

## 선천성 승모판 폐쇄 부전 환자에서 수술 후 좌심실 기능의 변화

은영민<sup>1,3</sup> · 최재영<sup>1,3</sup> · 이종균<sup>1,3</sup> · 설준희<sup>1,3</sup> · 이승규<sup>1,3</sup> · 박영환<sup>2,3</sup> · 조범구<sup>2,3</sup>

### Left Ventricular Function after Mitral Valve Operation in Congenital Mitral Regurgitation

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#### ABSTRACT

**Background** : Severe mitral regurgitation is a common clinical entity that can lead to progressive, irreversible left ventricular dysfunction, and thus should be corrected in proper stage of life. Authors have conducted this investigation to assess left ventricular function after mitral valve operation and to determine the predicting factors. **Methods and Results** : The echocardiographic parameters, specifically left ventricular ejection fraction, shortening fraction, end-systolic dimension and volume, and end-diastolic dimension and volume were measured in preoperative and postoperative period of congenital mitral regurgitation patients (n = 60), between March 1992 and March 1998. After correction of severe mitral regurgitation, left ventricular ejection fraction and shortening fraction decreased significantly ( $p < 0.001$  and  $p < 0.05$  respectively). Furthermore, after reoperation of recurred mitral regurgitation, left ventricular ejection fraction and shortening fraction decreased significantly ( $p < 0.05$ ). Left ventricular ejection fraction and shortening fraction in mitral valve reoperation group (n = 23) is significantly lower than those in non-reoperation group (n = 37) in both preoperative and postoperative period ( $p < 0.05$ ). Left ventricular ejection fraction and shortening fraction is also significantly lower in mitral valve replacement group (n = 20) than in mitral valvuloplasty group (n = 40) ( $p < 0.05$ ). Severe postoperative left ventricular dysfunction led to dilated cardiomyopathy in 5 patients. Postoperative left ventricular end systolic dimension increased significantly in reoperation group and DCMP group respectively ( $p < 0.05$ ). **Conclusion** : After surgical correction of mitral regurgitation, left ventricular dysfunction is frequent and carries a poor prognosis. Postoperative left ventricular dysfunction can be predicted by preoperative ejection fraction, shortening fraction and systolic diameter. Therefore surgical therapy before the onset of left ventricular dysfunction is recommended. (**Korean Circulation J 2000;30(6):737-744**)

**KEY WORDS** : Mitral regurgitation · Mitral valvuloplasty · Mitral valve replacement · Left ventricular dysfunction.

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가 20 (33.3%), 20 (33.3%), 20 (33.3%) . 1  
 가 (preload) 가 29 8 37 (61.7%) ,  
 가 (afterload) 23 (38.3%)  
 가 11 12  
 가 20 (33.3%)  
 가 (Fig. 1). 가 27 , 가  
 33 0.8 : 1 3  
 15 5.9 ± 5.2 , 4.5 kg 45  
 kg 18.9 ± 11.4 kg ,  
 1 72 11.9 ± 10.8  
 (Table 1).

11

(valvuloplasty) (replacement) ATL (Bothell, WA, USA)  
 (ejection fraction) Ultramark 9 HDI 5000 Ultrasound System  
 (fractional shortening) 가 ,

대상 및 방법

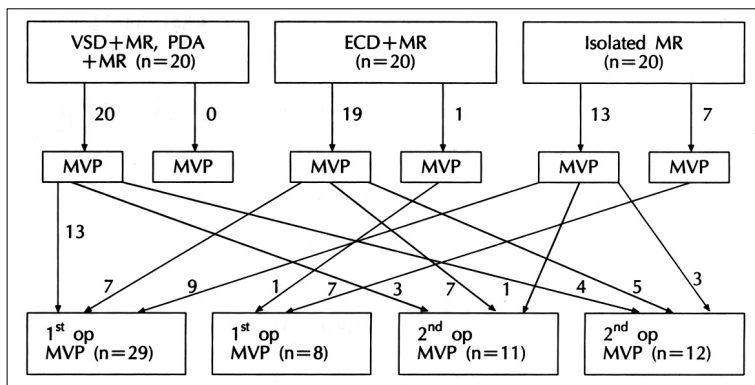
1992 3 1998 2

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**Table 1.** The profiles of the patients with mitral regurgitation

