

승모판 협착증의 경피 승모판막 성형시술 전과 이후의 좌심실 수축 기능

신 영 우

= Abstract =

Left Ventricular Ejection Performance Before and Following Percutaneous Mitral Valvuloplasty in Mitral Stenosis

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Background : In cases of pure mitral stenosis, it is known that the impairment of left ventricular (LV) ejection performance is frequently accompanied, but long term follow up studies on the LV ejection performance after successful percutaneous mitral valvuloplasty are rare so far.

Methods : An prospective investigation was performed on 32 cases of patients, 10 being male and 22 female, who have been maintained after successful percutaneous mitral valvuloplasty of pure mitral stenosis. The LV ejection performances have been measured with cardiomechanography and echocardiography before and following the procedure, and the follow-up periods were 24 months in average, in the range of 12 to 35 months.

Results : The stroke volume, cardiac output, cardiac index, ejection fraction, mean velocity of circumferential shortening and fractional shortening (FS), which are indices of LV ejection performance, all increased in follow-up than before procedure. In addition, LV end-diastolic dimension and LV end-diastolic dimension index, which are indices of LV preload, increased, and the end-systolic LV wall stress which is an index of afterload, decreased. And the ratio of measured FS to expected FS, which is an index of myocardial contractility, increased in follow-up.

Conclusion : The successful percutaneous mitral valvuloplasty of pure mitral stenosis is found to improve LV ejection performance in long term by increasing preload, decreasing afterload, and increasing myocardial contractility of left ventricle.

KEY WORDS : Mitral stenosis · Percutaneous mitral valvuloplasty · Left ventricular ejection performance.

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대상 및 방법

1. 연구 대상

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Reicheck 16)

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17)

10)

(g/cm²) = [{

(mmHg)} {

(cm)} { 1.3

5)] / [{ 4} {

(cm)} { 1 +

(cm)} { }

15,18)

20)

36 ± 9

21 50 , 가 22 , 가 10

32

24 ± 7 12 35

32 22 10

15)

(cir/sec) = 0.0045

[

15,18)

10%

2. 연구 방법

Inoue 11)

(%) = 0.0956 × [

(g/cm²) + 38.7

5

가 10

Student t , 가 SV 가 74.3 ± 10.4 CO

SPSS/PC+ P 0.05 (Table 1). SV

가 0.36(p<0.05) 0.38(p<0.04) (Table 2, 3), SV

결 과

1. 일회 심박출량(SV), 심박출량(CO) 및 심 계수(CI)

32 가 가 가 (r=0.81, p<0.0001) (Table 4). SV 0.54(p<0.0001) 0.54(p<0.0001) (Table 2). SV 가 가 가 r=0.43, p<0.02 (Table 4).

SV 48.6 ± 12.5ml 가 CO 3.8 ± 0.9l/ 59.0 ± 11.9ml , CI 2.4 ± 0.5l/ /m² 2.8 ± 0.5l/ /m² 가(p<0.0001) r=0.41, p<0.02 가 (Table 4).

79.9 ± 15

Table 1. Changes in left ventricular performance variables before and following percutaneous mitral valvuloplasty in 32 cases of mitral stenosis

	HR	CO	SV	EF	FS	mVcf	FS ratio	MVcf ratio	LVIDd	LVIDs	ES
Before	79.9 ± 15.1	3.8 ± 0.9	48.6 ± 12.5	66.3 ± 7.5	30.9 ± 5.0	1.2 ± 0.2	0.9 ± 0.1	1.1 ± 0.2	47.5 ± 5.1	32.8 ± 4.4	63.1 ± 14.5
Following	74.3 ± 10.4	4.4 ± 0.7	59.0 ± 11.9	71.2 ± 6.8	34.4 ± 5.2	1.3 ± 0.2	1.0 ± 0.1	1.2 ± 0.2	49.7 ± 5.3	32.6 ± 5.2	57.6 ± 15.0
p Value	0.02	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0002	NS	0.009

Values are expressed as mean value ± SD : comparison between variables before and following percutaneous mitral valvuloplasty. NS=not significant ; HR=heart rate per minute ; CO=cardiac output(l/min) ; SV=stroke volume(ml) ; EF=ejection fraction ; FS=fractional shortening(%) ; mVcf=mean velocity of circumferential shortening (cir/sec) ; FS ratio=FS/expected FS ; mVcf ratio=mVcf/expected mVcf ; LVIDd=end-diastolic left ventricular dimension(cm) ; LVIDs=end-systolic left ventricular dimension(mm) ; ES=end-systolic left ventricular wall stress (g/cm²)

