.7	12.9± 3.8	14.7± 4.0	15.0± 4.9	18.0± 5.8	14.2± 4.4
Cr (mg/dL)	1.0± 0.2	0.9± 0.2	0.9± 0.2	0.9± 0.2	0.9± 0.2	1.0± 0.2	0.9± 0.2
T. Cholesterol (mg/dL)	160.6± 35.0	174.1± 37.2	178.3± 38.7	183.7± 37.9	172.8± 44.8	180.5± 36.3	176.7± 38.9
Triglyceride (mg/dL)	121.8± 50.5	124.9± 64.7	134.8± 55.0	139.0± 46.7	136.8± 66.2	126.1± 57.5	133.2± 55.6
Glucose (mg/dL)	95.3± 8.9	91.3± 9.8	95.5± 11.2	98.8± 12.0	100.3± 10.2	100.5± 10.2	97.4± 10.9

test p 0.05 28), 60 65 (25 , 40), 70
28 (14 , 14) 326 (150 , 176) . ,

결 과

Abbreviation and Acronyms

E :
E'M :
A :
A'M :
AT : E 가
ATM : E'M 가
DT : E
DTM : E'M
IVRT :
E'L :
LVEF :
A'L :
ATL : E'L 가
DTL : E'L

, AST, ALT, BUN, creatinine, , 가 (Table 1).

E 20 가 (83±15 cm/sec) 가 70 (55±13 cm/sec) , A 20 가 (50±12 cm/sec) E 가 가 70 (80±17 cm/sec). E/A 20 가 (1.73±0.45) 가 50 1 (0.95±0.31) 70 (0.69±0.16). E 가 가 20 가 (173±25 msec, 72±13 msec) 가 (Table 2). DTI

Table 2. Echocardiographic characteristics according to an age

	Age (yr)						
	20-29 (n=49)	30-39 (n=40)	40-49 (n=83)	50-59 (n=61)	60-69 (n=65)	Over 69 (n=28)	Total (n=326)
LVEF (%)	63.0 ± 4.4	64.4 ± 4.6	64.4 ± 5.4	65.7 ± 5.2	65.7 ± 6.1	65.3 ± 4.7	64.8 ± 5.3
Mitral flow							
Peak E velocity (cm/sec)	82.7 ± 15.2	70.8 ± 18.4	68.9 ± 16.9	62.2 ± 16.2	59.7 ± 17.2	54.9 ± 13.4	67.0 ± 18.4
Peak A velocity (cm/sec)	50.1 ± 11.7	54.5 ± 13.9	57.8 ± 11.8	67.7 ± 13.7	76.6 ± 17.8	80.1 ± 16.5	63.7 ± 17.4
E/A ratio	1.73 ± 0.45	1.34 ± 0.35	1.23 ± 0.34	0.95 ± 0.31	0.79 ± 0.22	0.69 ± 0.16	1.13 ± 0.46
AT (msec)	92 ± 12	90 ± 12	91 ± 16	91 ± 14	86 ± 13	82 ± 15	89 ± 14
DT (msec)	173 ± 25	185 ± 38	203 ± 38	213 ± 38	232 ± 41	250 ± 67	208 ± 46
IVRT (msec)	72 ± 13	84 ± 15	93 ± 17	102 ± 16	103 ± 20	125 ± 24	95 ± 22
Mitral annulus velocity from medial corner							
Peak E'M velocity (cm/sec)	12.8 ± 2.6	9.8 ± 2.4	8.6 ± 2.0	7.4 ± 1.6	6.7 ± 1.1	6.3 ± 1.5	8.6 ± 2.8
Peak A'M velocity (cm/sec)	8.3 ± 1.5	8.8 ± 1.9	9.7 ± 2.0	10.7 ± 2.0	10.2 ± 1.7	10.2 ± 1.7	9.7 ± 2.0
E'M/A'M ratio	1.59 ± 0.39	1.16 ± 0.41	0.94 ± 0.34	0.70 ± 0.17	0.67 ± 0.16	0.64 ± 0.19	0.95 ± 0.44
ATM (msec)	71 ± 10	72 ± 9	69 ± 10	72 ± 13	67 ± 10	65 ± 10	70 ± 11
DTM (msec)	101 ± 17	98 ± 17	103 ± 17	103 ± 20	103 ± 20	88 ± 22	101 ± 19
Mitral annulus velocity from lateral corner							
Peak E'L velocity (cm/sec)	19.4 ± 3.2	14.9 ± 3.2	13.1 ± 3.3	10.4 ± 2.7	9.2 ± 2.1	8.3 ± 2.6	12.7 ± 4.6
Peak A'L velocity (cm/sec)	9.3 ± 2.5	10.1 ± 2.5	10.6 ± 3.0	11.8 ± 2.7	11.9 ± 2.4	12.0 ± 3.4	10.9 ± 2.9
E'L/A'L ratio	2.20 ± 0.57	1.55 ± 0.44	1.31 ± 0.45	0.91 ± 0.27	0.81 ± 0.26	0.72 ± 0.25	1.27 ± 0.63
ATL (msec)	72 ± 11	77 ± 12	74 ± 13	76 ± 12	72 ± 13	71 ± 16	74 ± 13
DTL (msec)	85 ± 15	91 ± 12	93 ± 17	92 ± 13	91 ± 20	86 ± 25	90 ± 17
E/E'M	6.69 ± 1.55	7.38 ± 1.92	8.26 ± 2.17	8.49 ± 2.43	8.97 ± 2.50	8.96 ± 2.77	8.11 ± 2.34
E/E'L	4.37 ± 0.88	4.89 ± 1.36	5.54 ± 1.69	6.10 ± 2.10	6.77 ± 2.30	7.19 ± 2.52	5.75 ± 2.05