Parameter	Data
Sex (M : F)	27 : 33
Op. Age (yr)	5.9 ± 5.2 (3 mo - 15 yr)
Weight (kg)	18.9 ± 11.4 (4.5 - 45)
F/U duration after op. (mo)	11.9 ± 10.8 (1 - 72)

Number in the parenthesis means ranges of the parameter



**Fig. 1.** Population (n = 60) of the patients with mitral regurgitation.

가 M - mode ± 11.3 mm(38.0 ± 14.6 mm/m<sup>2</sup> BSA) 29.0 ± 11.8 mm(37.7 ± 15.2 mm/m<sup>2</sup> BSA) , , 32.2 ± 15.8 ml(62.1 ± 52.4 ml/m<sup>2</sup> BSA) 32.5 ± 16.2 ml(52.7 ± 34.4 ml/m<sup>2</sup> BSA) ± , 1 m<sup>2</sup> 46.1 ± 12.5 mm(59.9 ± 16.2 mm/m<sup>2</sup> BSA) Student 38.4 ± 10.6 mm(49.9 ± 13.8 mm/m<sup>2</sup> BSA) t - (paired or unpaired) ANOVA , (p<0.01)(Table 2). p 0.05 3 23 결과 64.3 ± 9.3% 54.9 ± 17.8%

**Table 2.** The echocardiographic measurements before and after mitral valve operation (n = 60) (mean ± SD)

	Pre-op	Post-op	p-value
LVEF (%)	68.2 ± 9.1	60.0 ± 14.2	p < 0.001
FS (%)	37.6 ± 7.8	33.4 ± 9.9	p < 0.05
LVEDD (mm)	44.7 ± 15.0	42.7 ± 11.1	NS
(mm/m <sup>2</sup> BSA)	58.0 ± 19.4	55.4 ± 14.4	
LVESD (mm)	29.3 ± 11.3	29.0 ± 11.8	NS
(mm/m <sup>2</sup> BSA)	38.0 ± 14.6	37.7 ± 15.2	
LVEDV (ml)	86.1 ± 28.5	83.5 ± 18.8	NS
(ml/m <sup>2</sup> BSA)	146.1 ± 79.9	138.8 ± 67.6	
LVESV (ml)	32.2 ± 15.8	32.5 ± 16.2	NS
(ml/m <sup>2</sup> BSA)	62.1 ± 52.4	52.7 ± 34.4	
LAD (mm)	46.1 ± 12.5	38.4 ± 10.6	p < 0.01

NS : not significant

**Table 3.** Comparison of pre- and post-operative parameters between initial operation group and re-operation group (mean ± SD)

		Initial op (n = 37)	Re-op (n = 23)	p-value <sup>†</sup>
LVEF (%)	Pre-op	71.2 ± 7.8	64.3 ± 9.3	p < 0.01
	Post-op	63.5 ± 9.9*	54.9 ± 17.8*	p < 0.05
FS (%)	Pre-op	39.9 ± 8.9	35.4 ± 6.0	p < 0.05
	Post-op	36.2 ± 8.2*	29.7 ± 10.8*	p < 0.05
LVEDD (mm)	Pre-op	42.3 ± 14.4	48.4 ± 15.2	NS
	Post-op	39.0 ± 9.7	47.8 ± 12.2	NS
(mm/m <sup>2</sup> BSA)	Pre-op	57.1 ± 19.5	71.2 ± 22.7	
	Post-op	52.6 ± 13.0	70.8 ± 25.2	
LVESD (mm)	Pre-op	26.8 ± 10.2	32.1 ± 12.2	NS
	Post-op	36.2 ± 13.6	40.6 ± 12.6	NS
(mm/m <sup>2</sup> BSA)	Pre-op	25.8 ± 8.8	34.1 ± 13.4*	NS
	Post-op	34.9 ± 11.9	49.0 ± 18.3	
LVEDV (ml)	Pre-op	86.1 ± 43.6	124.9 ± 51.2	NS
	Post-op	116.3 ± 58.9	160.5 ± 58.4	NS
(ml/m <sup>2</sup> BSA)	Pre-op	112.8 ± 25.4	159.0 ± 57.8	
	Post-op	83.5 ± 18.8	124.3 ± 46.0	p < 0.05
LVESV (ml)	Pre-op	32.5 ± 16.7	42.8 ± 30.6	NS
	Post-op	43.9 ± 22.6	66.0 ± 41.2	NS
(ml/m <sup>2</sup> BSA)	Pre-op	32.2 ± 15.2	62.1 ± 59.3	NS
	Post-op	43.5 ± 20.5	72.9 ± 38.6	

\*p < 0.05 vs pre-op values †p values when compared initial operation vs re-operation group NS : not significant

( $p < 0.05$ ).

