

THE ROSS PROCEDURE

Excise Pulmonary Valve... Pulmonary Valve To Aorta... Homograft To Pulmonary Artery...



Figure 1. Principles of the operative procedure.

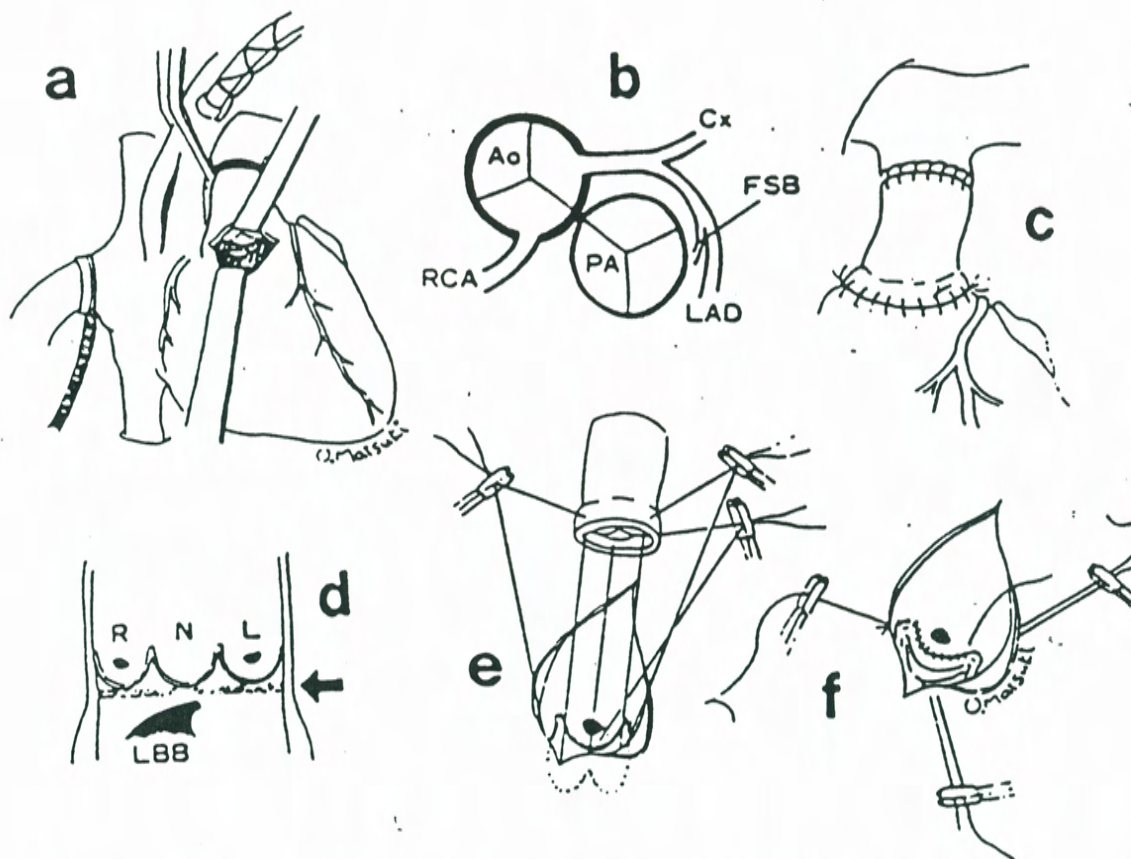
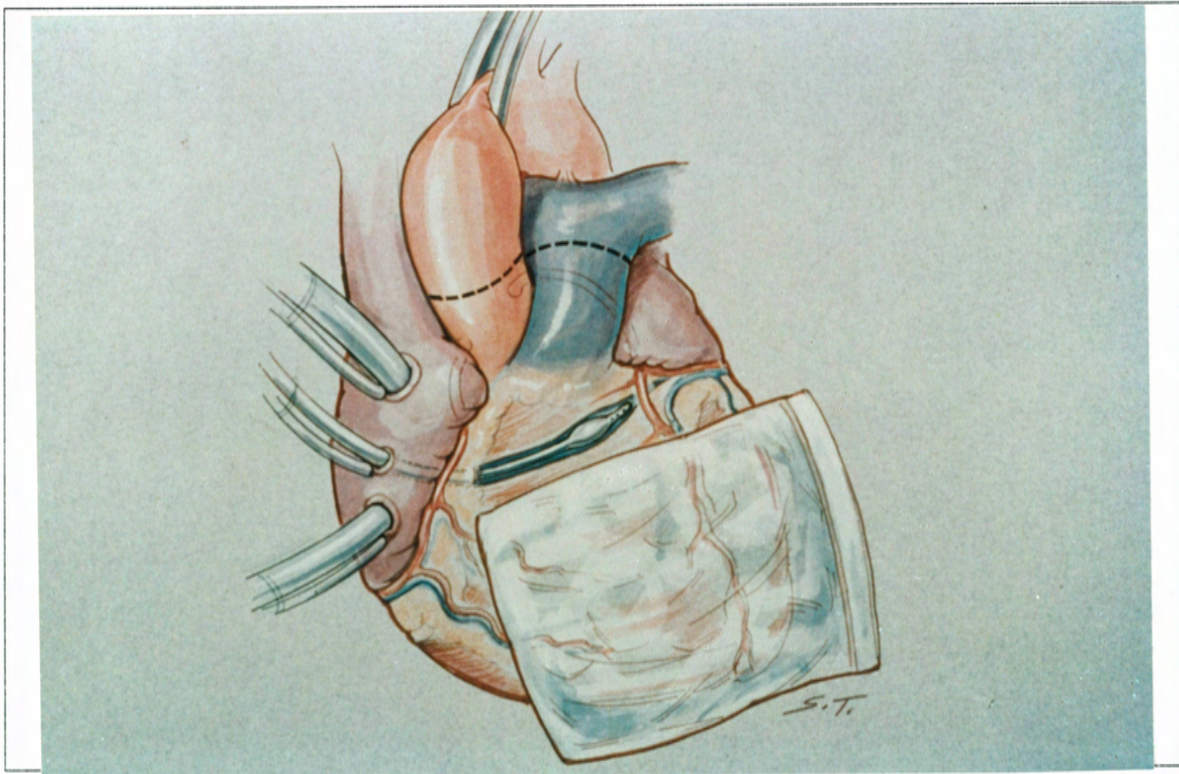
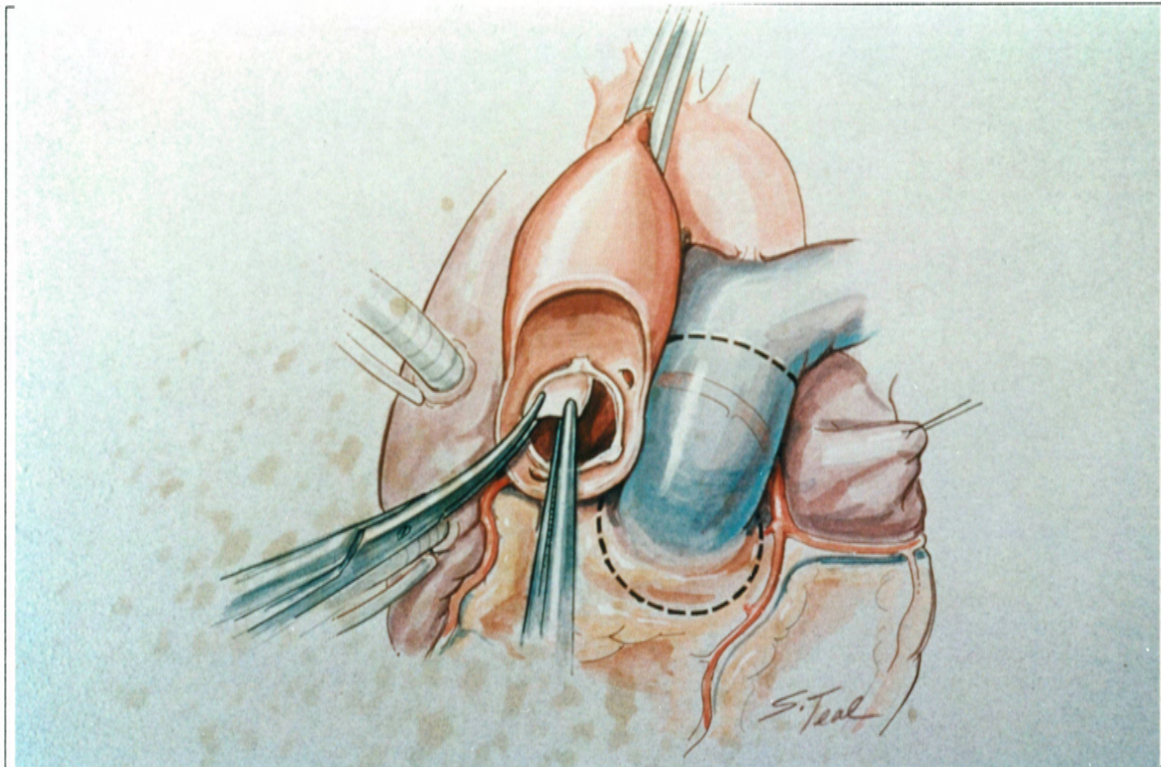


