The Heart Surgery Forum #2004-1137
8 (1), 2005 [Epub January 2005]
doi:10.1532/HSF98.20041137 Online address: www.hsforum.com/vol8/issue1/2004-1137.html

Role of Closed Mitral Commissurotomy for Mitral Stenosis: Mid- and Long-term Surgical Outcome of 36 Patients

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ABSTRACT

Purpose: To evaluate long-term survival and valve-related complications as well as prognostic factors for mid- and long-term outcome after closed mitral commissurotomy, covering a follow-up period of 14 years.

Material and Methods: Between 1989 and 2003, 36 patients (28 women and 8 men, mean age 28.8 ± 6.1 years) underwent closed mitral commissurotomy at our institution. The majority of patients were in New York Heart Association (NYHA) functional class IIB, III, or IV. Indication for closed mitral commissurotomy was mitral stenosis. Closed mitral commissurotomy was undertaken with a Tubbs dilator in all cases. Median operating time was 2.5 hours ± 30 minutes.

Results: After closed mitral commissurotomy, the mitral valve areas of these patients were increased substantially, from 0.9 to 2.11 cm^2. No further operation after initial closed mitral commissurotomy was required in 86% of the patients (n = 31), and NYHA functional classification was improved in 94% (n = 34). Postoperative complications and operative mortality were not seen. Follow-up revealed restenosis in 8.5% (n = 3) of the patients, minimal mitral regurgitation in 22.2% (n = 8), and grade ≥3 mitral regurgitation in 5.5% (n = 2) patients. No early mortality occurred in closed mitral commissurotomy patients. Reoperation was essential for 5 patients following closed mitral commissurotomy; 2 procedures were open mitral commissurotomies and 3 were mitral valve replacements. No mortality occurred in these patients.

Conclusions: The mitral valve area was significantly increased and the mean mitral valve gradient was reduced in patients after closed mitral commissurotomy. Closed mitral commissurotomy is a safe alternative to open mitral commissurotomy and balloon mitral commissurotomy in selected patients.

INTRODUCTION

Rheumatic mitral stenosis is frequently encountered in our country. It affects a younger population and is a major cause of morbidity. Mitral commissurotomy is among the oldest cardiac interventions reported in the world medical literature. Mitral valvotomy is the definitive therapy for this disease and can be achieved by closed mitral commissurotomy (CMC), open mitral commissurotomy (OMC), and balloon mitral commissurotomy (BMC). Although the prevalence of rheumatic mitral valve disease is declining in most industrialized nations, the disease continues to be endemic in much of Asia, Latin America, Africa, and the Middle East [Agarwal 1981]. After the development of cardiopulmonary bypass (CPB), OMC performed under direct vision became feasible for mitral stenosis (MS). In 1984, Inoue and associates first described BMC for use in patients with symptomatic MS; since then, the use of BMC has increased [Inoue 1984]. Several studies showed that mitral commissurotomy resulted in better long-term survival rates and fewer valve-related complications compared to valve replacement [Laschinger 1982, Eguaras 1993].We report a retrospective study focused on indications, techniques, and results of CMC through assessment of 36 patients with rheumatic MS who underwent CMC surgery in our clinic between 1989 and 2003.

MATERIAL AND METHODS

Between 1989 and 2003, candidates for CMC surgery comprised 28 women and 8 men. Their ages ranged from 17 to 43 years (28.8 ± 6.1 years). All 36 patients were examined by both the cardiologist and the cardiac surgeon before they were enrolled in the study. The patients underwent full clinical evaluation, including routine laboratory tests (erythrocyte sedimentation rate, antistreptolysin-O titer, and C-reactive protein) and radiological and electrocardiographic examination. The majority of patients were in New York Heart Association (NHYA) functional class IIB, III, and IV. Preoperative clinical characteristics are shown in Table 1.

Patients with severe mitral incompetence, severe valve calcification, concomitant aortic valvular disease, or associated coronary artery bypass grafting were excluded from the study. Pregnancy was not an exclusion criterion. Patients considered for CMC where those with severe rheumatic MS (mitral valve area, 0.9 ± 0.5 cm^2) and normal sinus rhythm plus (1) absence of other cardiac valvular disease, (2) no history of thromboembolism, (3) absence of calcification of leaflets or annulus, (4) absence of left atrial thrombus on transthoracic echocardiography, (5) presence of appropriate subvalvular apparatus, and (6) absence of calcification or severe retraction

Received September 10, 2004; received in revised form October 2, 2004; accepted October 4, 2004.

