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Percutaneous Mitral Balloon Valvuloplasty in Patients with Restenosis after Surgical Commissurotomy: A Comparative Study

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We performed percutaneous mitral balloon valvuloplasty (PMV) in 367 patients to compare the effectiveness of PMV between patients with mitral restenosis after surgical commissurotomy (group 1) and patients with unoperated mitral stenosis (group 2). Twenty-two had undergone closed or open mitral commissurotomy 11.2 years before. There were no significant differences in clinical profiles between the two groups. The mitral valve area was increased from 1.0 ± 0.8 to $1.8\pm0.6\,cm^2$ in group 1 and 0.9 ± 0.3 to $2.0\pm0.7\,cm^2$ in group 2 ($p>0.05$). The mitral gradient was decreased from 14 ± 5.9 to 6 ± 2.6 mmHg in group 1 and 18 ± 7.0 to 7 ± 5.3 mmHg in group 2 ($p>0.05$). The increment of mitral regurgitation and significant left to right shunt after PMV were not significantly different (10% versus 14.7%, 5% versus 10.4% respectively). Optimal results were attained in 75% of the patients in group 1 and in 84.3% of the patients in group 2 ($p>0.05$). These results suggest PMV in mitral restenosis after surgical commissurotomy may be safe in selected patients and may be equally effective as in unoperated mitral stenosis.

Key Words: Percutaneous mitral balloon valvuloplasty, surgical commissurotomy, restenosis

Recurrence of mitral stenosis after surgical commissurotomy was first reported by Brock (1952). The most common practice has been to treat recurrent stenosis after initial conservative measures with valve replacement. In selected patients with mitral stenosis without heavy calcification or severe mitral regurgitation, surgical commissurotomy has been performed to delay valve replacement (John *et al.* 1978; Pepper *et al.* 1987). Repeat surgical commissurotomy has been associated with a greater mortality and morbidity than are associated with the initial operation (Rutledge *et al.* 1982; John *et al.* 1983). Percutaneous mitral ballon valvuloplasty (PMV) has proved to be an alternative to surgery in selected patients with mitral stenosis (Inoue *et al.* 1984; Al Zaibag *et al.* 1986; Palacios *et al.* 1987; Herrmann *et al.* 1988; Shim *et al.* 1991; Shim *et al.* 1992). This study assesses the efficacy of PMV in patients with mitral restenosis after surgical commissurotomy compared with patients who did not undergo prior surgical commissurotomy.

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MATERIALS AND METHODS

Patient population

Three hundred sixty seven patients underwent PMV at Yonsei University Severance hospital for symptomatic mitral stenosis from April 1988 to March 1991. We classified our patients into two groups.Group 1: Twenty two patients presented with recurrent mitral stenosis 11.2 years after closed (four patients) or open (sixteen patients) mitral commissurotomy.

One patient underwent two previous closed mitral commissurotomy. Closed mitral commissurotomy followed by open mitral commissurotomy was performed in one patient. Group 2: The remaining three hundred forty five patients who had not undergone previous mitral valve surgery. Both groups were chosen as candidate for PMV using the same criteria (no visible atrial thrombus, less than grade 2 of mitral regurgitation and provision of informed consent). All patients underwent echocardiographic study before and after PMV and were evaluated about the echoscore, mitral valve area by 2-D and pressure half time, left atrial size and mitral regurgitation using Hewlett Packard ultrasound imaging system (model 77020 A with 2.5 MHz transducer). There was no evidence of left atrial thrombus on two dimensional echocardiography before the procedure.

The clinical profiles include the age, sex, cardiac rhythm,mitral valve area before and after PMV and total echoscore.

PMV procedure

Right heart catheterization was performed percutaneously from the right internal jugular vein with a balloon-tipped catheter. A 7 Fr pigtail catheter was placed at the non-coronary cusp of the aortic valve through the left femoral artery percutaneously to monitor systemic blood pressure and to perform left ventriculography after the procedure. Transseptal left heart catheterization was performed from the right common femoral vein with 8 Fr Mullin transseptal sheath and dilator (USCI) and a Brockenbrough needle. Systemic anticoagulation was achieved by 100 units/kg body weght of heparin after the interatrial septal puncture. Activated clotting time (ACT) was maintained from 300 to 400 seconds during the procedure. A 7 Fr wedge balloon catheter (Critikon) was introduced into the left ventricle and aorta through the Mullin sheath placed in the left atrium and a long exchange guide wire was inserted into the descending aorta or left ventricle. The balloon catheter was advanced over the guide wire through the left atrium and positioned across the mitral valve. The balloon catheter was then inflated by hand until the indentation of the balloon due to the stenotic mitral valve disappeared. An Inoue balloon catheter was used in 9 (40.9%) patients of group 1 and 108 (31.3%) patients of group 2. Separate double balloons were used in 12 patients(54.5%) of group 1 and in 173 (50.1%) patients of group 2. A Twin balloon was used in one patient of group 1. Other balloons (single Cook balloon,monofoil or bifoil balloon) were used in 64 (18.6%) patients of group 2. Immediately after PMV, hemodynamic measurements and left ventriculography at a 30' right anterior oblique projection were performed.

