EARLY AND LONG-TERM RESULTS OF CLOSED MITRAL COMMISSUROTOMY FOR MITRAL STENOSIS

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Between 1956 and June 1991, 5434 patients with mitral stenosis were treated with a closed mitral valvotomy. A total of 39.7% were in functional class IV. The overall hospital mortality was 3.04%, and during the last ten years, only 1.45%. Ninety-eight percent of the patients had a satisfactory surgical result. In 2% the valvotomy was inadequate. An actuarial analysis by the method of Cutler and Ederer showed a 94.0%, 89.4%, 85.0%, and 78.3% survival at 6, 12, 18, and 24 years, respectively, without having to undergo a second procedure. The incidence of restenosis varied from 4.2% to 11.4% per 1000 patients/year between the fifth and fifteenth year of follow-up. Closed transventricular revalvotomy was carried out in 206 patients. Based on this experience, we prefer the technique of closed mitral valvotomy as the palliative procedure of choice in rheumatic mitral stenosis.

THE MERITS AND DEMERITS of open and closed valvotomy for mitral stenosis have been discussed for many years. More recent reports tend to condemn the closed mitral valvotomy as a procedure of the past. Based on our experience with more than 5000 patients who underwent closed mitral commissurotomy at the Christian Medical College Hospital, Vellore, we renew our claim that this should be the procedure of choice in the treatment of mitral stenosis.

Materials and Methods

Between 1956 and 1991, 5434 subjects with mitral stenosis underwent closed mitral commissurotomy. Their ages ranged from 6 to 69 years with a mean (± SO) of 27.7 (± 9.2) years; 25% were less than 20 years old and 40% were in their third decade. Male patients constituted 52.4% of the patient population.

Presenting Symptoms and Signs

Sixty-five percent had symptoms for less than 3 years and only 4% had complaints beyond 10 years. A history of rheumatic fever was obtained in 47.2% of patients, 14.1% of whom had more than two episodes. Major preoperative clinical features are as follows: 41.5% belonged to functional class IV, 57.5% to class III, and the remaining 1% to class II. A total of 12.5% were in atrial fibrillation and the remainder in sinus rhythm. The preoperative embolic episodes in those with sinus rhythm was 3.1% and it was 11.3% in subjects with atrial fibrillation. A poor nutritional status was a striking feature in many. Over 40% of our patients who were under 20 years were in the second- and third-degree state of malnutrition (less than 70% based on weight for age by American standards). Auscultatory findings of a sharp opening snap was evident in 93.5% and a loud first heart sound in 96.5%. Fluoroscopic examination revealed mild-to-moderate calcification in 15.3%. The other associated valvular lesions encountered were mild mitral regurgitation in 12.8%, mild aortic regurgitation in 15.5%, and tricuspid regurgitation (which was functional in almost every instance) in 40.5%. Functional tricuspid regurgitation was considered to be present when the typical clinical
features of tricuspid valve incompetence were present along with right ventricular failure and pulmonary arterial hypertension. These signs became less marked, with total disappearance of some, after mitral valvotomy. Patients were not considered for mitral valvotomy if significant mitral regurgitation and heavy calcification were observed before surgery.

Electrocardiographic evidence of left ventricular hypertrophy in mitral stenosis was seen in 8.5% of patients, presumably the result of associated aortic valve disease or thin chest wall which were common. The criteria for left ventricular hypertrophy was an R wave in V5 or V6 and an S wave in V1 more than 35 mm in height (for adults) or over 45 mm in height (for children).

Cardiothoracic ratio ranged from 50% to 80%, with a mean (± SD) of 56.2 ± 5.6%. Pulmonary venous hypertension as defined by Braunwald was evident in 75% of patients. Although cardiac catheterization and angiographic examination on a routine basis are not feasible, these procedures were performed in 306 subjects (including many young subjects) to quantitate the degree of pulmonary hypertension and in other patients to document the degree of associated valvular lesion when it was deemed mandatory because of tight mitral stenosis.