Figure 2. Technique. a. Enucleation of the valve pulmonary artery already transected. b. The first septal branch of the left anterior descending runs close to the pulmonary valve root. c. Pulmonary homograft inserted with locking continuous sutures distally. d. Line of insertion of the autograft along the base of the sinuses and above the conducting tissue. e, f. Multiple interrupted sutures along lower margin and a continuous suture above skirting the coronary orifices.

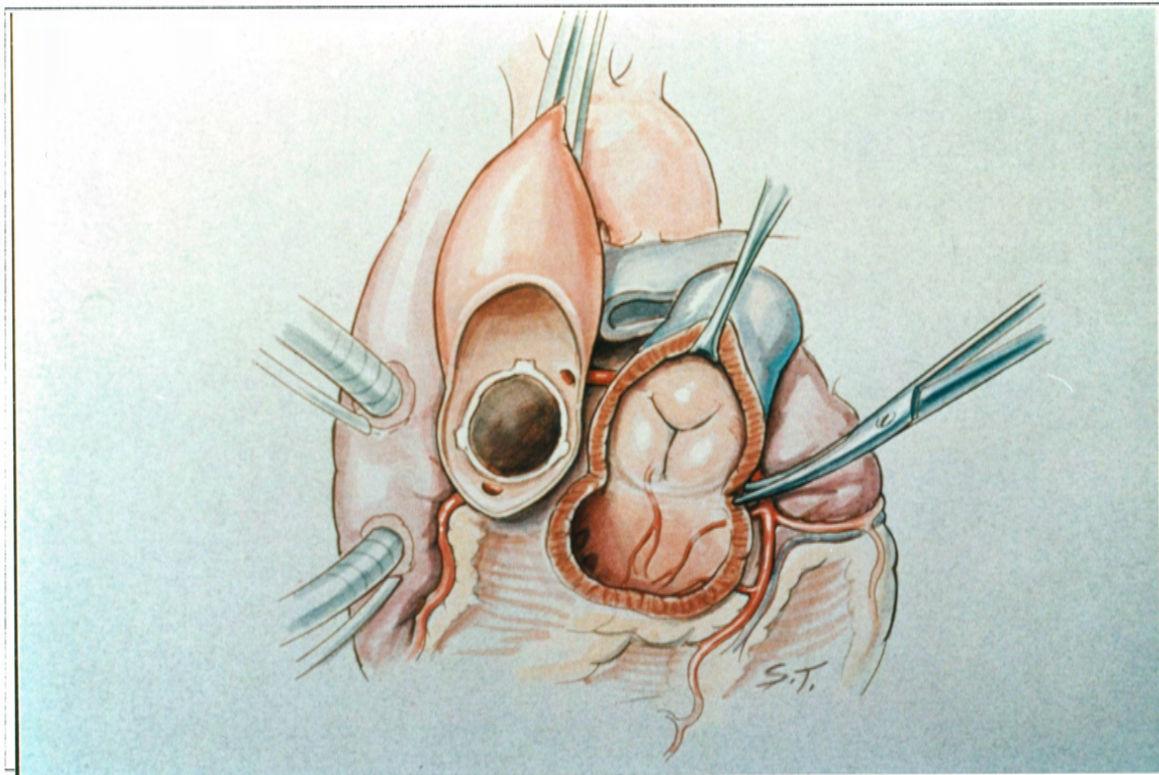
Preparation for the pulmonary autograft "root replacement" requires bi-caval cannulation, placement of a retrograde cardioplegia cannula, and aortic cannulation near the takeoff of the innominate artery. The great vessels are separated with the proposed transection lines as depicted. Following initiation of cardiopulmonary bypass, systemic cooling is initiated and additional separation of the aorta and pulmonary artery can be performed with a low level cautery. The right coronary artery is identified and can be partially dissected circumferentially. Limited amount of dissection around the left coronary is performed so as not to injure the vessel. Following systemic cooling, hyperthermic cardiac arrest is induced.



