Spontaneous Closure of a Ventricular Septal Defect in a Patient with Prior Pulmonary Artery Banding

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The fourth case of spontaneous closure of a ventricular septal defect in a patient having prior pulmonary artery banding is reported. Statistics to date indicate that ventricular septal defects in patients who require banding may close with lesser frequency than those for which banding is not required. The apparent lower incidence of spontaneous closure of these defects should not influence the use of banding for the control of intractable cardiac failure in infants with ventricular septal defects.

It is estimated that approximately 25 percent to 50 percent of ventricular septal defects will close spontaneously, usually during the first year of life. Despite this high incidence of closure, only three instances of spontaneous closure have been previously reported in children who required pulmonary artery banding for the control of cardiac failure in the first year of life. This report records the fourth documented case of spontaneous closure of a ventricular septal defect in a child having a pulmonary artery band on in infancy for the control of cardiac failure.

CASE REPORT

The patient was an 11-day-old baby girl, the product of a normal term delivery, admitted to the Boston Floating Hospital on October 20, 1961, in congestive heart failure. She was tachypneic, the heart rate was 200 beats per minute, her liver was enlarged and a soft systolic murmur was present over the precordium. Chest roentgenogram revealed a globular heart and pulmonary congestion. Electrocardiogram revealed right ventricular hypertrophy. She was placed on digoxin with some improvement, but continued to do poorly. Cardiac catheterization and angiocardiography, performed on November 11, 1961, revealed a large left to right shunt at the ventricular level which increased pulmonary blood flow to 4.5 times systemic flow. Systolic pressure in the right ventricle was at systemic level. The pulmonary artery and aorta were not entered, and therefore it was not possible to rule out a concomitant patent ductus arteriosus. Only right ventricular injections were made during angiocardiography and these revealed immediate reopaification of the right ventricle from the left ventricle on the levo-phase, confirming the presence of a large left to right shunt at the ventricular level (Table 1). On November 28, 1961, because of persistent cardiac failure, a cotton tape band was placed on the main pulmonary artery through an anterolateral thoracotomy in the left fourth intercostal space. Improvement was dramatic, and she was discharged on December 6, 1961. Her growth and development were normal thereafter, but in late 1967 she complained of fatigue. Physical examination revealed a right ventricular thrust, a thrill along the left sternal border and in the suprasternal notch. Electrocardiogram revealed right ventricular hypertrophy and right bundle branch block. Chest roentgenogram showed poststenotic dilatation of the main pulmonary artery. Repeat cardiac catheterization, angiocardiogram and indicator dilution curves were performed on February 28, 1969. There was no oxygen step-up in the right ventricle or pulmonary artery. Pulmonary artery pressure proximal to the band was slightly greater than systemic arterial pressure. There was a peak systolic gradient of 80 mm of mercury across the band. Angiocardiogram demonstrated the band with poststenotic dilatation of the pulmonary artery (Fig 1) and an intact interventricular septum (Fig 2). Indicator dilution curves showed no evidence of a shunt in either direction (Table 2). The girl was operated upon on March 21, 1969, on total cardiopulmonary bypass. Inspection of the ventricular septum through a right ventriculotomy revealed no ventricular septal defect. The band was incised longitudinally and the incision in the pulmonary artery closed transversely with interrupted sutures, creating a lumen of greater than 2 cm diameter. The ventriculotomy was closed and the bypass discontinued. Her postoperative course was uneventful except for mild depressive reaction which cleared after discharge from the intensive care unit on the third postoperative day. She was discharged on the eighth postoperative day. She returned to school three weeks after surgery and continues to do well. Her murmur is at present a grade II/VI soft midystolic blowing sound. There has been no remarkable change in the chest roentgenograms.

DISCUSSION

Many ventricular septal defects either close or become functionally smaller in the first year of life. The fact

<table>
<thead>
<tr>
<th>Catheter Location</th>
<th>Pressure (mm Hg)</th>
<th>O2 Content (vol. %)</th>
<th>Angiocardiogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior vena cava</td>
<td></td>
<td>7.3</td>
<td>Large left to right shunt at ventricular level</td>
</tr>
<tr>
<td>Right atrium</td>
<td>5.7</td>
<td>8.7</td>
<td></td>
</tr>
<tr>
<td>Right ventricle</td>
<td>57/8</td>
<td>11.9</td>
<td></td>
</tr>
<tr>
<td>Pulmonary artery</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Femoral artery</td>
<td>57/40</td>
<td>13.1</td>
<td></td>
</tr>
</tbody>
</table>

Qp/Qs = 4.5/1 (estimated).

