Long Term Results of Mitral Commissurotomy

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This study aims to evaluate the different surgical procedures used in 358 patients undergoing mitral commissurotomy. 89 patients underwent closed mitral commissurotomy by finger fracture (CMCF) and 162 by transventricular dilator (CMCD). 107 patients underwent open mitral commissurotomy (OMC).

The following conclusions can be made:

- 1) Commissurotomy is one of the better palliative procedures for mitral stenosis (MS).
- 2) It is logical to continue the use of CMCD for selected patients with MS.
- 3) A careful follow-up study of patients with mitral commissurotomy is necessary, and reoperation should be carried out positively when indicated.
- 4) It has been confirmed in the survey that 7 patients out of 358 succumbed to sudden death. It is one of the goals of future work to determine the causes of sudden death and to develop an effective method of prevention.
- 5) It can be expected that a patient with MS who undergoes a flawless operation at the right time will survive and recover full strength.

THE surgical treatment of valvular heart diseases has markedly improved with recent advances in intraoperative myocardial protection, preoperative and postoperative management and the use of artificial valves. The passage of time has increased the survival rate of patients undergoing heart valve surgery using these improved methods.

The survival rate of surgically untreated mitral stenosis reported by Rapaport¹ was approximately 60% after 10 years. On the other hand, mitral commissurotomy has relieved serious symptoms experienced by patients with mitral stenosis. All current operations for this condition are palliative, and the best surgical result is less than ideal in mitral stenosis induced by

progressive rheumatic disease. Mitral valve commissurotomy is merely a method to "buy time" for patients until the occurrence of recurrent disability.² The more time bought, the more benefit is obtained. The objective of surgical treatment of mitral stenosis is "to have the greatest number of patients live the longest time in the best possible condition".³ There can be no argument with this objective, but there are three types of mitral commissurotomy performed to achieve it.

In this study we report the evaluation of the long-term results of different types of mitral commissurotomy performed up to this time, and we assess each procedure.

MATERIALS AND METHODS

From 1957 to 1984, 358 patients with mitral stenosis survived mitral commissurotomy performed in Nagoya University Medical School. Of 358 patients, 89 underwent CMCF, 162 CMCD and 107 OMC (Table I). The patient age

Key Words:

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TABLE I

Procedure	No. of patient	Late death	Reoperation	Mean follow-up (months)	Longest survival (years)
CMCF	89	28	23	166	(27)
CMCD	162	10	20	122	(21)
OMC	107	4	2	55	(18)
Total	358	42	45	—	—

TABLE II CAUSES OF LATE DEATH

	CHF*	Reoperation	Thromboembolism	Sudden death	Others	Total
CMCF	6	6	1	1	14	28
CMCD	1	1	0	5	3	10
OMC	0	0	1	1	2	4
Total	7	7	2	7	19	42

*CHF = congestive heart failure

Fig. 1. Average age of patients at operation.

at operation ranged from 12 to 68 years, with a mean (SD) of 27.3 (6.8) in the CMCF group, 33.9 (9.0) in the CMCD group and 42.3 (9.3) in the OMC group. The average age of all patients at operation increased by 0.7 years every year (Fig. 1). 45.9% of the patients were male. CMCF was performed until 1963, and from 1964 CMCD was used.

A detailed clinical profile was obtained on each patient to determine functional class, thromboembolic incidence, data of reoperation (if any) and cause of late death. In order to obtain the recent follow-up data in this group of postoperative patients, we employed a telephone survey involving detailed questionnaires sent to each patient. The survey was augmented by further follow-up procedures in a thoracic surgical clinic where patients were seen and

examined directly. Late follow-up was obtained in 312 (87.2%) of the 358 patients operated on, and the data were assessed according to each operation group.

Assessment of time-related events was reported in actuarial, absolute and linearized (% per patient-year) terms with standard-error of the mean. Survival and cumulative incidence curves were obtained by the usual life-table method⁴

RESULTS

CMCF: 89 patients survived CMCF from 1957 to 1963. Seventeen patients were lost to follow-up. The longest follow-up time was 27 years. A total of 28 patients (2.28% per patient-year) died during the follow-up period. The causes of late death were congestive heart failure (CHF) in 6 patients, reoperation in 6 patients, thromboembolism in 1 patient, sudden death in 1 patient, non-cardiac in 2 patients and unknown in 12 patients (Table II). The actuarial probability of survival was $79.6 \pm 4.7\%$ at the 10th post-operative year, $72.6 \pm 5.2\%$ at the 15th and $60.7 \pm 6.0\%$ at the 20th (Fig. 2). Postoperative functional class at the time of this survey was assessed. Eleven patients were in functional class (NYHA) III-IV (Table III). All of them lived for more than 15 years after operation. Causes of disability were recurrent mitral stenosis in 8, mitral regurgitation or air embolism on reoperation in 2 and incomplete valve opening on the first operation in 1. Thirty-three patients were in