STATISTICAL ANALYSIS

Data are expressed as mean±SD. Differences in group means were analyzed with the use of the unpaired t-test. The paired t-test was used for comparing the changes after valvuloplasty. Association between the categorical data (sex, incidence of sinus rhythm) were tested using the chi-square test. Significance was established at the level of $p<0.05$.

RESULTS

Clinical profiles of both groups of patients are presented in Table 1. The age, sex, incidence of sinus rhythm and echoscore were similar in both groups. Table 2 shows the

Table 1. Clinical profiles

	Group 1	Group 2
Age (years)	42.8±10.4	40.3±10.2
M/F	8/14	102/243
NSR/AF	18/ 4	178/167
Echoscore	6.6±3.3	6.7±3.2
EBDA/BSA	4.2±0.5	4.2±0.5

M: Male, F: Female, NSR: Normal sinus rhythm, AF: Atrial fibrillation, EBDA: Effective balloon dilating area, BSA: Body surface area

Table 2. Hemodynamic data

		Group 1	Group 2
PAP	pre	24.6±11.2	31.1±12.5
	post	202.2±5.2	21.2±9.2
LAP	pre	18.1±7.1	21.8±7.7
	post	11.6±4.6	10.0±4.3
CO	pre	4.5±0.9	4.2±0.9
	post	4.9±1.3	4.8±1.2
MVA	pre	1.0±0.1	0.9±0.3
	post	1.8±0.6	2.0±0.7

PAP(mmHg): Pulmonary artery pressure, LAP (mmHg): Left atrial pressure, CO(l/min): Cardiac output, MVA(cm^2): Mitral valve area. All data are not statistically significant

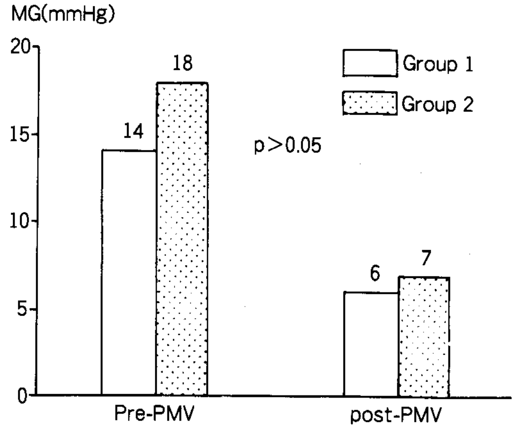

Fig. 2. *Mitral gradient before and after PMV.*
MG: mitral gradient
PMV: percutaneous mitral balloon valvuloplasty

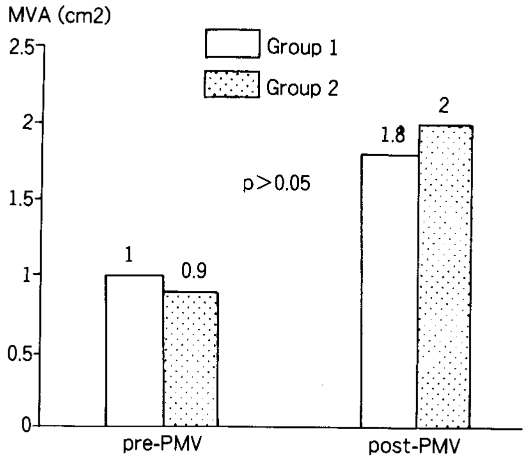

Fig. 1. *MVA of pre and post-PMV.*
MVA: Mitral valve area
PMV: Percutaneous mitral balloon valvuloplasty

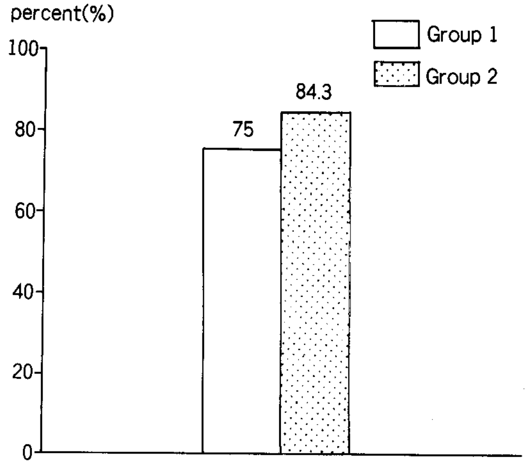

Fig. 3. *Optimal result after PMV.*
PMV: percutaneous mitral balloon valvuloplasty

changes induced by balloon valvuloplasty in either group. As seen in figure 1, the mitral valve area was increased from 1.0±0.1 to 1.8 ±0.6 cm^2 in group 1 and 0.9±0.3 to 2.0±0.7 cm^2 in group 2 without a significant difference between the groups. Mitral gradient was decreased from 14 mmHg to 6 mmHg in group 1 and 18 mmHg to 7 mmHg in group 2 without a statistically significant difference (Fig. 2).