35.4 ± 6.0%      29.7 ± 10.8%

( $p < 0.05$ ).

48.4 ± 15.2 mm (71.2 ± 22.7 mm/m<sup>2</sup>)

BSA)      47.8 ± 12.2 mm (70.8 ± 25.2 mm/m<sup>2</sup>)

BSA),      124.9 ± 51.2

ml (160.5 ± 58.4 ml/m<sup>2</sup> BSA)      124.3 ±

46.0 ml (159.0 ± 57.8 ml/m<sup>2</sup> BSA) ,

42.8 ± 30.6 ml (66.0 ± 41.2 ml/m<sup>2</sup>)

BSA)      62.1 ± 59.3 ml (72.9 ± 38.6 ml/m<sup>2</sup>)

BSA)

32.1 ± 12.2 mm (40.6 ± 12.6 mm/m<sup>2</sup>)

BSA)      34.1 ± 13.4 mm (49.0 ± 18.3 mm/m<sup>2</sup>)

BSA)      가 ( $p < 0.05$ )

(Table 3).

1

64.3 ± 9.3%      1      71.2

± 7.8%      ( $p < 0.01$ ),

54.9 ± 17.8%      1      63.5

± 9.9%      ( $p < 0.05$ ).

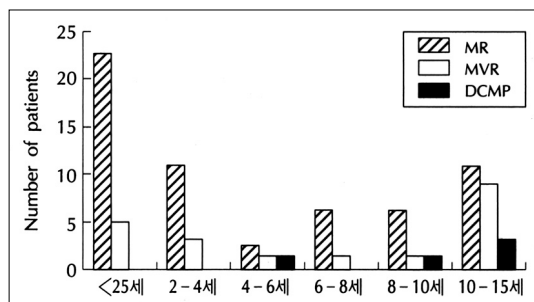
35.4 ± 6.0%

1      39.9 ± 8.9%

( $p < 0.05$ ),      29.7 ±

10.8%      1      36.2 ± 8.2%

( $p < 0.05$ ).



**Fig. 2.** Age variation of the patients with mitral regurgitation.

**Table 4.** The characteristics of the patients with dilated cardiomyopathy

Name	Age	Disease entity	Type of operation	Op. age : 1st	2nd
Soh YM	15	ECD, MR	MVP MVR	4 yr	14 yr
Kang GH	10	VSD, MR	MVP MVR	3 yr	9 yr
Kim EK	14	MR	MVR	13 yr	
Lee SW	8.5	ECD, TOF, MR	MVP MVR	28 mo	8 yr
Seo H	3.4	ECD, MR	MVP MVR	11 mo	3 yr

Mean age of operation : 9.2 ± 4.7 (yr)

Mean interval of primary operation and re-operation : 4.9 ± 3.6 (yr)

124.3 ± 46.0 ml      1      83.5

± 18.8 ml      가      ( $p < 0.05$ ).

,      ,

1

가

가      (Table 3).

12

8      20

70.1 ± 7.4%

65.1 ± 5.8%      ( $p < 0.001$ ),

39.4 ± 7.4%      36.3 ± 7.8%

( $p < 0.05$ )      ,

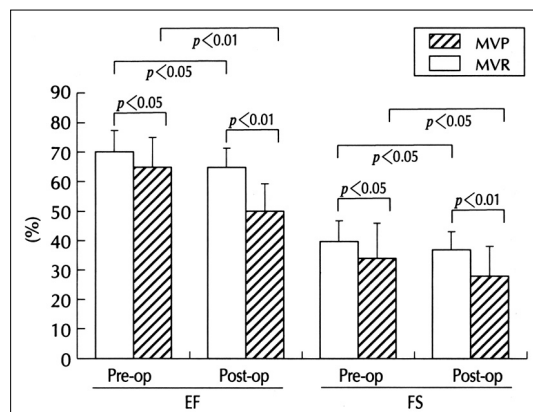
64.5 ± 11.1%

50.2 ± 19.8%      ( $p < 0.005$ ),

34.8 ± 7.6%      27.3 ± 11.1%

( $p < 0.05$ )      .