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Table 1. Baseline Characteristics of Patients Undergoing Closed Mitral Commissurotomy*

Patients	n = 36
Sex, n	
Female	28
Male	8
Age	28.8 ± 6.1 years
Rhythm	
Normal sinus rhythm	All
Atrial fibrillation	—
Preoperative functional capacity, n	
NYHA I	—
NYHA II	19
NYHA III	16
NYHA IV	1
Mitral valve area, cm^2	0.9 ± 0.5
Mitral valve gradient, mmHg	16.9 ± 4.1
Mitral valve regurgitation, n	3 (grade 1)
Thromboembolic events	Absent
Left atrial thrombus	Absent
Aortic regurgitation, n	4 (grade 1)
Tricuspid regurgitation, n	7 (grade 1)
Aortic and mitral regurgitation, n	1 (grade 1)
Mitral and tricuspid regurgitation, n	2 (grade 1)
Wilkins score	≤8 (all of the patients)

*NYHA indicates New York Heart Association.

of the subvalvular structure with the probability of enough valvular opening after splitting.

We used the echocardiographic scoring system reported by Wilkins et al [1988] to evaluate the structural makeup of the mitral valve. The Wilkins score was determined by assigning a maximum of 4 points each for the severity of 4 mitral valve variables: leaflet mobility, leaflet thickening, subvalvular thickening, and calcification. In addition, preoperative cardiac catheterization was performed in 8 patients to evaluate the severity of mitral regurgitation. All our patients had noncalcific valves with a Wilkins score of less than 8 of a possible 16.

Operative Technique

Patients were given preoperative prophylactic antibiotics 1 hour before the procedure. Anesthesia was induced and endotracheal intubation was performed. The patient was placed in a supine position with the left hemithorax slightly elevated and the left hand positioned behind the head. The entire chest of the patient was prepared with povidone-iodine, from shoulder to umbilicus. The technique of CMC was performed as previously described [Ellis 1967]. A submammarian skin incision was started 18 to 22 cm over the fifth intercostal space, beginning at the midclavicular line and extending medially, preserving the integrity of the left internal mammary artery. The pectoralis muscle was incised with cautery. The pericardium was opened anterior to the phrenic nerve. An incision was made in the left atrial appendage, then the surgeon's right index finger was inserted into the left atrium. A purse-string suture was placed at the apex of the left ventricle, and the Tubbs dilator was subsequently passed through the apical ventriculotomy to the mitral valve orifice. The Tubbs dilator was then positioned across the mitral valve orifice by palpation and opened 1 to 4 times. Subsequently, the mitral valve orifice was assessed by the surgeon's right index finger, which had been placed into the left atrium. Commissurotomy was repeated, with careful assessment of mitral regurgitation (MR), until a satisfactory valve area was reached. The Tubbs dilator was withdrawn, and the purse-string suture was tightened with a simple accessory stitch to achieve adequate hemostasis. The pericardiotomy was closed, except for a 2-cm window left open in the lower portion to allow free drainage. The thoracotomy was closed, and a tube to the thorax was placed through the fifth intercostal space.

In the early postoperative period, heparin was used prophylactically to prevent thrombosis or emboli. The patients' operative records were reviewed retrospectively. Follow-up data were obtained from the medical record, and survival and follow-up information was acquired by questionnaires and telephone interviews with patients, relatives, and family practitioners. Clinical examination, echocardiography, and electrocardiogram were performed at our institute. Valve function, gradient, valve area, and myocardial functions were determined. The functional status was assigned according to the New York Heart Association (NYHA) scale. Mean follow-up time was 8.7 ± 4.6 years (median, 12.6 years; range, 4.2 months to 13.9 years).

Table 2. Echocardiography Evaluation Results before and after Closed Mitral Commissurotomy (CMC)

	Before CMC	After CMC
Mitral valve area, cm^2	0.9 ± 0.5	2.11 ± 0.4
Transvalvular gradient, mmHg	16.9 ± 4.1	5.6 ± 1.4
Mitral regurgitation (minimal), n	3 (8.3%)	8 (22%)
Mitral regurgitation ≥ grade 3, n	—	2 (5.5%)
Commissural separation, n	0	36
Cordal rupture, n	0	0
Valve mobility	Decreased	Increased (100%)