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that most of the patients requiring constriction of the pulmonary artery for the control of heart failure are in the first three months of life is consistent with this tendency for ventricular septal defects to become functionally smaller with increasing age.1,2

Some authors have stressed the large size and high location of the ventricular septal defects in patients requiring banding,6 but others have noted smaller and lower defects as well.7 Some patients have had multiple defects of the interventricular septum.8

While this is the fourth recorded case of spontaneous closure of a ventricular septal defect which required pulmonary artery constriction for the control of heart failure in infancy, the number of reported two-stage corrections has been small.4 Five groups of patients have been reported,6-10 with additional case reports,3,5,11-18 totaling 83 patients. This represents a spontaneous closure rate of approximately 5 percent for lesions requiring banding, well below the figure ordinarily given for spontaneous closure of ventricular septal defects,1,2 and suggests that the high flow and high pressure defects requiring constriction of the pulmonary artery in the first year of life may close with lesser frequency than those with lower flows and pressures.5

The four isolated case reports of spontaneous closure of these defects after banding do not to us constitute a reason for changing our attitudes toward pulmonary artery constriction. We continue to feel that this is the

Table 2—Data from Cardiac Catheterisation Performed on February 26, 1969, Prior to the Second Operation

<table>
<thead>
<tr>
<th>Catheter location</th>
<th>Pressure (mm Hg)</th>
<th>O2 Saturation</th>
<th>Angiocardiogram</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superior vena cava</td>
<td>—</td>
<td>75</td>
<td>Pulmonary artery band with poststenotic dilatation; intact interventricular septum</td>
</tr>
<tr>
<td>Right atrium</td>
<td>(2)</td>
<td>77</td>
<td></td>
</tr>
<tr>
<td>Right ventricle</td>
<td>130/0</td>
<td>74</td>
<td></td>
</tr>
<tr>
<td>Pulmonary artery (proximal)</td>
<td>120/24</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pulmonary artery (distal)</td>
<td>40/20 (30)</td>
<td>73</td>
<td></td>
</tr>
<tr>
<td>Left atrium</td>
<td>(4)</td>
<td>95</td>
<td></td>
</tr>
<tr>
<td>Femoral artery</td>
<td>110/70</td>
<td>94</td>
<td></td>
</tr>
</tbody>
</table>

Qp/Qs = 1/1.
ANASTOMOSIS BETWEEN ATRIAL APPENDAGES

wisest procedure for sick infants in refractory cardiac failure from ventricular septal defect who are under 15 pounds in weight and under six months of age or both.

REFERENCES

1 Bloomfield DK: The natural history of ventricular septal defects in patients surviving infancy. Circulation 29:914, 1964
15 Craig TV, Sirak HD: Pulmonary artery banding. Thorac Cardiovas Surg 45:599, 1963

Anastomosis between the Atrial Appendages in a Patient with Juxtaposition*

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An operation was performed on a nine-month-old child with complete transposition of the large arteries, ventricular septal defect, pulmonary stenosis and left-sided juxtaposition of the atrial appendages. A Fontan anastomosis was established in order to enhance the flow through the lungs. During operation, the left atrium was found to be bright red (mean pressure 20 mm Hg), while the right atrium had an intensive blue color (mean pressure 17 mm Hg). In an effort to ensure adequate mixing at the atrial level, an anastomosis was established between the atrial appendages. After this, there was no longer a difference in color between the atria, and the mean pressure had diminished to 10 mm Hg in the left and 8 mm Hg in the right atrium.

Complete transposition of the large arteries is rarely associated with juxtaposition of the atrial appendages. We observed a patient who showed this combination of anomalies, and report our findings with a view to the surgical consequences.

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![Figure 1. Preoperative ECG. Calibration: 1 cm = mV. Paper speed 25 mm/sec.](image-url)