Comparative Study of Thoracic Approaches in Atrial Septal Defect Closure

Juan-Miguel Gil-Jaurena, Marcos Murtra, Arturo Gonçalves, Luis Miró, Ramón Vilà and Manel García-Górriz


Our early experience in approaching ASD by right thoracotomy as opposed to midline sternotomy is presented. Between July 2000 and December 2001, 15 patients (group A) were operated by right thoracotomy. Mean age of patients was 8.6 years and mean weight was 31.6 kg. In the same period, midline sternotomy was used in 16 patients (group B). Mean age was 4.7 years and weight was 16.5 kg. The duration of the procedure, by-pass, and aortic cross-clamping were similar. Bleeding was 265 ml (8.4 ml/kg) in group A, and 152 ml (9.2 ml/kg) in group B. The duration of the ICU stay and time of discharge were 2.4 days and 6 days in group A, and 2.23 days and 6.87 days in group B, respectively. No significant differences were found in ASD closure by thoracotomy and sternotomy. The cosmetic appearance acceptance of right thoracotomy was excellent.

Key words: Atrial septal defect. Thoracotomy. Direct cannulation.

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INTRODUCTION

Midline sternotomy is the incision generally used for heart surgery. Articles that describe alternative approaches appear regularly that are surgically less traumatic and eliminate the risk of sternal instability, in addition to improving cosmetic results.1,3

In this study we report our initial experience in the closure of atrial septal defects (ASD) in children using right anterolateral thoracotomy, with cannulation of the aorta and both cava veins through the same incision. The results obtained are compared with a control group of patients with ASD closed by midline sternotomy.

MATERIAL AND METHODS

From July 2000 to December 2001, 15 patients (group A) underwent ASD closure via a right anterolateral thoracotomy. The surgical indication was ostium secundum ASD (8 cases), sinus venosus with partial anomalous drainage of pulmonary veins (4 cases), and ostium primum ASD (3 cases). In the same period, 16 patients (group B) underwent surgery using midline sternotomy (12 ostium secundum, 4 ostium primum). Patients were assigned to one approach or another at the discretion of the surgeon (Table 1).

Inclusion criteria

Initially, female patients with complete breast development were chosen. Later, age was not an inclusion criterion. Similarly, the first cases were ostium secundum type ASD, then the indication was expanded to...
include sinus venosus and ostium primum type ASD.

**Exclusion criteria**

Age under 2 years; diseases not located in the atrial septum.

**Anesthesia**

All patients received balanced general anesthesia with propofol, fentanyl, sevoflurane, and ropivacaine. In addition, thoracic epidural anesthesia was associated (puncture level T6-T8) in 10 patients in group A, with intraoperative ropivacaine and postoperative morphine (24-36 h). The epidural catheter was introduced after the patient had been intubated and withdrawn when the patient was discharged from the ICU.

**Access**

After making the skin incision (Figure 1), the subcutaneous tissue (future mammary gland) and pectoral muscle are dissected en bloc. The latissimus dorsi and serratus muscles do not have to be sectioned. The thorax is opened in the fourth intercostal space. After removing the right lobe of the thymus, the pericardium is opened in front of the phrenic nerve and the incision is prolonged in cephalad direction over the aorta. Exposure of the aorta is facilitated by fixing the pericardium to the second rib, then passing a tape to facilitate aortic traction and manipulation.

**Cannulation**

The aorta and both vena cava can be cannulated directly (Figure 2) through the thoracotomy. Ostium secundum type ASDs were closed by direct suture or a patch. Sinus venosus ASD was closed with a patch and enlargement of the atriotomy in the superior vena cava with another patch. Ostium primum ASDs were closed with a patch of autologous pericardium and closure of the cleft mitral valve.

**Associated procedures**

In one patient in group A, a ventricular septal defect was closed (intermediate channel). In group B, a patent ductus arteriosus was ligated in 2 cases. In one patient, a pulmonary commissurotomy was made and in one patients, a small ventricular septal defect was closed.

