A Superior-Septal Approach for Mitral Valve Repair — Experience from Eight Cases

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Background: Satisfactory exposure of the mitral apparatus is a prerequisite for accurate repair of the mitral valve. The technique of cardiectomy used for transplant recipients can be modified to improve exposure of the mitral valve for patients with difficult anatomical access. Methods: Eight patients (5 men, 3 women) were treated with the superior-septal approach for mitral valve repair from December 2000 to August 2001; ages ranged from 20 to 75 years. Three patients received both mitral valve repair (MVR) and tricuspid valve annuloplasty (TVA). Follow-up periods ranged from 1 to 27 months. Results: One case was complicated by postoperative bleeding, which necessitated reopening surgery. Seven of the patients who had a normal sinus rhythm preoperatively remained in normal sinus rhythm at a late follow-up stage. One patient died as the result of spontaneous subdural hematomas, subarachnoid hemorrhage and delayed intracranial hemorrhage, about 1 month after MVR and TVA. All other patients survived without any late complications. Conclusions: The septal-superior (transplant) approach to MVR provides good surgical exposure of the mitral valve and the subvalvular apparatus. This limited series does not allow definitive conclusions to be drawn on the effects of this approach on postoperative cardiac rhythm. However, there appear to be no significant effects on postoperative heart rhythm, and late follow-up results appear acceptable.

Key words: mitral valve repair, superior septal approach, valvular heart disease

INTRODUCTION

Adequate exposure of the mitral valve and the subvalvular apparatus during a surgical procedure is a prerequisite for the success of mitral valve procedures. The traditional left atrial incision, although widely used, may not provide optimal visualization of the mitral valve, especially under certain circumstances, such as (1) a small left atrium, (2) proximate dense adhesions from previous procedures, (3) the presence of a rigid aortic prosthesis, (4) congenital anomalies of the heart or thorax, (5) atrial calcification, and (6) the presence of a large, organized thrombus. By contrast, the superior septal approach provides the surgeon with a large operative field, even when the left atrium is small. With such an approach, both the surgeon and assistants can easily observe the operative field, whereas with the conventional approaches assistants cannot always do so. The superior septal approach does, however, entail transection of the sinus node artery and the anterior internodal conduction pathway. However, postoperative rhythm disturbances, such as supraventricular arrhythmia and atrio-ventricular conduction disturbances, could be troublesome for some patients, following this approach. Recently, we began to employ this surgical approach because of the increasing number of patients who require reconstruction of the mitral valve. We describe here our experience with 8 patients who received the superior septal approach for MVR from December 2000 to August 2001.

MATERIALS AND METHODS

Patient Population

Between December 2000 and August 2001 8 patients (5 men and 3 women) underwent mitral valve repair (MVR) using the superior-septal approach at Tri-Service General Hospital, Taipei. Demographic features are summarized in
Superior septal approach for mitral valve repair