Fig. 2. Actuarial survival curve of CMCF, CMCD, OMC and reoperation after mitral commissurotomy. CMCF = closed mitral commissurotomy with finger fracture method; CMCD = closed mitral commissurotomy with transventricular dilator method; OMC = open mitral commissurotomy

TABLE III FUNCTIONAL STATUS OF PATIENTS WITH CMCF, CMCD AND OMC AT DIFFERENT STAGES OF FOLLOW-UP PERIOD

Postop. years	Number of patient		Late death	Reoperation
	NYHA I~II	NYHA III~IV		
CMCF				
≤10	1	0	15	10
11~15	4	0	5	6
16~20	7	1	7	4
>20	21	10	1	3
CMCD				
≤10	58	4	8	5
11~15	34	1	0	5
16~20	19	4	2	10
>20	8	1	0	0
OMC				
≤10	84	1	4	2
11~15	11	1	0	0
>15	0	1	0	0

functional class I-II and 21 of these lived for more than 20 years after the first operation. The frequency of reoperation for recurrent mitral stenosis or mitral regurgitation is calculated in Fig. 3. Twenty-three patients required reoperation, an absolute incidence of 25.8% or an annual incidence of 1.9% per patient-year (Table II). The reoperation-free actuarial survival

rate revealed $68.5 \pm 5.2\%$ at the 10th post-operative year, $54.4 \pm 5.8\%$ at the 15th year and $42.2 \pm 6.1\%$ at the 20th year (Fig. 3).

CMCD: 162 patients survived CMCD from 1963 to 1982. The success of follow-up at this survey was 85%. Twenty-four patients were lost to follow-up. There were 10 late deaths, the causes being CHF in 1 patient, reoperation in 1 patient, sudden death in 5 patients and unknown in 3 patients (Table II). The actuarial probability of survival was $92.9 \pm 2.5\%$ at the 10th post-operative year and $90.1 \pm 3.9\%$ at the 20th year (Fig. 2). Postoperative functional class at the time of this survey was III-IV in 10 patients (Table III). The causes of this physical disability were restenosis of the mitral valve in 8 patients, incomplete valvotomy in 1 patient and mitral regurgitation in 1 patient. Two of 5 patients whose follow-up period was less than 15 years had substantial disability after operation due to incomplete valvotomy and mitral regurgitation, respectively. Twenty-seven patients in functional class I-II were followed up for more than 15 years after operation (Table III).

Twenty patients required reoperation of mitral valve, an absolute incidence of 12.3% or an annual incidence of 1.2% per patient-year (Table I). The reoperation-free actuarial survival rate revealed $90.2 \pm 2.9\%$ at the 10th post-operative year, $82.7 \pm 4.2\%$ at the 15th year and $50.6 \pm 9.6\%$ at the 20th year (Fig. 3).

OMC: 107 patients survived OMC from 1966 to 1984. The success of follow-up was 95%. Five patients were lost to follow-up. Late death

TABLE IV REOPERATION AFTER MITRAL COMMISSUROTOMY FOR MITRAL STENOSIS. BOTH THE FIRST AND THE SECOND OPERATION WERE PERFORMED IN THIS INSTITUTION

First operation		Second operation				Interval between 1st ope and 2nd ope (years)	
Procedure	Age at operation (years)	Procedure	Number of patient				Age at operation (years)
			Cases	Hospital death	Late death		
CMCF	27.2 ± 7.4 (mean ± SD)	CMCD	4	0	0	37.6 ± 7.8 (mean ± SD)	3~24 mean ± SD = 10 ± 5.7
		OMC	4	0	0		
		OMC.TAP	2	0	1		
		MVR	2	1	0		
		MVR.TAP	1	1	0		
		AVR.MVR	1	1	0		
CMCD	29.9 ± 1.7	OMC	11	0	0	43.4 ± 6.5	5~19 (13.2 ± 4.6)
		OMC.TAP	2	0	0		
		MVR	1	0	0		
		MVR.CA—B	1	0	0		
		MVR.CA—B-TAP	1	0	1		
OMC	39.5 ± 10.6	MVR	1	0	0	45.0 ± 4.2	1~10 (5.5 ± 6.3)
		MVR.TAP	1	0	0		
Total	29.5 ± 1.3	—	32	3	2	41.2 ± 7.6	1~24 (11.4 ± 5.2)

TAP = tricuspid annuloplasty; CA-B = coronary artery bypass

Fig.3. Actuarial survival curve free from reoperation of CMCF, CMCD and OMC.

occurred in 4 patients, the causes being thromboembolism in 1 patient, sudden death in 1 patient and non-cardiac in 2 patients (Table II). The actuarial probability of survival was $90.6 \pm 6.3\%$ at the 10th postoperative year (Fig. 2). Postoperative functional class was III-IV in 3 patients (Table III). In 1 of these 3 patients, the cause of disability was mitral

