The Autologous Pericardial Valved Conduit for Right Ventricular Outflow Tract Reconstruction

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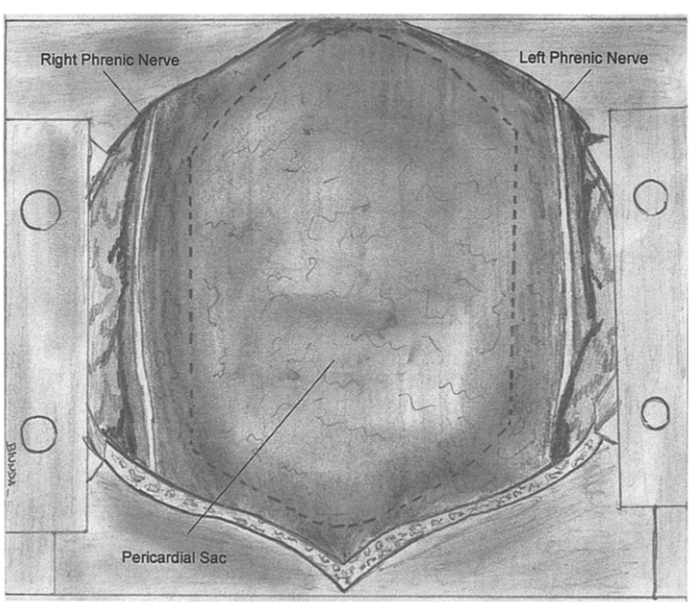
The repair of many complex congenital heart malformations requires the use of conduits to connect the venous ventricle to the pulmonary artery. After extensive experience with the use of pericardium for reconstruction of the right ventricular outflow tract in tetralogy of Fallot, since June 1983 we have been constructing a fresh autologous valved pericardial conduit to connect the venous ventricle with the pulmonary artery. The objective was and still is to reproduce the excellent long-term results of untreated autologous pericardial patches and unvalved conduits, obtaining adequate valve competence for the first postoperative months. Following our original description of the technique and further publication of the long-term follow-up results, this article will cover the technique of conduit construction.

SURGICAL TECHNIQUE

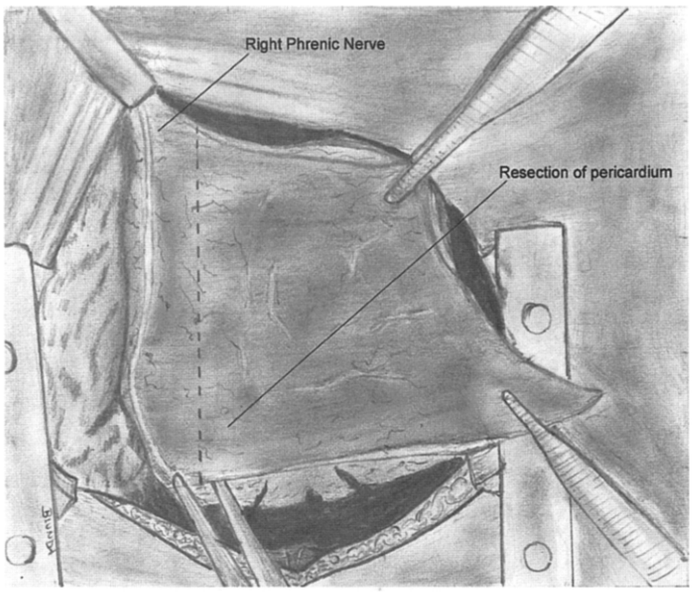


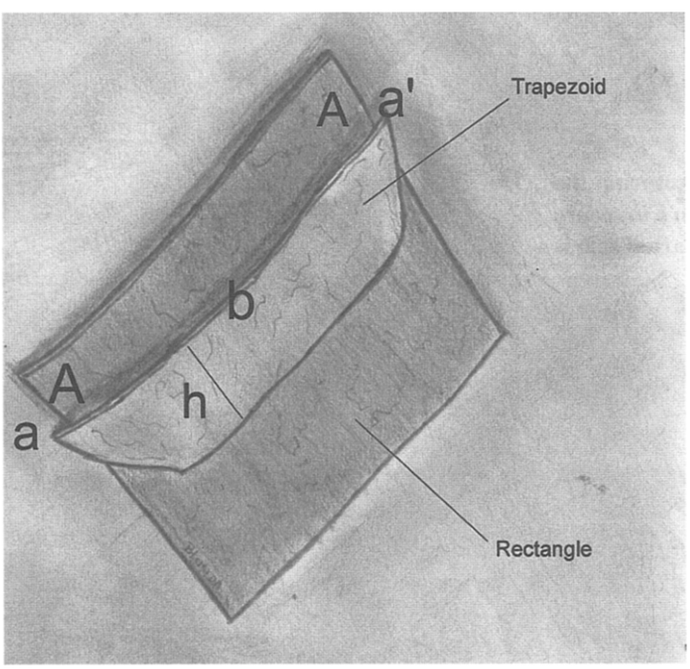
1 The patient is positioned on the operating table in the usual fashion for a classic midline sternotomy incision. After placing a modified Finochietto retractor to open the sternum, the thymus is excised and the pericardium is dissected free. With the aid of a ruler, measurements are performed to prepare a conduit according to the body surface area of the patient (Table 1).