Table 2. Correlation of stroke volume, ejection fraction, fractional shortening, mean velocity of circumferential shortening with hemodynamic and echocardiographic variables before percutaneous mitral valvuloplasty

	CO	CI	SV	EF	FS	LVIDd	LVIDs	SVR	ES	MVA
SV	0.76(0.00)	0.72(0.00)	-	0.54(0.00)	0.54(0.00)	0.36(0.05)	0(NS)	-0.83(0.00)	-0.35(0.05)	0.12(NS)
EF	0.44(0.01)	0.38(0.03)	0.54(0.00)	-	0.97(0.00)	-0.03(NS)	-0.58(0.00)	-0.37(0.04)	-0.61(0.00)	0.24(NS)
FS	0.48(0.01)	0.43(0.02)	0.54(0.00)	0.97(0.00)	-	0.03(NS)	-0.55(0.00)	-0.37(0.04)	-0.66(0.00)	0.33(NS)
mVcf	0.49(0.01)	0.4 (0.03)	0.35(0.05)	0.76(0.00)	0.81(0.00)	0(NS)	-0.47(0.01)	-0.29(NS)	-0.51(0.00)	0.39(0.03)

Values are expressed as correlation coefficient(p value). NS=not significant ; CI=cardiac index ; SVR=systemic vascular resistance ; MVA=mitral valve area ; other abbreviations as in Table 1.

Table 3. Correlation of stroke volume, ejection fraction, fractional shortening, mean velocity of circumferential shortening with echocardiographic variables following percutaneous mitral valvuloplasty

	CO	CI	SV	EF	FS	LVIDd	LVIDs	ES	MVA
	0.54(0.00)	0.54(0.00)	-	0.29(NS)	0.26(NS)	0.38(0.04)	0.13(NS)	-0.08(NS)	-0.06(NS)
EF	0.36(0.05)	0.29(NS)	0.29(NS)	-	0.98(0.00)	-0.35(0.05)	-0.76(0.00)	-0.77(0.00)	0.2 (NS)
FS	0.31(NS)	0.23(NS)	0.26(NS)	0.98(0.00)	-	-0.43(0.02)	-0.75(0.00)	-0.76(0.00)	0.19(NS)
mVcf	0.28(NS)	0.2(NS)	0.08(NS)	0.86(0.00)	0.88(0.00)	-0.42(0.02)	-0.68(0.00)	-0.64(0.00)	0.14(NS)

Values are expressed as correlation coefficient(p value). Abbreviations as in Table 1 and 2.

Table 4. Correlation of changes in stroke volume, cardiac output and cardiac index with changes in hemodynamic and echocardiographic variables following percutaneous mitral valvuloplasty

	EF	FS	mVcf	LVIDd	LVIDs	ES	MVA
SV	0.43(0.02)	0.41(0.02)	0.3 (NS)	0.81(0.00)	0.37(0.04)	-0.14(NS)	0.29(NS)
CO	0.43(0.02)	0.46(0.01)	0.41(0.02)	0.68(0.00)	0.26(NS)	-0.12(NS)	0.47(0.01)
CI	0.46(0.01)	0.49(0.01)	0.43(0.02)	0.7 (0.00)	0.26(NS)	-0.17(NS)	0.54(0.00)

Values are expressed as correlation coefficient(p value).
Abbreviations as in Table 1 and 2.

Table 5. Correlation of changes in ejection fraction, fractional shortening and mean velocity of circumferential shortening with changes in hemodynamic and echocardiographic variables following percutaneous mitral valvuloplasty

	LVIDd	LVIDs	ES	MVA	FS ratio	MVcf ratio
EF	0.22(NS)	-0.48(0.01)	-0.57(0.00)	0.18(NS)	0.92(0.00)	0.74(0.00)
FS	0.14(NS)	-0.57(0.00)	-0.64(0.00)	0.33(NS)	0.96(0.00)	0.76(0.00)
mVcf	0.14(NS)	-0.46(0.01)	-0.55(0.00)	0.26(NS)	0.79(0.00)	0.93(0.00)

Values are expressed as correlation coefficient(p value).
Abbreviations as in Table 1 and 2.

SV (r = -0.83, p<0.0001) (Table 2).