Surgical Considerations

A left anterolateral thoracotomy through the fifth intercostal space has been the method of choice for those in sinus rhythm. A posterolateral incision was routinely used in all subjects with atrial fibrillation; this allowed access through the body of the atrium when the appendage was shriveled and fibrosed. This approach was always used in patients with restenosis of the mitral valve when a closed revalvotomy was carried out.

Instrumental dilatation of the mitral valve was achieved in almost all instances with the Tubbs transventricular dilator. Early in our experience, finger fracture of the mitral valve was carried out in 219 subjects. It was extraordinary that 83.7% of subjects had valve orifice of 0.5 cm or less, the measurement being judged digitally.

Follow-Up

All patients at the time of discharge were prescribed long-term chemoprophylaxis and were advised to report at the end of one year to the outpatient department. Once every 3 weeks, chemoprophylaxis was achieved by the use of intramuscular injections of 1.2 million U benzathine benzylpenicillin in those weighing more than 27 kg and 600,000 U in those weighing less than 27 kg. In less than 2% of the patients, daily sulfadiazine was used for chemoprophylaxis since penicillin could not be given due to problems of sensitization. Over 90% of the patients adhered to this regimen. Routine checkup included physical, x-ray, electrocardiographic, and echocardiographic examinations. Following this, patients were asked to come for periodic review at the end of two years and subsequently at five-year intervals. However, if symptoms recurred, they were asked to report to us immediately.

The follow-up period ranged from 1 to 32 years and the success of follow-up at various time intervals is depicted in Table 1. In view of the fact that the patients treated hailed from remote corners of the country and even from abroad, it was not possible to have a 100% response. The help of social workers was sought in locating the few nonresponders. The assistance of referral physicians was also sought in getting the printed questionnaire filled and returned. However, it is remarkable that, as shown in Table 1, we were able to achieve over 70% follow-up at the end of 20 years. A comparison between non-responders at each follow-up period with those who responded revealed that the various clinical and other features were not significantly different.

Means, standard deviations, proportions, and their standard errors were computed when necessary. The incidence of various events and mortality were expressed per 1000 patients/year. Actuarial survival rates were computed by the method of CUjer and Ederer. 7

Table I. Number and percent of patients available for followup at various time intervals.

<table>
<thead>
<tr>
<th>Follow-up (y)</th>
<th>Patients at risk</th>
<th>Patients followed-up (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5269</td>
<td>5243 (99.5)</td>
</tr>
<tr>
<td>5</td>
<td>4563</td>
<td>4289 (94.0)</td>
</tr>
<tr>
<td>10</td>
<td>3569</td>
<td>2923 (81.9)</td>
</tr>
<tr>
<td>15</td>
<td>2600</td>
<td>2286 (87.9)</td>
</tr>
<tr>
<td>20</td>
<td>1528</td>
<td>1075 (70.3)</td>
</tr>
<tr>
<td>25</td>
<td>750</td>
<td>322 (42.9)</td>
</tr>
</tbody>
</table>

The hospital mortality (defined as death occurring within 30 days after surgery) was 3.2% in class IV and 2.8% in class III subjects, averaging 3.04% for the group as a whole. The most common causes of death were refractory cardiac failure and tachyarrhythmias or bradyarrhythmias. The mortality during the last ten years was 1.45%.

A satisfactory surgical result was achieved in 98% of patients. This was considered adequate or near normal in our experience when the orifice admitted 1 1/2 to 2 fingers or more. In 74 patients (1.4%), it was presumed that the valvotomy was incomplete. The common adverse features sometimes responsible for an inadequate valvotomy were tough fibrotic valves, extensive subvalvar fusion, and dense calcification inadvertently encountered at surgery; notwithstanding, a successful valvotomy was achieved in several patients.

A mild degree of postoperative mitral regurgitation (18%) resulted which we believe was not hemodynamically significant. Fourteen subjects (incidence of 0.26%) developed severe mitral regurgitation. Of these, nine underwent emergency valve replacement in the early postoperative period and this resulted in two deaths. Four died without surgery. In the 12.8% of patients in whom a mild degree of regurgitation was noted before surgery, a successful valvotomy resulted in its disappearance in 47%. In only 8%, did it increase to regurgitation of a moderate degree.

