A Mitral Valve Reconstruction Case After 16 Years Of Closed Mitral Commissurotomy

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INTRODUCTION

Although it’s incidence is decreasing in western countries, rheumatismal mitral stenosis is still frequent in developing countries. Closed mitral commissurotomy (CMC) was a successful treatment but open mitral commissurotomy took its place after 1990s. Reoperation is performed generally 5-20 years after first CMC operation. Mitral restenosis is the most frequent cause of reoperation. Mitral valve repair in rheumatic disease is technically more difficult, and there is little information on the long-term stability of this technique. The aim of mitral valve repair is to obtain a component mitral valve with the largest possible nonstenotic orifice and this repair represents a better alternative than valve replacement, as previously described, in terms of a higher survival rate and a significant reduction in mitral valve-related complications. In this study we’re presenting a new valve reconstruction technique used successfully in reoperation of a case who had CMC operation 16 years ago and symptomless up to last 4 months and the first patient repaired successfully after CMC.

CASE PRESENTATION

Our case was 44 years old woman and was followed for rheumatic mitral stenosis (MS) diagnosis for 21 years. CMC was performed 16 years ago in our patient by our same surgeons. She was examined at our Outpatient Clinic for dyspnea and increasing fatigue. She presented with cardiac decompensation refractory to medical treatment. She was presented with pulmonary edema 2 months ago before admittance and she was hospitalized one week in our Cardiology Clinic due to this symptom. She was in New York Heart Association (NYHA) functional class III-IV at presentation. She was evaluated by clinical, hematological, electrocardiographical and echocardiographical examination preoperatively. She had a sinus rhythm in electrocardiography. Chest X-ray showed cardiomegaly (CTI:0.58), hilar congestion and flattening of pulmonary conus. Transthoracic echocardiography (TTE) showed MS (mitral valve area: 1.1 cm²), and pressure gradient was maximum 14 mmHg and mean 10 mmHg at mitral valve. Mitral valve leaflets were thick, calcific and their opening was extremely limited. Diameter of left atrium (41 mm) and left ventricle (41/24 mm) were widened. Left ventricle EF was 70%. Pulmonary arterial pressure was 35/18 mmHg and echocardiographic score was found to be 8. Other valves’ functions were normal. Her cardiac functions were optimal protected with the aid of CMC. Because she was middle-aged, coronary arteriography (CAG) and cardiac catheterization were performed. RA, RV, PAP, LV and aorta pressures were 5 mmHg, 27/0/5 mmHg, 35/18 mmHg, 115/0/5 mmHg and 110/70 mmHg respectively. It was confirmed that EF: 65%.
Coronary arteries were normal. She went under operation.

**SURGICAL TECHNIQUE**

She was operated under endotracheal general anesthesia and in supine position. Following a median sternotomy, pericard was opened longitudinally. Constricting layers of epicardium were separated if possible. We freed the pericardium in this order: first from the aorta and pulmonary artery, including the left ventricular outflow tract; then from the left and right ventricles and the left pulmonary vein orifices; and finally from the superior and inferior venae cavae. During these steps, we set the amplitude of the cautery under 60 mV to avoid causing diathermal dysfunction of the right ventricle during electrocauterization. After heparinization, extracorporeal circulation is established between the venae cavae and the ascending aorta. A cross clamp was placed on aorta and by antegrad intermittent isothermic blood cardioplegy from aortic root, cardiac arrest was established. Hypothermia was moderate (28°C). A vent was placed via the right superior pulmonary vein. Standard left atriotomy was made from interatrial junction. The mitral valve is approached via a standard left atriotomy parallel to the interatrial sulcus. Cooley’s retractor is positioned for optimal exposure. The entire valvular apparatus was carefully examined in order to assess the feasibility of reconstructive surgery and to plan the operative technique. The valvular apparatus was then mobilized as an entire unit with a nerve hook in order to assess tissue flexibility and to identify leaflet restriction. Anterior leaflet was mildly thickened and fibrotic and cords were shortened. Free edges of anterior leaflet were evantrated downward. Posterior leaflet was completely thickened and because it could move freely there wasn’t any excessive material lost. Cords of posterior leaflets were also thickened and shortened. There was a fusion defect from anterolateral commissure to midpart of valve and there was a space only from central part to posteromedial commissure. The bilateral commissures were incised while leaving intact one millimeter of valvular tissue as in the normal anatomy. The underlying chordae and papillary muscles were then incised accordingly (Figure 1).

After this step we performed bilateral segmental annuloplasty. This procedure may also be used to achieve better approximation of leaflet tissue with the placement of mattress stitches at the commissures (Figure 2).

We tested the valve competence after this step on observing valve closure while the left ventricular cavity is filled with saline solution. There wasn’t saline regurgitation (Figure 3).
From a surgical point of view, a flexible ring reduces the tension of the sutures, decreasing the likelihood of ring dehiscence. The ring can also be split. This is particularly useful in those cases in which the surgeon doubts the quality of the repair. For these reasons we performed mitral ring annuloplasty with H608H31 Duran flexibl ring model H608H, 31mm. We re-tested the valve competence after this step on observing valve closure with saline solution. Valve competence and closure were excellent (Figure 4).

**Figure 4**
Figure 4. Image of salin test at the end of repair. There was any regurgitation on the repaired native valve.

Left atriotomy closed standartly. Postoperative rhythm was sinusal. She was no required inotropic support during weaning from cardiopulmonary bypass and early postoperative period. The volume of blood transfused was 2 units. The quantity of mediastinal drainage was 350 cc. She was extubated after an intubation duration 7 hours and stayed in the intensive care for 2 days. The hospital stay was 6 days. Postoperatively at the discharge day and after 2 months an echocardiographic investigation was revealed no regurgitation for the repaired mitral valve (Figure 5).