TABLE V INCIDENCE OF POSTOPERATIVE THROMBOEMBOLISM

Procedures	No. of patient
CMCF	5 (0.41% per pat. year)
CMCD	8 (0.49% per pat. year)
OMC	3 (0.60% per pat. year)

regurgitation after reoperation and this patient's follow-up period was less than 10 years. Disability of another 2 patients was due to restenosis of the mitral valve. Ninety-five of 107 patients (89%) with OMC belong to functional class I–II at the time of this survey. Two patients required reoperation. The reoperation-free actuarial survival rate revealed $83.5 \pm 8.3\%$ at the 10th postoperative year (Fig. 3). One patient underwent OMC due to restenosis of the mitral valve 13 years after CMCD, but this OMC resulted in the occurrence of significant mitral regurgitation, and mitral valve replacement was performed within one year after OMC. Another patient underwent the second OMC 10 years after the first OMC.

Reoperation: Thirty-two patients underwent both the first and the second operation within this institution. There were three hospital deaths, an absolute incidence of 9.4% (Table IV). Two patients entered functional class III–IV within five years because of mitral regurgitation and cerebral embolism on reoperation, respectively. The cause of disability of another 5 patients in functional class III–IV at the time of this survey was restenosis of the mitral valve which occurred more than 10 years after reoperation.

Thromboembolism: The occurrence of thromboembolism after the first operation is given in Table V. The incidence of thromboembolism was 0.41% per patient-year in CMCF, 0.49% per patient-year in CMCD and 0.60% per patient-year in OMC. There was no significant difference in the incidence of each procedure. Systemic embolism before operation occurred in 5 patients with CMCF, in 10 patients with CMCD and in 44 patients with OMC.

DISCUSSION

There is an increasing number of surgeons who support open mitral commissurotomy rather than closed mitral commissurotomy (CMC) as the surgical approach for mitral stenosis.^{5,6} Some surgeons have expressed the view that CMC should be abandoned. However, in many countries CMC is still important in the treatment of young patients with rheumatic mitral valve disease.^{7,8}

We tried to assess the three operative procedures of mitral commissurotomy — CMCF, CMCD and OMC — from the viewpoint of actuarial survival, reoperation-free actuarial

survival and postoperative functional class. The actuarial survival curve of CMCF decreased markedly in the 6th postoperative year, although the late survival of CMCF was better than the natural survival rate of patients with mitral stenosis reported by Rapaport.¹

The reoperation-free actuarial survival rates of CMCD and OMC at the 15th postoperative year were similar and were superior to those of CMCF, but the curve of CMCD goes down steeply at the 16th postoperative year. The reoperation-free actuarial survival rate at the 20th postoperative year revealed $42.2 \pm 6.1\%$ in the CMCF group and $50.6 \pm 9.6\%$ in CMCD group. No significant difference was noted between CMCF and CMCD.

Although it is apparent from these results that excellent palliation of patients with mitral stenosis may be attained for an extended period of time, awareness of average survival statistics alone is inadequate to assess the operative procedures. It is apparent that the age of the patients, the pathological features of the diseased valve and the pulmonary vascular disease on operation significantly influence both short- and long-term results after mitral valve commissurotomy. We may “buy a reasonable time of 15 years” by using CMCD but it is not known if we could gain more reoperation-free time by using OMC instead. CMC may be associated with complications of incomplete opening of the mitral valve and/or mitral regurgitation. This is a major problem of using the closed method. Moreover, the reduced risk of dislodging clots and calcium during their removal under direct vision adds a theoretical safety factor favoring the use of OMC. We need long term follow-up of substantial numbers of patients with various lesions of the mitral valve, treated by OMC. Furthermore, restenosis after surgical treatment occurred 10 years after CMCF and 13 years after CMCD on average. It would be very interesting to know if it is possible to buy more time by using OMC. But 28 patients with CMCF and 27 with CMCD were in functional class I–II more than 15 years after the first operation. However, considering the fact that 8 of these 28 patients with CMCF and 9 of the 27 patients with CMCD underwent reoperation because of recurrent mitral stenosis, a comparison in survival rates after the first operation and after reoperation was carried out. The actuarial survival rate revealed no significant difference between the patients with reoperation and those with CMCD or OMC. A careful follow-up study is necessary

of patients with mitral commissurotomy and reoperation should be carried out positively when indicated.

Mitral commissurotomy has been more extensively used in recent years in preference to mitral valve replacement. But reoperation for recurrent mitral stenosis, incomplete relief of mitral stenosis or mitral regurgitation after mitral commissurotomy increases with time and inconveniences the patients. According to our own limited experience with mitral valve commissurotomy, further improvement in artificial valves may significantly increase their application for the relief of mitral stenosis and render reconstruction surgery obsolete.

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