RESULTS

Commissurotomy was successfully performed in all patients. There was no early mortality either in the hospital or within the first 30 days after operation. Ventricular fibrillation did not occur. Adequate mitral valve area was achieved in all patients. No patient developed intraoperative or postoperative embolization. No surgical complications such as bleeding, ventricular or atrial rupture, and acute mitral insufficiency were encountered. Intraoperative blood loss varied from 100 to 400 mL (mean, 250 ± 70 mL). Postoperative blood loss ranged from 180 to 370 mL (mean, 220 ± 80 mL). The mean cost of undergoing the procedure was approximately US $1500 ± $400. This total cost included 2 to 3 days in the hospital, medication, sutures, and disposable items. After the CMC procedure, the parameters (mitral valve area, mean mitral gradient, mitral regurgitation, structure of the leaflet) were obtained. Transthoracic echocardiography (TTE) of the mitral valve area and pressure half-time methods were used. Postoperative TTE was performed in all patients. Mitral valve areas were determined and were found to be increased from 0.9 ± 0.5 to 2.11 ± 0.4 cm^2. Similarly, the mean mitral valve gradient was reduced from 16.9 ± 4.1 to 5.6 ± 1.4 after CMC. Commissural separation was observed in all patients who had sufficient echocardiographic images. In 86% of the patients (n = 31) no further operation after initial CMC was required, and NYHA functional classification was improved in 93% of patients (n = 33). In 8 patients (22%), minimal mitral regurgitation was detected (Table 2). Follow-up revealed restenosis in 3 patients (8.5%). Reoperation was required in 5 patients (13.8%), including OMC in 2 patients (5.5%) and mitral valve replacement (MVR) in 3 patients (8.3%). The mean intensive care unit surveillance time was 18 ± 4.1 hours. The mean hospitalization period was 5.2 ± 2.2 days. Twenty-eight (77%) of the patients were in NYHA functional class 1, 6 (17%) in class II, and only 2 (6%) in class III postoperatively. Operative and early postoperative mortality was 0% for CMC. In the late postoperative period, 1 patient died in the 80th month. Postoperatively, OMC was required for 2 patients in the mean 24th month and MVR for 3 patients in mean 54th month. There was no mortality after these operations.

DISCUSSION

Mitral commissurotomy is among the oldest cardiac interventions reported in the world medical literature. In 1923, Cutler and Levine reported the first CMC [Cutler 1923]. Harken and colleagues [Harken 1948] further developed the technique of closed commissurotomy in 1948, and Logan and Turner used a mechanical dilator for the surgical treatment of MS in 1959 [Logan 1959].

Three alternative methods, OMC, CMC, and BMC, have been employed for the surgical treatment of pure MS. Although OMC provides the best conditions for surgical treatment of pure MS, it has disadvantages such as the necessity for sternotomy and CPB. Because there is no significant difference between the results of these 3 methods, there is a tendency to choose the less invasive and lower cost method. The inception of digital commissurotomy [Bailey 1949] and the subsequent introduction of instrumental commissurotomy were considered major breakthroughs in the treatments of MS [Logan 1959, Dubost 1976]. Later, the development of CPB, cardioplegia, and anesthetic techniques enabled the safe performance of valvotomy under direct vision [Nichols 1962]. Since that time, there has been ongoing controversy about the continued use of closed techniques.

The present study showed excellent long-term results in closed commissurotomy. Most studies showed no difference in survival rates between the closed and open techniques [Molajo 1988, Hickey 1991, Scalia 1993]. Although in some cardiac centers the open method of mitral commissurotomy has become the favored technique for treatment of MS, Detter and colleagues [1999] did not show any significant differences in early and late survival in patients undergoing surgery performed using open versus closed technique. Nevertheless, the incidence of reoperation was significant lower after OMC. In our patients there were no atrial thrombi, the mitral apparatus was normal, and none had a history of arterial embolization. Despite identical long-term results, analysis of the study group shows that CMC was applied to a more favorable group of patients with characteristics including younger operative age, mild or moderate mitral valve disease, and lesser prevalence of preoperative arterial embolism [Farhat 1990]. However, the disadvantages of OMC should be kept in mind as well. For example, CPB itself carries risks, has a high cost, and can lead to postsurgical neurological or psychometric deficits [Ellis 1974]. Use of the CMC technique is less costly. Also, with OMC there is often residual or induced MR, which may later require MVR. We found that another complication of conventional CMC was atrial laceration [Spencer 1990] during the introduction of the index finger through a friable or small atrial appendage. In our series, however, no surgical complications such as bleeding or ventricular or atrial rupture were encountered.