Table 1 Patients summary

<table>
<thead>
<tr>
<th>No.</th>
<th>Age, sex</th>
<th>Diagnosis</th>
<th>Procedure</th>
<th>Surgical duration (mins)</th>
<th>Aortic cross clamp time (mins)</th>
<th>Total bypass time (mins)</th>
<th>ICU stay (hours)</th>
<th>Post-OP admission (days)</th>
<th>Post-OP follow-up period (months)</th>
<th>Post-OP Echocardiography follow-up</th>
<th>Result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>30, M</td>
<td>Infective endocarditis with severe MR</td>
<td>MV repair</td>
<td>360</td>
<td>78</td>
<td>105</td>
<td>45</td>
<td>7</td>
<td>27</td>
<td></td>
<td>Mild MR</td>
</tr>
<tr>
<td>2</td>
<td>75, F</td>
<td>1. Severe MR &amp; TR (degenerative)  2. Chronic renal insufficiency</td>
<td>MV repair + TV annuloplasty</td>
<td>315</td>
<td>65</td>
<td>118</td>
<td>29</td>
<td>16</td>
<td>1</td>
<td>Trivial MR</td>
<td>Died 1 month s/p op (spontaneous SDH &amp; SAH); valve OK</td>
</tr>
<tr>
<td>3</td>
<td>47, M</td>
<td>1. RHD with severe MR  2. Neurofibromatosis</td>
<td>MV repair</td>
<td>220</td>
<td>59</td>
<td>79</td>
<td>113</td>
<td>14</td>
<td>16</td>
<td>Mild MR</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>4</td>
<td>50, F</td>
<td>RHD with severe MR</td>
<td>MV repair</td>
<td>315</td>
<td>80</td>
<td>114</td>
<td>21</td>
<td>9</td>
<td>18</td>
<td>Mild MR</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>5</td>
<td>57, F</td>
<td>1. RHD with severe MR &amp; moderate TR  2. Af</td>
<td>MV repair + TV annuloplasty</td>
<td>345</td>
<td>75</td>
<td>111</td>
<td>90</td>
<td>18</td>
<td>22</td>
<td>Mild to moderate MR</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>6</td>
<td>29, M</td>
<td>RHD with severe MR</td>
<td>MV repair</td>
<td>270</td>
<td>86</td>
<td>119</td>
<td>24</td>
<td>14</td>
<td>15</td>
<td>Mild to moderate MR</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>7</td>
<td>20, M</td>
<td>1. Infective endocarditis with severe MR  2. CHF, NYHA II</td>
<td>MV repair</td>
<td>320</td>
<td>87</td>
<td>135</td>
<td>20</td>
<td>12</td>
<td>24</td>
<td>Mild to moderate MR</td>
<td>Satisfactory</td>
</tr>
<tr>
<td>8</td>
<td>58, M</td>
<td>1. RHD with severe MR &amp; TR  2. CHF, NYHA IV  3. Af with RVR</td>
<td>MV repair + TV annuloplasty</td>
<td>250</td>
<td>76</td>
<td>123</td>
<td>43</td>
<td>12</td>
<td>17</td>
<td>Trivial MR</td>
<td>Satisfactory</td>
</tr>
</tbody>
</table>


Table 1, and the ages of the patients ranged from 20 to 75 years. No patients had received any form of prior cardiac surgery. The range of cardiac diseases was complex, with involvement of more than one valve for 3 patients, and endocarditis for another two. The spectrum of surgical procedures performed paralleled the complexity of the underlying disease; MVR and tricuspid valve annuloplasty (TVA) were performed for 3 of the patients.

Surgical Technique for Superior-Septal Approach

Aortic and bicaval cannulation were used, using caval snares. Cold blood cardioplegia was employed; initially about 10 to 15 mL/kg of cold blood cardioplegia was infused. Topical hypothermia was also undertaken, wrapping the heart with a cold pad for insulation during the surgical procedure. Cardioplegia was recommenced every 20 min using appropriate quantities of cold blood to help maintain moderate hypothermia.

During the total bypass phase, the right atrium was typically opened along the anterior aspect of the atrioventricular groove with an incision 2-3 cm long being made in the interatrial septum starting from the inferior end of the fossa ovale. The right atriotomy was then extended superi orly between the right appendage and the atrioventricular groove to join the interatrial incision. To simplify closure we left at least 2 cm of free edge on the left superior side of the septal incision, and aimed to have the junction of the right atrial and septal incisions at a similar distance posterior to the aortic root. The artery to the sinus node was usually (and unavoidably) divided as the atrial incisions were joined across the top of septum. The left atrial dome was entered, beginning at the junction of the two previous incisions, following which the incision was extended to the base of the left atrial appendage behind the aorta, with particular care taken to leave 1-2 cm of atrial tissue available on the ventricular side to facilitate closure.

Retraction of the atrial wall to the left elevated the right atrium, the right ventricle, and the roof of the left atrium, bringing the entire valve into view. The difficult corner just under the aortic annulus was particularly well exposed
with this approach. Suture closure was commenced at the left end of the left atrial incision at the base of the atrial appendage and then carried forward as a simple running suture (3-0 polypropylene) into the septum, where it was used to join a similar suture commenced at the inferior end of the septum in the foramen ovale. The thick triangular wedge of tissue at the superior end of the interatrial septum served as a marker for orientation of the left atrial suture line. The cross clamp was then removed, and the right atrial incision was closed as it was created, also with simple running 3-0 polypropylene sutures.

RESULTS

The surgical details and operative results (surgery durations, aortic cross-clamp times, total bypass times, intensive care unit residence times, postoperative admission days, postoperative follow-up periods and postoperative echocardiography follow-up times) are summarized in Table 1. The postoperative follow-up times ranged from 1 to 27 months. One patient died from spontaneous subdural hematomas and subarachnoid hemorrhage, which did not appear to be valving related (Patient 2, Table 1).