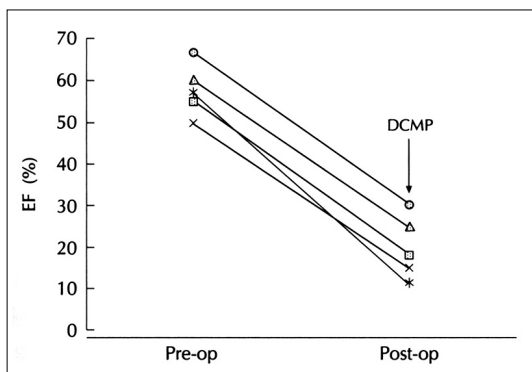
( $p < 0.05$ ) (Fig. 3).



**Fig. 3.** Comparison of pre-operative and post-operative left ventricular ejection fraction and fractional shortening between MVP group and MVR group.

30% (Table 4).  
 가 5 (8.3%) (Fig. 4).  
 5  
 25% 3 4  
 15 9.2 ± 4.7  
 60 (5.9 ± 5.2)  
 가 (p < 0.05).  
 가 3 ,  
 가 1 ,  
 1 ,  
 4.9 ± 3.6

2 가 ,  
 10 15 가 ,  
 4 6  
 (Fig. 2).  
 5  
 (55.5 ± 4.2% vs 17.5 ± 5.6%)  
 (23.5 ± 9.7% vs 9.5 ± 5.3%)  
 (p < 0.001).  
 가 45.5 ± 12.1 mm (47.3 ± 12.4  
 mm/m<sup>2</sup> BSA) 59.8 ± 5.4 mm (64.2 ± 21.2 mm/m<sup>2</sup>  
 BSA) (p < 0.05) (Table 5).



**Fig. 4.** Postoperative change of left ventricular ejection fraction in patients who had progressed to DCMP.

(p < 0.001).  
 146.0 ± 60.8 ml (122.9 ± 28.8 ml/m<sup>2</sup> BSA),  
 160.5 ± 45.3 ml (147.1 ± 80.5 ml/m<sup>2</sup> BSA),  
 192.7 ± 43.0 ml (185.6  
 ± 80.9 ml/m<sup>2</sup> BSA), 199.3 ± 73.9 ml (187.5  
 ± 17.0 ml/m<sup>2</sup> BSA)  
 가 , 100  
 ml/m<sup>2</sup> BSA

