Recently, Bhattacharyya and colleagues⁴ reported a case of decompression of an emphysematous bulla through a transbronchial aspiration needle. We considered this strategy to be unsuitable for our case because of the high risk of pneumothorax or bronchopleural fistula.

Finally, we considered using EBVs, which were designed for the treatment of emphysema and have been applied successfully for occlusion of bronchopleural¹ and bronchocutaneous⁵ fistulas. The EBVs work like a Heimlich valve, allowing escape of air and secretions from bulla at expiration (Figure 2, B) but preventing air inflow at inspiration (Figure 2, C), thus resulting in a redirection of airflow away from the blocked segments. The result is deflation of the GEB and the re-expansion of the more normal adjacent lung.

Our experience confirms that this noninvasive bronchoscopic treatment may represent a valuable alternative for patients who are poor surgical candidates. Bronchoscopic

EBV insertion is easily placed by a thoracic surgeon familiar with interventional endoscopic procedures, well tolerated, and easily removed if necessary. Large series and long-term trials are needed for adequate validation of the technique described.

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Right ventricular outflow tract reconstruction using a valved femoral vein homograft

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Restoration of right ventricle to pulmonary artery continuity in infancy and early childhood may require a conduit. However, appropriately sized pulmonary and aortic homografts in the range of 10 to 16 mm in diameter are frequently not available. Furthermore, pulmonary and aortic homografts are prone to early calcification, especially of the subvalvar muscle. They also require a hood of supplementary tissue, such as pericardium for the proximal anastomosis. We report our recent experience with the use of an alternative homograft that avoids many of these problems, namely, a valved segment of cryopreserved femoral vein homograft.

CLINICAL SUMMARY

Tetralogy of Fallot with pulmonary atresia was diagnosed in a 2-month-old girl weighing 5.7 kg, and she was scheduled for elective primary repair. Her central pulmonary ar-

teries were 3 mm in size. Because of the long-segment pulmonary atresia, interposition of a conduit was necessary; however, an appropriately sized aortic or pulmonary homograft (11–12 mm) was not available. After standard hypothermic cardiopulmonary bypass was established and cardioplegic arrest was achieved, a right ventriculotomy was made and the ventricular septal defect was closed in standard fashion. A 3-mm fenestration was made in the ventricular septal defect patch because of the small size of the pulmonary arteries and incomplete arborization in anticipation of high postoperative right ventricular pressure. An adult cryopreserved femoral vein homograft with diameter tapering from 16 to 11 mm (Cryolife Inc, Kensaw, GA) was chosen, thawed, and rinsed. The homograft was gently distended with the rinse solution, and a segment 11 to 12 mm in diameter and 4 cm in length containing a competent valve (Figure 1) was identified and cut from the 30 cm of vein available. By taking care to maintain the appropriate direction of flow through the graft, the distal anastomosis to the pulmonary artery was fashioned using continuous 6-0 polypropylene suture. After this, the proximal end of the graft was beveled and anastomosed to the right ventriculotomy using a running 5-0 polypropylene suture. No pericardial hood was necessary.

After the reconstruction, the patient was weaned easily from cardiopulmonary bypass and made an uneventful

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FIGURE 1. Distended femoral vein homograft (A) showing competent valve (white arrow) (direction of flow, black arrow) (B) and filleted to demonstrated valves (white arrows).

postoperative recovery. PredischARGE transthoracic echocardiogram revealed laminar flow through the conduit without any regurgitation or gradient across the valved homograft (Figure 2, A and B).

DISCUSSION

The search for an ideal homograft for right ventricular outflow tract reconstruction continues. An ideal conduit should be competent, be free of gradients, be resistant to calcification, not degenerate rapidly, be available in all sizes, and be inexpensive. Unfortunately, no such conduit is available. Pulmonary homografts have been the preferred conduits because of more rapid calcification of aortic homografts in this position in younger patients.^{1,2} However, appropriately sized pulmonary homografts for neonates and infants are not easily available, and early conduit failures are common with smaller sized pulmonary homografts.³ When larger sized homografts are used, delayed sternal closure may be needed to avoid significant conduit compression and hemodynamic compromise in

the early postoperative phase, which adds significantly to the morbidity. An alternative approach consists of downsizing large-sized homografts^{4,5} but adds to the operating time, and pulmonary regurgitation may occur.⁶ The thick arterial wall of large homografts is often unsuitable for anastomosis to fragile hypoplastic pulmonary arteries. Bovine internal jugular vein grafts (Contegra, Medtronic Inc, Minneapolis, Minn) have also been used⁷ but are glutaraldehyde preserved and more prone to accelerated calcification and degeneration, and may make the reoperation difficult.

Cryopreserved femoral vein homografts (Cryolife Inc) are marketed as segments 25 to 30 cm in length that taper from 10 mm at the inflow end to approximately 15 to 16 mm at the other end. On average, there are 2 to 3 valves. Therefore, it is almost always possible to obtain a valved segment of the desired size for smaller patients. The femoral vein is thin walled compared with the aortic or pulmonary homograft and is appropriate for anastomosing to small thin-walled pulmonary arteries. Absence of thick subvalvar muscle and

FIGURE 2. Parasternal short-axis view of right ventricular outflow tract showing laminar flow through the reconstructed right ventricular outflow tract (A) and absence of any pressure gradient across the conduit (B).

glutaraldehyde treatment may allow longer freedom from calcification. In addition, the vein homograft is significantly less expensive than valved pulmonary or aortic homografts.

CONCLUSIONS

Although no long-term information is available regarding performance of vein homografts in the application described, they have been used as alternative arterial conduits in infrainguinal vascular surgery⁸ with acceptable short-term results. Thus, we are encouraged to explore the suitability of these conduits in a pediatric application.

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