Table 1. Size of The Pericardium Required According to The Selected Conduit Diameter

	Rectangle	Trapezoid		
Diameter (mm)	Width of Pericardium (mm) (A-A')	Height of Valves (mm) (h)	Lesser Base (mm)	Wider Base (mm) (a-a')
12.0	38.0	11.0	38.0	42.0
14.0	44.0	12.5	44.0	48.5
16.0	51.0	13.5	51.0	56.0
18.0	56.5	15.0	56.5	62.0
20.0	63.0	16.0	63.0	69.0

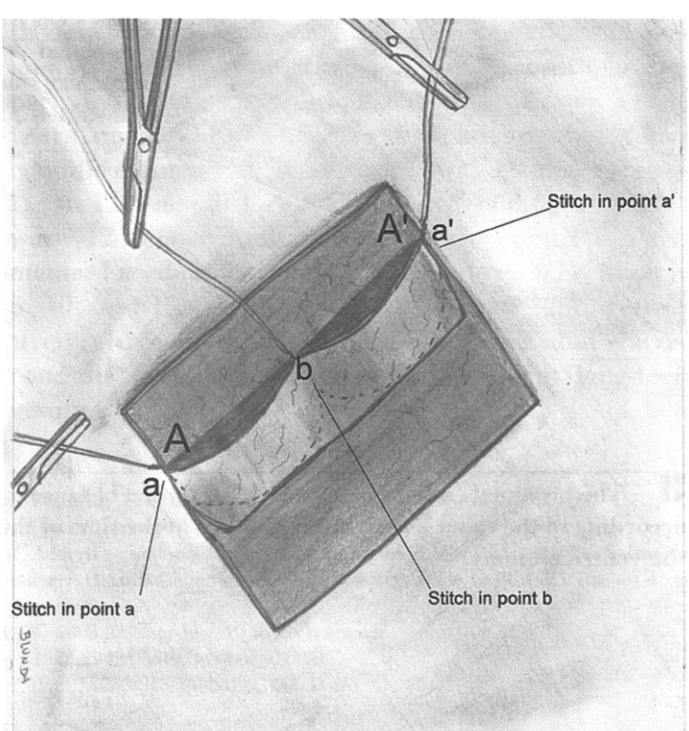
2 A rectangular piece of pericardium is resected with meticulous care to avoid injury to the right or left phrenic nerves. The serous layer of the pericardium will be the inner surface and the fibrous layer the external aspects of the conduit.