2. 심박출 계수(EF)
EF 66.3±7.5% , 71.2±6.8% 가(p<0.001) (Table 1). EF 가 -0.58(p<0.0001) -0.76(p<0.0001) (Table 2, 3), EF (r=0.48, p<0.01) 가 SV EF (Table 5). EF (r = -0.61, p<0.0001, r = -0.77, p<0.0001) (Table 2, 3), EF 가 (r = -0.57, p<0.0001) (Table 5). EF (r = -0.37, p<0.04) (Table 2). EF 가 (Table 5), EF (Table 2, 3).

3. 좌실경 단축율(FS)
FS 30.9±5.0% 34.4±5.2% 가(p<0.0001) (Table1). FS 가 -0.55(p<0.0001) -0.75(p<0.0001) (Table 2, 3), FS 가 (r=0.57, p<0.0001) 가 (Table 5). FS (r = -0.66, p<0.0001, r=0.76, p<0.0001) (Table 2, 3), FS 가 (r = -0.64, p<0.0001) 가 (Table 5). FS EF (r = -0.37, p<0.04) 가 (Table 2), (Table 2, 3). FS FS FS 0.9±1 1.0± 가(p<0.0001) (Table 1).

4. 좌심 평균 원주 단축 속도(mVcf)
mVcf $1.2 \pm 0.2 \text{cir/sec}$ 고 안
가 $1.3 \pm 0.2 \text{cir/sec}$ 가($p < 0.00$
01) (Table 1). mVcf
가 - 0.
47($p < 0.01$) - 0.68($p < 0.001$) 1/3
(Table 2, 3), mVcf 가 1,19,20,21)
가
($r = -0.46$, $p < 0.01$) 가 (Table
5). mVcf
($r = -0.51$ $p < 0.0001$,
 $r = -0.64$, $p < 0.001$) (Table 2, 3),
mVcf 가
($r = -0.55$, $p < 0.001$) 6,22,23)
(Table 5). EF mVcf
(Table 2).
mVcf
mVcf mVcf
 1.1 ± 0.2
 1.2 ± 0.2 가($p < 0.0001$) 7,8,24,25)
(Table 1).
5. 확장말기 좌심실 내경(LVIDd)
(LVIDId), 가 23,24,26)
(LVIDs), (LVIDIs) 1 가 10,27)
(ES)
32
LVIDd $47.5 \pm 5.1 \text{mm}$ $49.7 \pm 5.3 \text{mm}$,
LVIDId $31.1 \pm 3.7 \text{mm}$ $32.5 \pm 4.0 \text{mm}$ 가 7,9,12,17,22 - 25,27 - 30)
가 ($p < 0.0002$ $p < 0.0003$), LVIDs 12,23,31),
 $32.8 \pm 4.4 \text{mm}$ $32.6 \pm 5.2 \text{mm}$, LVIDIs 21.
 $6 \pm 3.5 \text{mm}$ $21.3 \pm 3.7 \text{mm}$ 24
. ES $63.1 \pm 14.5 \text{dynes} \cdot \text{sec}$. EF, FS mVcf 1/3
 $/\text{cm}^5$ $57.6 \pm 15.0 \text{dynes} \cdot$ 6,8,9,20,21,24,28,29,32)
 sec/cm^5 ($p < 0.009$) 가 8,9,24,29)
(Table 1). 가 17,25,28)가

EF, FS mVcf . 가 ⁹⁾ .

6,9,20,25,29) ,
ES가 가 20,25,32) ,
25) .
EF 가
33) EF 6,25) .
¹⁰⁾ LVIDd, LVIDId, , 가
9) , ES 17,32) , ES가
6,24,29,32) .
SV, CO CI 가 , EF, FS
ES EF, mVcf
6,29) . FS 가
LVIDd 가 7,8,24) ,
LVIDd ¹⁷⁾ , EF ES EF, mVcf FS 가
EF 6,32) ,
LVIDd 가 , 가
EF ³⁰⁾ , EF , 가
LVIDd SV . 가 가
가 ⁷⁾ LVIDd 가 1,20,29,32) ,
가 SV CO ²¹⁾ EF, FS, mVcf
LVIDs
가 6,17) . mVcf
SV LVIDd ¹⁸⁾ , FS LVIDs
LVIDd 17,34)
SV 가 ,
가 LVIDd 가 가
(r= 6,17) .
0.4, p<0.02) . ES FS 가 ¹⁷⁾ .
가 , FS , 가
LVIDd 가 , ES
FS FS
ES 가 17,20) . 가

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