**Figure 5**
Figure 5. During the second postoperative month, control echocardiography showed any regurgitation on repaired native valve.

Postoperatively, the mitral valve area was found to be 2.76 cm² by pressure half-time echocardiography (Figure 6).

**Figure 6**
Figure 6. This M mode echocardiographic image showed the sufficient opening after mitral valve repair.

The left ventricle diastolic diameter was found to be 41 mm preoperatively, 36 mm postoperatively. The mean gradient of the mitral valve was 4.9 mmHg. The functional capacity of our patient improved dramatically and she was in NYHA functional class I. We found no postoperative cardiac decompensation symptom in our patient during late follow-up and she was followed at our outpatient clinic without
additional problem.

**DISCUSSION**

There have been few clinical series reported analyzing a homogeneous patient population with the same valve etiology, and it has been pointed out that the repair in rheumatic valve disease is technically more difficult and less stable than in degenerative lesion(3). Mitral stenosis is the most frequently encountered valvular pathology and may require surgical intervention when the lesion is severe enough to cause heart failure in spite of medical therapy(4).

The choice of operative technique is also very important. In patients with eligible mitral valve pathologies, CMC may be an option before 1990(4). CMC was the first effective intervention in valvular heart disease. The possibility of opening a stenotic mitral valve by digital splitting of the fused comissures was apparently suggested by Samways as early as 1898. Recently, CMC has been reexplored due to concepts of less invasive valvular surgery. In patients with stenotic mitral valves with pliable and uncalcified leaflets and no thrombus in left atrium, CMC is a safe and cost-effective procedure as stated previously(5). Avoidance from cardiopulmonary bypass and short duration of operation is a very important advantage of the CMC(6).

Since 1970s, reconstructive surgery of the mitral valve was implanted definitively after the pioneering work of Carpentier(7). Since then, clinical experience has shown that this conservative surgery involves minor hospital mortality and more satisfactory long-term clinical results(3,8). Surgical techniques are evolving continuously and making it possible to treat lesions that we previously thought were beyond repair.

Since their introduction, annuloplasty rings have become essential components of reconstructive surgery of mitral and tricuspid valves. Their safety and durability have been proven in numerous clinical studies. The ring obviously deals only with the problems of valve area and does not address the other lesions that must be treated. Leaflet immobility must be treated by a comissurotomy for relieve stenosis, often accompanied by freeing of the matted subvalvular apparatus, including a long papillotomy. When redundant leaflet tissue appears to be located in a segment of the mitral valve, the mitral valve annulus may be narrowed by placing interrupted pledget-reinforced mattress stitches through the annulus at the comissure and drawing the redundant valve tissue into the mattress stitch at the annulus. This repair is the least controllable and least symmetric and must be done judiciously. In all cases mitral valve competence should be tested by distending the ventricle with isotonic electrolyte(salin) solution. This maneuver will demonstrate any areas of residual leakage, which may be repaired by additional sutures(9).

Mitral valve reconstructive surgery without annuloplasty entails a high incidence of early failures(10). The object of the annuloplasty is: to correct the annular dilatation; to increase free edge coaptation; to reinforce the annulus after a leaflet resection procedure; and to prevent further annular dilatation. Flexible ring annuloplasties were introduced based on the principles of mitral valve reconstruction introduced by Carpentier, particularly after the discovery of the three-dimensional continuous movements of the valve annulus(1, 2, 3). A completely flexible Duran ring reduces the abnormally dilated annulus, allowing the three-dimensional configuration of the mitral valve and was thought to be advantageous that the ring followed the changes of size and shape of the atrioventricular anulus in a physiological manner. Pump function was expected to improve because a flexible ring would interfere less with muscular contraction than would a rigid one. Moreover, the tension on the sutures would be less, which might reduce the chance of developing a partial dehiscence(11). David et al. their data indicate that 2-3 months after mitral valve reconstruction left ventricular pump function is better in patients with a flexible ring than in patients with a rigid mitral ring(11, 12). A consequence of preserving the left ventricular(LV) function is a reduction of the hospital mortality(3.3%), even lower in patients undergoing isolated mitral valve reconstruction(2.7%). These values contrast with those reported with Carpentier’s ring(5.3%) and for mitral replacement(5% to 8%)(1, 13). A flexible ring minimizes the risk of systolic anterior motion(SAM) and LV outflow tract obstruction(11). It offers better diastolic blood flow across the mitral valve, particularly during exercise(14).

Some form of intraoperative assessment and direct observation for evaluating the mitral closing mechanism is mandatory. Intraoperative transesophageal two-dimensional color echocardiography is an extremely reliable method for observing the functioning the mitral valve. However, it is used only when the patient is off cardiopulmonary bypass. The surgeon also needs to observe the valve as many times as necessary before, during, and at the end of the procedure. The salin injection under pressure is favorable for observing the mitral valve motion(SAM) and LV outflow tract obstruction. The salin injection under pressure is favorable for observing the functioning the mitral valve.
Patients with rheumatic disease have a higher incidence of thromboembolism than do those with degenerative or ischemic pathology\(^1\). For this reason we performed to treat with oral anticoagulant therapy during postoperative 3 months.

In conclusion, etiology plays a very important role in correction difficulties and in terms of late results affected by the progression of the disease. Rheumatic lesions, have been more difficult to treat conservatively and have a higher rate of repeat operations for early and late valve dysfunction, which oscillates between 10\% and 27\%(\(^\text{10}\)). Mitral valve reconstructive surgery with Duran flexible ring annuloplasty for rheumatic disease entails a low hospital mortality with satisfactory long-term clinical results, actuarial freedom from reoperation and it allows improvement of left ventricular function.

References

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