Repair of Aortopulmonary Window at Left Thoracotomy for Patent Ductus Arteriosus*

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The inability to differentiate accurately between patent ductus arteriosus and aortopulmonary window may occasionally result in finding an aortopulmonary window while prepared to close a patent ductus arteriosus at left thoracotomy. Anatomic and technical factors now allow aortopulmonary window closure from the left chest using surgical clips in certain selected cases. The successful repair of such a case is presented.

Aortopulmonary window is an uncommon but often challenging congenital defect of aortic septation. Authors have grouped various expressions of the anomaly by location of the defect. Current experience strongly supports repair using extracorporeal-circulation via median sternotomy. Despite increasing knowledge and awareness of aortopulmonary window, its diagnosis may not be established prior to operation or death. A recent patient of ours, who presented and was explored as a patent ductus arteriosus case, provided an opportunity to close the aortopulmonary window from the left chest using surgical clips.

CASE REPORT

An infant appeared healthy when born at term, weighing 7 lb 9 oz. At one week of age, a heart murmur was noted. By five months, when she weighed 12.5 lb, mild heart failure was evident. Examination revealed a grade 3/6 systolic murmur, machinery in quality, and loudest at the base. Brisk pedal pulses were present bilaterally. She was digitalized and had a good response. Right heart catheterization showed oxygen step-up in the main pulmonary artery and left pulmonary artery, with a Qp/Qs ratio of 2.5:1. Main pulmonary artery pressure was 38/20 mm Hg. Angiocardiogram showed normal anatomy of the pulmonary arteries and veins. Some washout of contrast was appreciated in the main pulmonary artery. With contrast entering the ascending aorta and arch, faint opacification of the pulmonary arteries was again noted. The inability to pass the catheter through the patent ductus arteriosus was observed. However, without a clear definition of the aortopulmonary window, patent ductus arteriosus was thought to be the most likely diagnosis.

At left thoracotomy, the ductal remnant was small, without associated thrill, but a prominent thrill was easily palpable along the distal main pulmonary artery. The ductus or ligamentum arteriosus was suture ligated. The pericardium was opened parallel to the phrenic nerve, exposing the main pulmonary artery and ascending aorta. The main pulmonary artery was retracted laterally with slight rotation, using a Moynihan clamp on the adventitia. Careful dissection exposed the aortopulmonary window located on the distal main pulmonary artery. It measured 6 to 7 mm in diameter and 4 to 5 mm in length (Fig 1). The window was clearly distal to the aortic valve and coronary ostia. Division of the window between ductus clamps appeared unwise due to the short length and location of the window.

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FIGURE 1. Exposure of the aortopulmonary window through a pericardial incision at left thoracotomy.

A medium-large (9-mm) Tantalum ligating clip (Ligacip, Ethicon, Inc) was selected, and two were carefully applied from the superior (cephalad) margin of the window. There was no bleeding, and the thrill disappeared. With closure, the radial artery diastolic pressure rose by 13 to 15 mm Hg. Postoperatively, she did well without murmur or heart failure. Chest roentgenograms are shown in Figure 2. Follow-up for 21 months after the operation has been uneventful.

DISCUSSION

In clinical practice, aortopulmonary window may be confused with patent ductus arteriosus because they both produce similar physiologic changes. This is especially so because aortopulmonary window is quite rare, and patent ductus arteriosus is relatively common. Further complicating the differential diagnosis between the two conditions is the frequent occurrence of associated cardiac anomalies. Thirty-five percent of patients with aortopulmonary windows have coexistent cardiac anomalies (patent ductus arteriosus in 11 percent), and 15 percent with patent ductus arteriosus have other cardiac anomalies (aortopulmonary window accounts for 1 percent). The importance of the differential diagnosis between aortopulmonary window and patent ductus arteriosus is reported by Richardson et al. Four of their eight patients with aortopulmonary window who had surgical repair of type 1 and 2 defects had previously undergone exploratory thoracotomy with an incorrect diagnosis. Only one of these four had a patent ductus arteriosus associated with the aortopulmonary window. Gross, who reported the first successful repair of aortopulmonary window in 1962, discovered the defect at left thoracotomy for patent ductus arteriosus, which was absent. The increased surgical treatment of patent ductus arteriosus in neonates without catheterization would appear to increase the frequency of exploring infants for patent ductus arteriosus only to find aortopulmonary window. Therefore, correction of aortopulmonary window, when possible at the time of left thoracotomy, would be especially helpful in reducing morbidity and providing immediate physiologic correction.

In analyzing our patient, two factors encouraged our attempting transthoracic repair of the aortopulmonary window. First, a history of only mild-to-moderate congestive heart failure, well controlled by digitalization, suggested a relatively small window. Second, the point of maximal thrill was in the distal main pulmonary artery. This implied a type 2
dissection then provided accurate assessment of the size and proximal extent and allowed safe closure with two large clips. The risk of bleeding was reduced by not using ligatures or encircling tapes.

The anatomic features of the "window" in our patient (ie, 4 to 5 mm in length, 6 to 7 mm in diameter) offered temptation to perform ligation. However, Gross encountered serious bleeding with his first successful ligation of an aortopulmonary window. Another report described massive hemorrhage with attempted ligation in one case. In this instance, a successful outcome was possible with cardiopulmonary bypass, which would be more complex via left thoracotomy, if available. Thus, the decision to close the window by clipping seemed reasonable, since it required limited dissection and was supported by the increased role of clips in vascular surgery. Use of the clip in closing patent ductus arteriosus in selected patients has been reported.8

Our early success in the management of this case using clips is not intended to suggest departure from repair using cardiopulmonary bypass as the primary treatment of choice.9 The large majority of aortopulmonary windows would not be suitable for clipping. Additionally, the long-term effects of clip closure are not known. Nevertheless, clipping of certain forms of aortopulmonary window can be safely performed. In those unusual instances where a neonate without prior heart catheterization is explored for patent ductus arteriosus and found to have aortopulmonary window, clipping may provide prompt relief, and its use should be considered. The decision to use clip closure requires individual judgment, weighing the simplicity, reduced morbidity, and immediate physiologic improvement against the technical problems imposed by the dimensions and location of the window.

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REFERENCES