Surgical revision for the control of bleeding was necessary for only 1 patient (Patient 8), and no patients in this series required reexploration because of bleeding from the atrial suture.

The perioperative cardiac rhythm patterns are summarized in Table 2. One patient (No. 2) was in atrial fibrillation prior to surgery and at her most recent follow-up, and another patient (Patient 8) who was in atrial fibrillation prior to surgery returned to normal sinus rhythm (NSR) postsurgery. Among the 6 patients who were in NSR preoperatively, 3 (No. 1, 3 and 5) returned to NSR following a brief period (less than 48 h) of junctional bradycardia postsurgery, and then remained in NSR at late follow-up. The other three patients who were in NSR preoperatively (No. 4, 6 and 7) remained in NSR after surgery.

For an evaluation of the effects of MVR, postoperative echocardiography follow-up was routinely performed at our outpatient department from 1 to 8 months following discharge. There were 2 patients (No. 2 and 8) who progressed to trivial mitral regurgitation (MR) from severe MR, 3 patients (No. 1, 3, and 4) who progressed to mild MR postoperatively, and 3 patients (No. 5, 6, and 7) who showed mild to moderate MR at a late follow-up stage.

DISCUSSION

Good exposure of the target tissue is vital to the success of all surgical procedures. The superior septal approach provides excellent exposure of the mitral apparatus, in our experience, even when unsatisfactory exposure through a conventional left atriotomy is anticipated.

This approach combines the advantages of the superior approach with those of the transseptal approach and develops logically from an appreciation of the exposure obtained during cardiectomy for transplant recipients. Most of the right atrium and the superior vena cava are left lying laterally to the right by joining the transseptal and superior incisions medial to the superior vena cava, as to expose the mitral valve only the right ventricle and a small portion of the right atrium must be retracted to the left.

Using the superior-septal approach, the superior vena cava does not need to be elevated or mobilized more than the small amount needed for placement of a caval snare, which presents a substantial advantage for cases of repeat surgery. The left atrium is essentially bivalved, and the difficult region of the anterolateral commissure underneath the aortic valve is principally well exposed with the left atrial incision extended under the aorta to the base of the appendage.

The possibility of detrimental effects upon postoperative rhythm elicited by division of the superior interatrial septum must be evaluated against the benefits of improved exposure before adopting the superior-septal approach. Two principal causes for concern should be noted: (1) possible interruption of the important pathways for atrial conduction of impulses traveling from the sinus node to the atrioventricular node, and (2) the sinus-node artery is usually divided.

The sinus-node artery arises from the right coronary artery for about 55% of hearts and from the left circumflex...
or main coronary artery for the remainder. When it originates from the right coronary artery, it runs posteriorly and superiorly over the anterior wall of the right atrium and beneath the right appendage to the base of the superior vena cava. Therefore, the sinus-node artery frequently must be sacrificed when the superior septal approach is adopted as the surgical procedure of choice. Collateral blood flow pathways may emerge in the postoperative recovery phase, but the overall blood supply to the sinus node will be reduced in the early postoperative phase. Moreover, the atrial incision required for the superior septal approach is longer than that required for conventional approaches, and this may interfere with the cardiac conduction system, resulting in conduction disturbances and arrhythmias.

Sinus node function and atrial vulnerability following cardiac surgery remain important considerations with the superior septal approach because the technique involves transecting the sinus-node artery and the anterior inter- nodal conduction pathway and requires incisions in both atria. Consequently, there are concerns for the potential effects upon postoperative sinus-node function and atrial vulnerability. Thus, the technique has not yet gained widespread acceptance.

Experience with the 8 patients reported here does not allow for definitive conclusions to be drawn regarding the effects of the superior septal approach on postoperative cardiac rhythm, although it did not appear to be associated with a significantly higher incidence of postoperative rhythm disturbances.

In summary, the superior-septal approach does not appear to elicit long-term adverse effects upon sinus node function or atrial vulnerability, although transient changes may be observed. Thus, the superior-septal approach can be viewed as an effective approach for mitral valve repair and may be indicated for patients for whom unsatisfactory exposure through conventional approaches is anticipated.

REFERENCES