Over the past decade, patients with mitral stenosis and complicating atrial fibrillation underwent a 3-week anticoagulant regime before surgery. In this group of 265 patients, the incidence of postoperative embolism was 0.4%. Early in this series, in 204 subjects with atrial fibrillation who did not undergo the anticoagulant regime, the occurrence of postoperative embolism was

6.2%. In patients who were in sinus rhythm, the overall incidence of postoperative embolism was only 0.5%.

One hundred and fourteen patients had concomitant closed transventricular mitral and aortic valvotomies while six had triple valvotomies (tricuspid valve included). In the presence of associated tricuspid stenosis, closed combined mitral and tricuspid valvotomies were accomplished in three patients.

The functional status of patients at each stage of follow-up is illustrated in Figure 1. In the 2286 subjects who were followed up for 15 years, clinical status revealed that 86% maintained an excellent or good condition. It is noteworthy that of 322 subjects who were seen beyond 25 years, 36% were in functional class I and 4.5% in functional class II. Actuarial analysis indicates a good long-term survival with 94.0%, 89.4%, 85.0%, and 78.3% alive at 6, 12, 18, and 24 years, respectively, without having to undergo a second procedure (Figure 2).

The incidence of various events at different stages of follow-up is given in Table 2. The occurrence of restenosis varied from 4.2% to 11.4% in 1000 patients/year between the fifth and fifteenth

Functional Status at Different Stages of Follow-up

Table 2. Incidence of various events (per 1000 patients) at different periods of follow-up.

<table>
<thead>
<tr>
<th>Follow-up (y)</th>
<th>No. of cases followed</th>
<th>Mitral restenosis</th>
<th>Rheumatic reactivity</th>
<th>Mitral regurgitation</th>
<th>Systemic embolism</th>
<th>Late deaths</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>5243</td>
<td>0.0</td>
<td>1.6</td>
<td>4.2</td>
<td>0.3</td>
<td>1.7</td>
</tr>
<tr>
<td>5</td>
<td>4289</td>
<td>4.2</td>
<td>2.2</td>
<td>5.5</td>
<td>0.2</td>
<td>3.4</td>
</tr>
<tr>
<td>10</td>
<td>2923</td>
<td>8.1</td>
<td>1.7</td>
<td>3.5</td>
<td>0.3</td>
<td>3.5</td>
</tr>
<tr>
<td>15</td>
<td>2286</td>
<td>11.4</td>
<td>1.8</td>
<td>4.7</td>
<td>0.6</td>
<td>3.4</td>
</tr>
<tr>
<td>20 or more</td>
<td>1075</td>
<td>5.6</td>
<td>1.3</td>
<td>1.9</td>
<td>1.6</td>
<td>3.8</td>
</tr>
</tbody>
</table>

Figure 1.
Late deaths occurred in 3.5%, the most common being progressive cardiac failure.

Discussion

The operative treatment for rheumatic mitral stenosis is palliative, whether it is an open or a closed procedure. The two important criteria for evaluating the merits of these procedures are operative mortality and the interval before significant symptoms recur or when reoperation is required. The operative mortality in our series was 3.04%. However, it was only 1.45% during the last ten years when 1657 patients were operated. The operative mortality for open valvotomy varied from 1.4% to 10% in various series.3.8.9 The number of patients in class IV functional status is 20% in reports claiming a low mortality for open valvotomy3.8-10 whereas in our series, 40% of patients belonged to class IV.

The incidence of restenosis with recurrence of original symptoms peaked around the twelfth year in our series. II Schoevarde et al12 stated that the tenth postoperative year is the critical year when the need for reoperation is the greatest, irrespective of whether the procedure was open or closed. Selzer and Cohn 13 had stated that turbulence across the valve is responsible for the worsening of the fibrosis. A majority of our patients were in the younger age group, probably with valves in an early stage of fibrosis. This would explain the delayed restenosis in our series. Chemoprophylaxis may have helped in decreasing the onset of restenosis.