**Table 5.** Comparison of preoperative and postoperative data between patients without DCMP group and with DCMP group

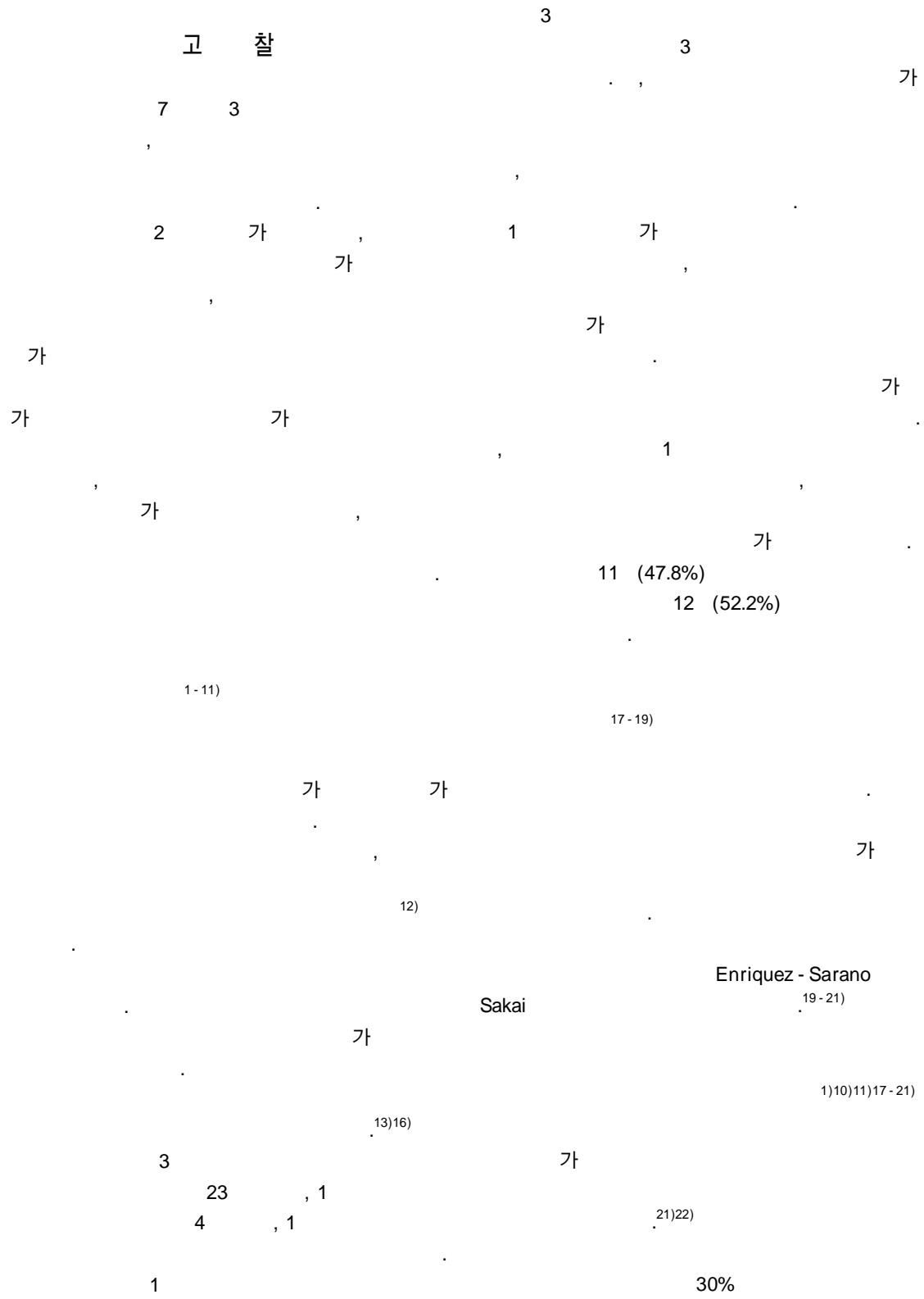
Parameters		DCMP (-) (n = 55)	DCMP (+) (n = 5)	p-value*
LVEF (%)	Pre-op	68.2 ± 9.1	55.5 ± 4.2	p < 0.001
	Post-op	60.0 ± 14.2	17.5 ± 5.5	p < 0.001
FS (%)	Pre-op	37.6 ± 7.8	23.5 ± 9.7	p < 0.001
	Post-op	33.4 ± 9.9	9.5 ± 5.2	p < 0.001
LVEDD (mm)	Pre-op	44.7 ± 8.0	59.2 ± 4.1	NS
	Post-op	42.7 ± 11.1	65.2 ± 6.2	NS
LVESD (mm)	Pre-op	28.9 ± 11.0	41.5 ± 3.5	NS
	Post-op	29.3 ± 11.4	59.7 ± 5.3	NS
LVEDV (ml)	Pre-op	86.1 ± 28.5	192.7 ± 43.0	p < 0.05
	Post-op	83.5 ± 18.8	199.3 ± 73.9	p < 0.05
LVESV (ml)	Pre-op	32.2 ± 15.8	146.0 ± 60.8	NS
	Post-op	32.5 ± 16.2	160.5 ± 45.3	NS

\*when compared with DCMP (-) and DCMP (+) group

†p < 0.01 when compared with pre-op and post-op period

‡p < 0.001 when compared with pre-op and post-op period

NS : not significant



5 가 , 가

가 가 , 가

가 가 ,<sup>13-15)</sup> 가

3 가 ,<sup>13)16)</sup> 11

가 가

가 . Krishnan<sup>27)</sup> 4 5

23)24)

가 가

가 가

가 가

122.9±28.8 ml/m<sup>2</sup> BSA, 요 약

147.1±80.5 ml/m<sup>2</sup> BSA, 배 경 :

185.6±80.9 ml/m<sup>2</sup> BSA, 187.5±<sup>25)</sup> 가

17.0 ml/m<sup>2</sup> BSA Nakano 100 ml/m<sup>2</sup>

BSA 가 가 가 가

방법 및 결과 :

1992 3 1998 3 60

13-15)

가

13)

Lee<sup>22)</sup> ( $p<0.05$ ). 1

( $p<0.05$ ).

( $p<0.05$ ),

가<sup>21)22)26)</sup> 가 ( $p<0.05$ ).

결 론 :

가

가  
가  
중심 단어 :

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