After completing the correction, ventricular pacemaker leads were placed before unclamping the aorta. The ventilation and defibrillation maneuvers were similar to those used with sternotomy: in every case, the pericardium was closed and two drainages were left in place (intrapericardial and intrathoracic).

**RESULTS**

The mean duration of the intervention was 152 min with the thoracotomy approach and 137 min with the sternotomy approach. Cardiopulmonary bypass lasted

**TABLE 1. Demographic data**

<table>
<thead>
<tr>
<th></th>
<th>Thoracotomy</th>
<th>Sternotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex, male/female</td>
<td>7/8</td>
<td>9/7</td>
</tr>
<tr>
<td>Age, years</td>
<td>8.6 (3-15)</td>
<td>4.7 (10 months-16 years)</td>
</tr>
<tr>
<td>Weight, kg</td>
<td>31.6 (15-77)</td>
<td>16.5 (6.8-70)</td>
</tr>
<tr>
<td>ASD type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ostium secundum</td>
<td>8</td>
<td>12</td>
</tr>
<tr>
<td>Sinus venosus</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>Ostium primum</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>Associated defects</td>
<td>1 VSD</td>
<td>1 VSD, 1 PS, 2 ductus</td>
</tr>
</tbody>
</table>

VSD indicates ventricular septal defect; PS, pulmonary valve stenosis.
TABLE 2. Results

<table>
<thead>
<tr>
<th></th>
<th>Thoracotomy</th>
<th>Sternotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical time, min</td>
<td>152 (120-195)</td>
<td>137 (105-180)</td>
</tr>
<tr>
<td>CPB time, min</td>
<td>43.2 (22-72)</td>
<td>47.4 (25-74)</td>
</tr>
<tr>
<td>Clamping time, min</td>
<td>25.8 (8-50)</td>
<td>24.3 (7-52)</td>
</tr>
<tr>
<td>Drainage, ml</td>
<td>265 (8.4 ml/kg)</td>
<td>152 (9.2 ml/kg)</td>
</tr>
<tr>
<td>ICU stay, days</td>
<td>2.4</td>
<td>2.27</td>
</tr>
<tr>
<td>Discharge after surgery, days</td>
<td>6</td>
<td>6.87</td>
</tr>
</tbody>
</table>

CPB indicates cardiopulmonary bypass; ICU, intensive care unit.

On the other hand, there is controversy about compromising the future growth of breast tissue in young girls. One French group recommends delaying right thoracotomy until the breasts are fully developed in these patients. However, the real risk of affecting the breast tissue is scant if the skin incision is made below the sixth intercostal space and the subcutaneous tissue is dissected en bloc with the pectoral muscle before attempting thoracotomy in the fourth space. The possibility of affecting the spine is remote, inasmuch as the anterolateral thoracotomy respects the latissimus dorsi and the spinal muscles. In any case, only prolonged follow-up can provide evidence of cosmetic effects on the breasts or spine.

From a technical point of view, most groups attempt to reproduce the basic steps of sternotomy when using the thoracotomy approach: cannulation of the aorta and two vena cava, clamping and cardioplegia, all through the same incision (Figure 2).

Our work has several biases. In the first place, it is not a randomized study. The distribution in both groups was individualized way at the discretion of the surgeon. The first 3 cases for thoracotomy were selected (os- tum secundum type ASD in girls with fully developed breast), then the indications were later extended. For this reason, the mean weight and age of group A is greater, and there are two peak ages (3-4 and 13-14 years). In contrast, 10 of the patients in group B were younger than 4 years. Secondly, several patients in the thoracotomy group were selected by anesthesiologists to undergo general anesthesia in addition to epidural anesthesia and they were extubated in the operating room. This explains the large number of extubations that took place in the operating room in group A.

CONCLUSIONS

Surgical closure of ASDs through a right anterolatera thoracotomy was feasible in our initial series. There were no significant differences in the results compared with midline sternotomy. The instruments used and surgical steps were the usual ones. The cosmetic results of thoracotomy were excellent.

REFERENCES