Over the last decade, there have been several reports claiming superior results with open valvotomy.4.8.1 But several lacunae found in these reports make comparison of the two procedures difficult.

Open mitral commissurotomy allows careful and complete splitting of both commissures. The status of the chordae and leaflets can be precisely judged under direct vision. However, the functional performance of the mitral valve is more important and can be judged only when commissurotomy is performed on the beating heart. This is the primary advantage of the closed technique.14 Furthermore, the temptation to replace a morphologically grotesque but functionally still competent mitral valve is greater when

Table 3. Reoperations following CMV

<table>
<thead>
<tr>
<th>Operation</th>
<th>Performed at CMCH</th>
<th>Performed at other centers</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>RE-CMY</td>
<td>185</td>
<td>21</td>
<td>206</td>
</tr>
<tr>
<td>MVR</td>
<td>76</td>
<td>17</td>
<td>93</td>
</tr>
<tr>
<td>DVR</td>
<td>19</td>
<td>8</td>
<td>27</td>
</tr>
<tr>
<td>OMV</td>
<td>5</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>OMV/OAY</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>OMV/A VR</td>
<td>1</td>
<td>-</td>
<td>1</td>
</tr>
<tr>
<td>AVR</td>
<td>1</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>Total</td>
<td>288</td>
<td>52</td>
<td>340</td>
</tr>
</tbody>
</table>

CMV= closed mitral valvotomy; CMCH= Christian Medical College and Hospital; RE-CMY= closed mitral revalvotomy; MVR= mitral valve replacement; DVR= double-valve replacement; OMV= open mitral valvotomy; OMY= open aortic valve replacement; OMV/OAY= open mitral and aortic valve replacement; OMV/A VR= open mitral and aortic valve replacement; AVR= aortic valve replacement.
the procedure is performed under direct vision. There is no doubt that more patients will have prosthetic valve replacement when mitral commissurotomy is performed routinely as an open heart procedure. It is important not to sacrifice a reasonable valve in favor of an unnecessary valve replacement. Most reports supporting the open technique do not include those patients who had mitral valve replacement after an attempted open mitral valvotomy. In Roe2 and Montaya4 series, the need for valve replacement was 44% and 20%, respectively. Less than 1% of our patients required immediate valve replacement for severe regurgitation, in fact, it was 0.26%. Two percent of the patients who had incomplete valvotomy required a second operation during the next one or two years.15

Our experience denotes that in terms of safety, efficacy, and excellent long-term results, closed valvotomy remains the treatment of choice as a palliative operation for mitral stenosis.16,17 Furthermore, with the need for cost containment in health care, the technique of closed valvotomy assumes even greater importance. We believe that closed mitral valvotomy is a valid and worthy alternative to open valvotomy in view of low hospital mortality, being an almost near zero in the last five years. Moreover, is the fact that with an absence of valve dysfunction in 90% of cases at the end of 15 years, a functional class of I or II becomes evident. Furthermore, a low incidence of restenosis and thromboembolism remains a very gratifying feature in the follow-up.

The presence of mild mitral incompetence, mild aortic incompetence, and minimal calcium on the valves does not exclude the possibility of closed mitral valvotomy. A graded split would allow the surgeon to limit the procedure before worsening the insufficiency. However, it is mandatory to have open heart back-up when closed mitral valvotomy is planned in "complicated" mitral stenosis.14,18

During the last decade, the routine use of anticoagulation in subjects with mitral stenosis and atrial fibrillation has resulted in a postoperative thromboembolic occurrence rate of 4% as contrasted with a figure of 10% to 22% with significant emboli observed by other authors.19-22

In general, we believe that the younger the patient, in early stages of the disease (class' II or III), the better is the long-term prognosis with this procedure. Moreover, considering the natural history of mitral stenosis, together with the low operative risk and the high probability-of a durable repair, we offer our support for a compelling argument for early surgical correction. These data lend support to the growing clinical preference for closed mitral valvotomy and the study represents the largest precise follow-up analysis of results ever reported.

References