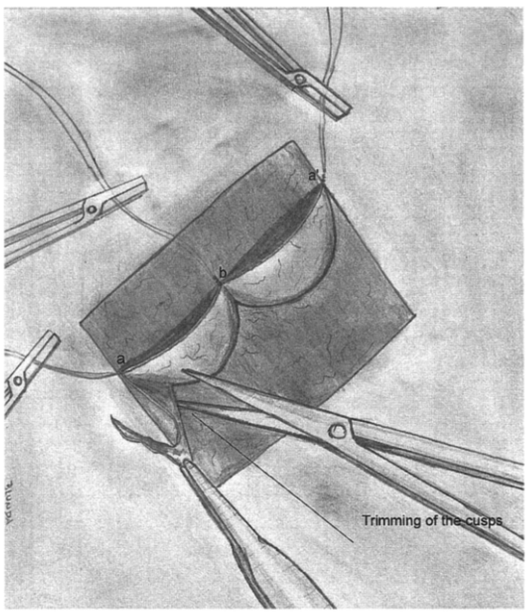




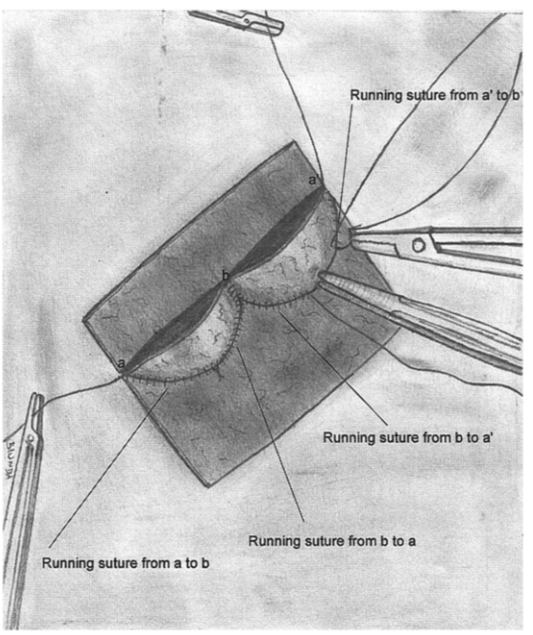
3 The harvested pericardium is positioned on a wet drape and is trimmed into 2 different geometric forms: a rectangle (the future conduit) and a trapezoid (the future bicuspid valve). The length of the rectangle is the measured distance from the pulmonary artery to the ventriculotomy. The rectangle is secured to the wet drape with 4 stay stitches at the angles. The trapezoid is superimposed on the rectangle, with its longer base (a -a') placed 5 to 6 mm below the distal end of the rectangle. As a rule, the longer base of the trapezoid is always 10% longer than the base of the rectangle.

4 The trapezoid (valve) is secured to the rectangle at 3 different points with 6-0 polypropylene sutures. The serosal surface of the cusps is oriented to the sinuses. Two stitches join a and a′ with A and A′ at both lateral ends, and a third stitch is placed in the exact middle of both pericardial pieces at point b.

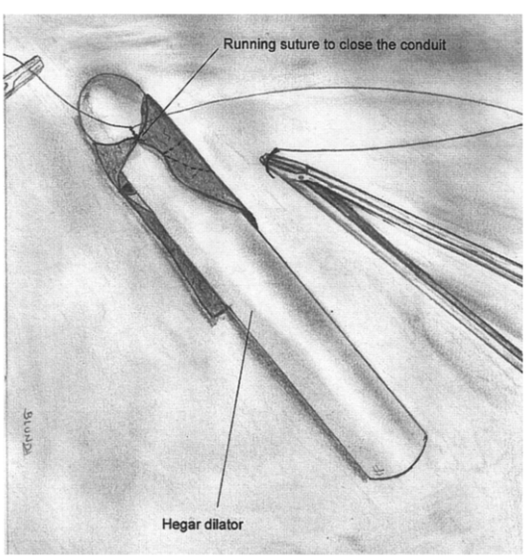




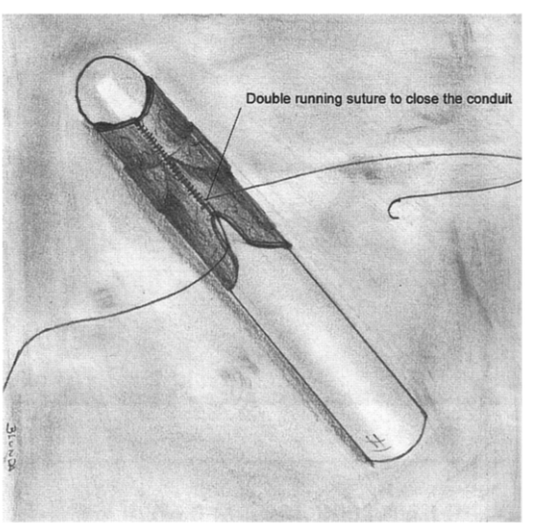
5 The trapezoid is then trimmed. Three small triangular pieces are excised to achieve 2 semilunar cusps, leaving intact the union of both in a length of 4 mm.



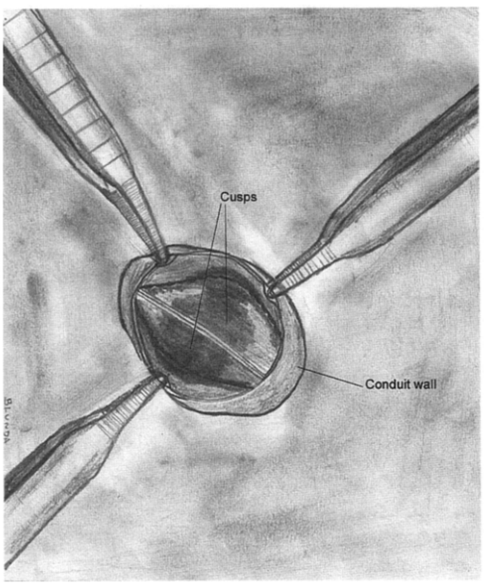
6 The running suture is performed starting from *A* and *A'*, suturing the trapezoid to the edge of the rectangle in the first 3 mm, and then from *b* to secure the cusps to the rectangle. Note that the first 4 mm of the suture started at *b* is double.