Recent randomized trials comparing BMC with CMC have reported similar improvement in symptomatology and greater improvement in mitral valve area and exercise time in the BMC group [Patel 1991]. Recently, a long-term randomized trial reported significantly improved follow-up symptom class, restenosis rates, and freedom from subsequent procedures in patients undergoing BMC versus CMC [Shrivastava 1992]. Recent long-term studies following BMC have demonstrated 4- to 5-year survival rates of 76% to 98%, whereas survival rates ranged from 90% to 96% after CMC and 90% to 97% after OMC. Event-free survival rates ranged from 58% to 82% after BMC, 72% to 95% after CMC, and 80% to 95% after OMC [Farhat 1990, Iung 1996, Tokmakoglu 2001]. Compared to CMC, BMC is less invasive but currently is more expensive. With the reduction of cost, BMC may be become the procedure of choice for the treatment of rheumatic MS in future.

Early results of CMC in our patients were optimal in terms of a substantial increase in mitral valve area, an optimal reduction in mitral valve gradient, and the absence of postoperative MR. Farhat and colleagues [1990] were able to show that after open commissurotomy hemodynamics improved to a greater extent than with closed commissurotomy and that open valvotomy is more effective in relieving the obstruction even when performed on selected patients with no preoperative MR.

Subsequent studies have confirmed that the structure of the mitral apparatus is the major determinate of both the short- and the long-term results of CMC. This procedure is only indicated in patients presenting with no or mild mitral insufficiency and a flexible mitral valve free of calcification [Eguaras 1993]. Eguaras and associates [1993] also demonstrated better results for early commissurotomy in young patients with sinus rhythm who are free of symptoms. In our cases, patients had the same situation. Such early surgical intervention could possibly prevent serious secondary changes such as left atrial hypertrophy, atrial fibrillation, pulmonary hypertension, tricuspid insufficiency, and the risk of thromboembolism [Laschinger 1982]. Thus, early operation and the proper selection of patients should be the major goal when performing commissurotomies [Detter 1999].

In our study, 34 patients (94%) were in NYHA class I or II, and the patients had a good quality of life. At the time of this report, the patients were still in sinus rhythm. Also, in the majority of patients not requiring reoperation, echocardiographic evaluations showed good results. Most patients had good left ventricular function with normal myocardial diameters, results that highlight the excellent hemodynamic function of the native valve.

We estimate that the cost of the CMC technique is less than that of OMC and BMC, and more blood transfusion and longer hospital stays are required with OMC. OMC is major surgery requiring CPB, blood transfusions, and postoperative intensive care. But, the open technique allows the surgeon to remove atrial thrombi, repair the subvalvular apparatus, carry out debridement of calcium deposits, and perform an annuloplasty. In well-selected patients with pure MS and no leaflet calcification, open commissurotomy still remains a valid surgical option. It should be appreciated that CMC is a simple procedure with an acceptable operative mortality [Ellis 1974, Rihal 1992].

The cost of heart operations and the problems related to anticoagulation after prosthetic valve replacement are among the limitations faced in nonindustrialized countries by patients with MS caused by chronic rheumatic heart disease. This study shows CMC can be successfully performed with good short- and medium-term results in a hospital in a nonindustrialized country; surgeons in nondeveloped countries must go on studying this surgical technique. The optimal and least costly way to achieve treatment objectives in patients with MS caused by chronic rheumatic heart disease is by CMC. CMC is thus an economical, simple, and safe palliative procedure that carries good long-term results. CMC currently represents a valid alternative to MVR in selected patients. Even when a heart-lung machine is available, a condition that is almost always an indication for CMC is pregnancy, because of the risk to the fetus from heparinization [Laschinger 1982, Cohen 1992]. In our cases, there were 6 pregnant patients.

In conclusion, it is difficult to compare the long-term results of the open and closed methods of mitral valvotomy without controlled randomized trials, because of the differences in patient selection and because of the different eras of cardiac surgery that the literature represents. CMC is a palliative procedure to relieve mitral stenotic lesions in patients who meet the ideal criteria for the technique. For young patients with sinus rhythm, noncalcific normal mitral apparatus, absence of left atrial thrombus, no history of embolus, absence of additional valve lesions, and low socioeconomic level, CMC appears to be an effective and simple method of palliative treatment for MS. The good results, lower cost, and elimination of the drawbacks of CPB indicate that CMC should be the treatment of choice of tight pliable rheumatic MS. CMC has a place as a low-cost treatment of MS when a heart lung machine is not available. The technique should be particularly useful in developing countries, where rheumatic fever is endemic and resources are limited. We consider CMC to be a safe alternative to OMC and BMC, provided that patient selection criteria are strictly followed.

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