EM 20 가 (12. 37 ± 3.18 cm/sec) 가 70
83 ± 2.55 cm/sec) 가 70 가 (8.29 ± 2.65 cm/sec), AL
(6.29 ± 1.49 cm/sec), A'M 20 가 (9.29 ± 2.50 cm/sec)
20 가 (8.27 ± 1.54 cm/sec) 가 70 가
가 50 (12.04 ± 3.43 cm/sec). E'L/A'L 20
(10.67 ± 1.96 cm/sec) 60 70 가 (2.20 ± 0.57)
(10.15 ± 1.71 cm/sec, 50 (0.91 ± 0.27) 70
10.17 ± 1.69 cm/sec), E'M/A'M 20 (0.72 ± 0.25). ATL,
가 (1.59 ± 0.39) 가 DTL (Table 2).
40 (0.94 ± 0.34) 70 E E' (E/E'M) 20
가 (0.64 ± 0.19). ATM, DTM 가 (6.69 ± 1.55) 가
(Table 2). 가 60 (8.97 ±
DTI 2.50). (E/E'L) 20
E'L 20 가 (19. 가 (4.37 ± 0.88) 가

Table 3. Correlation coefficient of E, E'M, EL group, A, A'M, A'L group and E/A, E'M/A'M, E'L/A'L group

	Age(yr)						
	20 - 29 (n = 49)	30 - 39 (n = 39)	40 - 49 (n = 83)	50 - 59 (n = 60)	60 - 69 (n = 65)	Over 69 (n = 27)	Total (n = 323)
R value of E, EM, EL							
E-E'M	0.204	0.509**	0.398**	0.470**	0.447**	0.302	0.564**
E - E'L	0.409**	0.379*	0.336**	0.177	0.188	0.105	0.520**
E'M - E'L	0.333*	0.544**	0.699**	0.546**	0.407**	0.541**	0.797**
R value of A, A'M, A'L							
A - A'M	0.130	0.652**	0.161	0.042	0.067	0.158	0.303**
A - A'L	0.189	0.368*	0.152	0.085	0.045	0.257	0.293**
A'M - A'L	0.200	0.517**	0.319**	0.249	0.222	0.277	0.381**
R value of E/A, E'M/A'M, E'L/A'L							
E/A - E'M/A'M	0.190	0.558**	0.571**	0.491**	0.425**	0.571**	0.716**
E/A - E'L/A'L	0.216	0.427**	0.522**	0.355**	0.616**	0.643**	0.723**
E'M/A'M - E'L/A'L	0.294*	0.508**	0.628**	0.347**	0.268*	0.558**	0.764**

* : p<0.05, ** : p<0.01

가 70 . 가

E'L, A'L E'M,

A'M

(p<0.05), E'L/A'L E'M/A'M

(p<0.05). E/E'L 30%

E/E'M 가

(p<0.05). 1-3)

DTI

E'M E 20 가 4)5)

70

(p<0.01) E'L 20 , 30 가

, 40 ,

가

. A'M A'L A 6)7)

30

E/A 가

, Zaky 4

20 (p<0.01)(Table 3).

. 6) 4 , 4

고 찰

DTI , 4 DTI

가 가

. 8) 4

667

요 약

연구목적 :

가

가

가

E/E' 가 20 가

가

가

대상 및 방법 :

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246

Nagueh ¹⁴⁾ E/E' 가 10 80

가

가

20 10

DTI 6

E (E'A, E/A, AT, DT)

E'M 20 70

E'L 20 , 30 , (E'M, E'L),

40 가 (A'M, A'L), (E'M/

E/A E'/A' A'M'E'L/A'L), 가 (ATM, ATL),

20 (DTM, DTL)

DTI E'/A'가

E/A 가

결 과 :

AST,

DTI ALT, BUN, Cr

가

E', A'

가 E'

20 가 가

가 70

A'

20 가 가

가 50

60 70

가 가
 70 . E' / A'
 20 가
 40 , 50 1
 , 70 가
 . E/E' 20 가
 가 가
 .
 결 론 :
 DTI
 E/A E' / A'
 가 .
 중심 단어 : .
 .
 감사문
 80

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