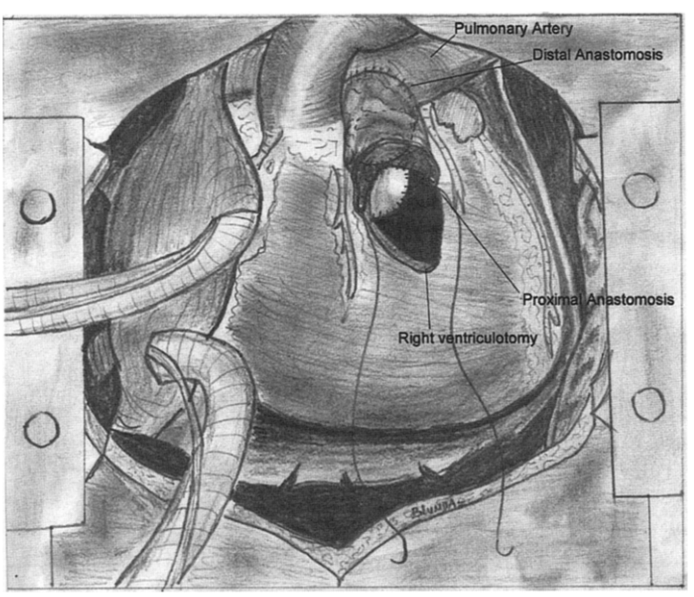
7 Once the valve is constructed, a Hegar dilator of the selected conduit diameter is placed over the pericardial rectangle with the cusps. A 6-0 polypropylene double-running suture is then performed from the distal to the proximal end. This suture is started 2 mm from the distal end to leave a wider distal anastomotic orifice.



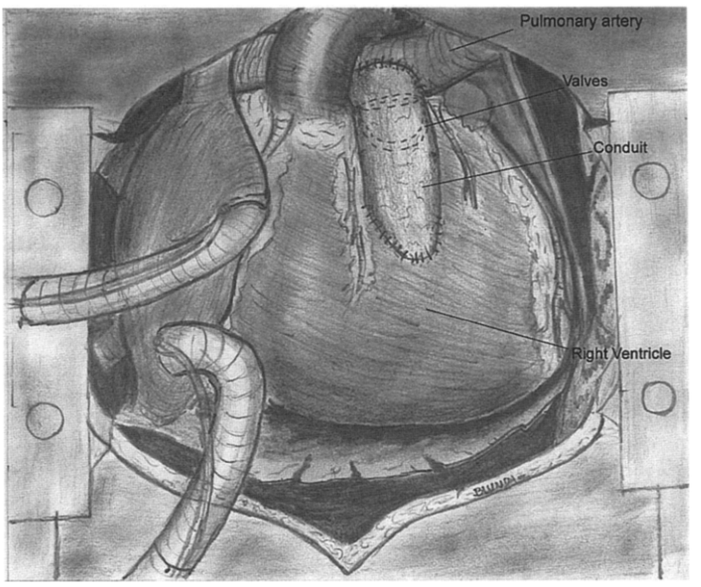
8 The proximal end of this suture is left untied because it will be adjusted according to the exact length of the conduit at the time of the anastomosis to the ventriculotomy.



9 The valve function is tested with flushes of normal saline, and the conduit is ready for implantation.



10 Once the intracardiac repair is completed, the distal end of the conduit is sutured to the pulmonary artery with 6-0 polydioxanone suture. This is interrupted in the 4 quadrants and tied over the Hegar dilator to prevent distal end narrowing. During the first 3 years of our experience to 1986, distal narrowing at the time of tying the sutures was the cause for distal stenosis. Since 1986, we have increased the width of the distal end of the pericardial rectangle by 4 mm, thus obtaining a wider anastomotic orifice.



11 The proximal end of the conduit is then sutured to the ventriculotomy. In only 3 cases was a polytetra fluora ethylene hood added to achieve an anastomosis without tension.

SUMMARY

Between June 1983 and December 2002, 138 autologous pericardial conduits were placed in the pulmonary position. Diagnosis included D-transposition of great arteries (n = 45 patients), truncus arteriosus (n = 30), L-transposition of great arteries (n = 28), tetralogy of Fallot, pulmonary atresia with ventricular septal defect (n = 25), and double-outlet ventricle (n = 10). Implantation age ranged from 15 days to 24 years (mean 2.9 years). Median conduit diameter was 15 mm. There were 19 (13.7%) early deaths. Of the patients, 29% had trivial, 59% mild, 9% moderate, and 3% severe pulmonary regurgitation during the early postoperative period. The 119 survivors were monitored from 1 to 19 years (mean 9.8). There were 6 late deaths. Mean conduit diameter at implantation was 16 mm, increasing to 17.9 mm at last evaluation ($P < 0.0001$). There were 12 reoperations, with only 3 conduit replacements. Freedom from conduit related reintervention at 5, 10, and 15 years was 90%, 81%, and 77%, respectively. In conclusion, autologous pericardial valved conduits provide good early and excellent long-term results.

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