An optimal result defined as final valve area more than 1.5 cm^2 with a gain of more than 25% of the initial mitral valve area was attained in 75% of the patients in group 1 and 84% in group 2 (Fig. 3). A similar percentage of patients of group 1 and 2 had an optimal result. The appearance or progression of mitral regurgitation to grade 2 or more occurred in 10% of the patients in group 1 and 14.7% of the patients in group 2 but the difference between the two groups was not significant (Fig. 4). Significant left to right shunt through the atrial septal puncture site defined Qp/Qs more than 1.5 was observed in

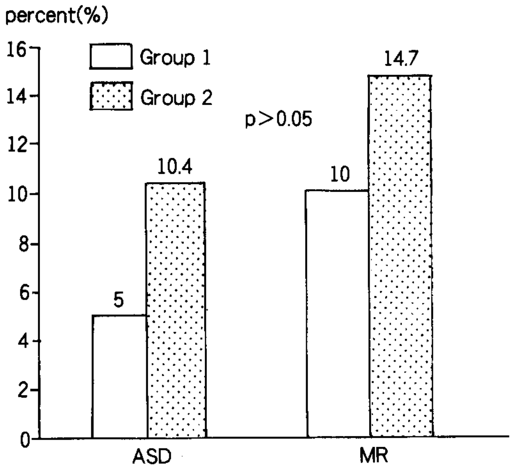

Fig. 4. *Complications after PMV.*
ASD: atrial septal defect
MR: mitral regurgitation

two patients (5%) of group 1 and fifty one patients (10.4%) of group 2 without a significant difference between the groups (Fig. 4).

DISCUSSION

About 30% of the patients who underwent surgical commissurotomy presented functional deterioration due to mitral restenosis within 5 years after operation (Belcher *et al.* 1960; John *et al.* 1983). Repeat surgical commissurotomy has been associated with greater mortality and morbidity than the initial operation (Harken *et al.* 1961; Logan *et al.* 1962; Keith *et al.* 1972). Since its introduction by Inoue *et al.* in 1984, numerous investigators have shown that percutaneous mitral balloon valvuloplasty leads to good results in patients with symptomatic mitral stenosis. Turi *et al.* (1991) demonstrated in their randomized, prospective trial comparing PMV with surgical commissurotomy in 40 patients that PMV and surgical commissurotomy resulted in comparable hemodynamic improvement that was sustained through 8 months of follow-up period.Rediker *et al.* (1988) demonstrated that PMV was a safe and effective procedure for patients with mitral restenosis after surgical commissurotomy. On the other hand, Vahanian *et al.* (1991) reported in their large series of patients that poor results could be predicted in those patients with previous surgical commissurotomy and Bernard *et al.* (1991) reported similar finding. In our study, we compared the efficacy and safety of PMV between mitral restenosis after previous surgical commissurotomy and unoperated mitral stenosis patients. All clinical and hemodynamic variables before and after PMV were not significantly different between two groups with similar success rate without serious complications. Although some selection bias would exist, it is somewhat interesting to notice that the echoscores of those patients with prior surgical commissurotomy was not so high compared with those of unoperated patients. Martuscelli *et al.* (1992) demonstrated in their small series of patients with mitral stenosis who underwent PMV followed by surgical commissurotomy that although open commissurotomy gave better results in patients with a non-optimal echoscore, it carried greater intraoperative risks and had not been shown to provide greater functional and prognostic improvement in patients with pure mitral stenosis. Although the operative mortality rate of surgical commissurotomy has progressively decreased owing to improvement in surgical technique and post-operative care, the incidence of operative mortality after repeat mitral valve surgery was found to be greater than that of the initial operation (Rutledge *et al.* 1981). John *et al.* (1983) reported a 6.7% operative mortality in a series of 130 patients who underwent a second closed mitral commissurotomy whereas mortality at the initial operation was 3.8%. A potential benefit of PMV in patients with prior surgical commissurotomy and recurrent stenosis is the avoidance of a second thoracotomy and its related morbidity(Serra *et al.* 1993). Repeat sternotomy is a predisposing factor for mediastinal infection. Rutledge *et al.* (1981) reported a 1.4% incidence of mediastinal infection in a large series of patients who underwent median sternotomy for cardiac surgery and the associated mortality was 52%. The risk of bleeding and the subsequent need for transfusion is greater in patients undergoing a second thoracotomy (Mary *et al.* 1974). Thus PMV for mitral restenosis after surgical commissurotomy appears to be an attractive alternative to surgery with a reduced complication rate and can delay valve replacement and avoid prosthesis-related complications. However, long-term results regarding mortality, morbidity and restenosis rate should be followed to define the role of this procedure.

CONCLUSION

Percutaneous mitral balloon valvuloplasty in mitral restenosis after surgical commissurotomy is safe and equally effective in selected patients with favorable morphology as in unoperated mitral stenosis.

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