Calcification of the Pulmonary Artery: A Complication of the Banding Procedure*


Calcification of the pulmonary artery in the region of banding occurred in a patient with a ventricular septal defect. Although total surgical correction was performed, significant obstruction at the site of the banding persists. Calcification may compound the technical problem of "debanding," and by preventing reconstruction of the pulmonary artery, make prognosis unfavorable.

Since its introduction by Muller and Dammann,1 banding of the pulmonary artery has become an established method of palliative therapy in certain types of congenital heart disease.2-4 Experience with the surgical correction of the cardiac defect together with "debanding" of the pulmonary artery has been published from various centers.4-6 The remote complications of the banding procedure have included increasing obstruction to the right ventricular out-flow which results in cyanosis and syncopal attacks,6 slippage of the band and its migration distally towards the bifurcation of the pulmonary artery.10 The following report presents a patient in whom circumferential calcification in the region of the band and in the proximal part of the pulmonary artery developed following banding for a ventricular septal defect.

CASE REPORT

In October 1980, at the age of three months, this white male infant was admitted to another institution with a history of respiratory distress and failure to thrive. A clinical diagnosis of ventricular septal defect was made and subsequently confirmed by cardiac catheterization. Pertinent findings on cardiac catheterization included a pulmonary arterial pressure of 80/30, a normal arterial oxygen saturation, a significant step-up in the oxygen content in the right ventricle indicative of a ventricular septal defect, and a further step-up in the oxygen content in the pulmonary artery suggestive of a patent ductus arteriosus in addition. Response to medical therapy was poor, and a few days following cardiac catheterization, banding of the pulmonary artery with umbilical tape and ligation of a small patent ductus arteriosus were performed. Immediately after banding, systolic pressures in the right ventricle and the pulmonary artery were 90 mm and 30 mm Hg, respectively. The postoperative course was uneventful and symptoms and signs of cardiac failure improved.

In December 1981, this child was seen at this hospital for the first time. Physical examination revealed a somewhat underdeveloped white male infant in no distress. Significant physical findings included a systolic thrill, and a long, harsh, ejection systolic murmur along the left sternal border. Prominence of the right ventricle, dilatation of the main pulmonary artery, and diminution of the pulmonary vascular markings were present in the chest x-ray film. The electrocardiogram revealed right ventricular hypertrophy (Fig 1). Physical findings, radiological appearances, and the electrocardiogram remained unchanged over the next two years. In 1984, during a routine outpatient

![Figure 1. Electrocardiogram at the age of five months showing right ventricular hypertrophy.](http://journal.publications.chestnet.org/pdfaccess.ashx?url=/data/journals/chest/21496/ on 06/26/2017)
visit, increased density and flecks of calcium in the main pulmonary artery were seen for the first time on a routine chest x-ray picture. During the subsequent outpatient visits, increasing dilatation of the proximal main pulmonary artery and increasing density of calcification were noted (Fig 2 A). A left parasternal impulse was easily palpable by now, and the right ventricular hypertrophy pattern in the electrocardiogram became more marked. In 1967, dyspnea and episodes of cyanosis appeared. Cardiac catheterization at this time revealed that a left-to-right shunt through the ventricular septal defect was still present. The right ventricular systolic pressure was 85 mm, and the pulmonary arterial pressure distal to the band was 20/10 mm (Table 1).

In view of the continued retardation of growth and the appearance of dyspnea and cyanosis, closure of the septal defect and "debanding" of the pulmonary artery


FIGURE 3. Electrocardiogram following surgery reveals right bundle branch block.
CALCIFICATION OF THE PULMONARY ARTERY

was recommended. At operation, gross dilatation of the pulmonary artery proximal and distal to the band was noted. Calcification of the pulmonary artery proximal to, and at the site of the band was also seen. The pulmonary valve was normal, but distal to the valve, in the region of the band, there were severe stenosis and dense fibrosis of the arterial wall. A high ventricular septal defect, measuring 2 cm in diameter, was seen in the membranous septum. The ventricular septal defect was closed, the band in the pulmonary artery was excised, and a patch repair of the pulmonary artery performed. The postoperative course was uneventful. The electrocardiogram revealed right bundle branch block (Fig 3), and the chest x-ray picture continued to show cardiomegaly, dilatation of the pulmonary artery, and circumferential calcification in the proximal pulmonary artery (Fig 2 B). The systolic thrill and the systolic murmur persisted, but were much less marked. Cardiac catheterization was repeated ten months after surgery and showed no evidence of a left-to-right shunt. The right ventricular systolic pressure was still elevated, approaching the systemic pressure (Table 1). No gradient was found at the level of the infundibulum or the pulmonary valve. There was a gradient of 65 mm Hg across the region of the band. There was no evidence of calcification elsewhere nor was there any evidence of an underlying metabolic disorder to account for the calcification. Detailed metabolic studies were, however, not made.

COMMENT

Teflon, nylon, cotton umbilical tape, silk, and Dacron have all been used to band the pulmonary artery. Although silk and cotton have been held by some to give greater tissue reaction, it is common for bands made of most materials to become incorporated in the pulmonary artery with dense adhesions, often necessitating a patch repair of the pulmonary artery. Even with a patch repair, residual narrowing is common. In the patient presented in this report, it is possible that the use of umbilical tape was responsible for some of the intense tissue reaction. Although there is a considerable residual pressure gradient across the pulmonary banding with severe right ventricular systolic hypertension, the density of the fibrous tissue and the calcification make further surgical repair at the area of the banding a formidable technical problem. On the other hand, with conservative treatment, the possibility of a further increase in the right ventricular pressure and the potential risk of subacute bacterial endocarditis make the prognosis unfavorable.

While calcification of the pulmonary artery as a complication of banding must be exceedingly rare, its occurrence in this patient strikes a further note of caution in the selection of patients for banding of the pulmonary artery.

REFERENCES

1 Muller WH Jr, and Dammann JF Jr: The treatment of certain congenital malformations of the heart by the creation of pulmonic stenosis to reduce pulmonary hypertension and excessive blood flow, Surg Gynee Obstet, 95:213, 1952
2 Morrow AG, and Braunwald NS: The surgical treatment of ventricular septal defect in infancy. The technic and results of pulmonary artery constriction, Circulation, 24:34, 1961

Table 1—Cardiac Catheterization Data

<table>
<thead>
<tr>
<th>Pressures</th>
<th>O₂ Content</th>
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<td></td>
<td>Preop</td>
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<tr>
<td>SVC</td>
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</tr>
<tr>
<td>RA (High)</td>
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<tr>
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<tr>
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<tr>
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<tr>
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<tr>
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</tr>
<tr>
<td>MPA-RVOFT gradient</td>
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</tr>
<tr>
<td>BA</td>
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</tbody>
</table>

Key: SVC = superior vena cava, RA = right atrium, RV = right ventricle, MPA = main pulmonary artery, LPA = left pulmonary artery, RVOFT = right ventricular outflow tract, and BA = brachial artery.

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Reprint requests: Dr. Vladim Maranhao, Deborah Hospital, Browns Mills, New Jersey 08015