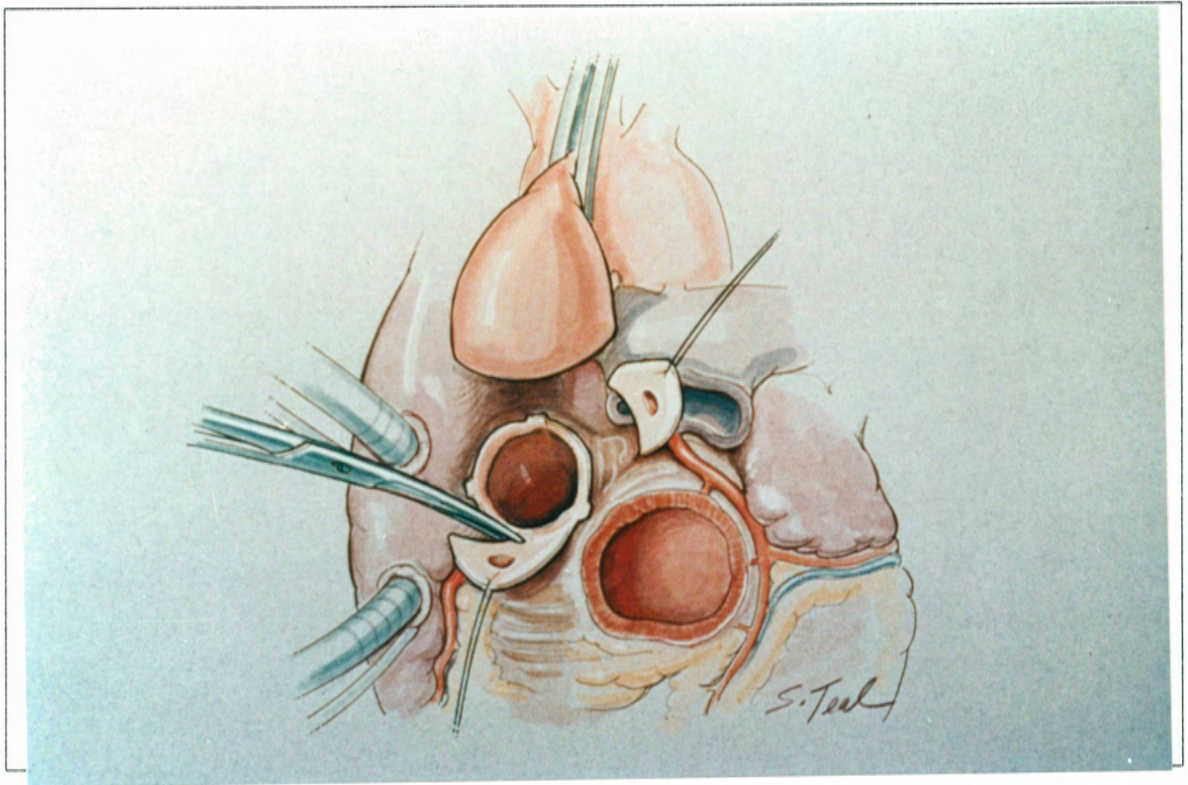
Following completion of cardioplegic infusion, a transverse aortotomy is performed just superior to the level of the valve. The valve and coronary ostia are both inspected and the valve leaflet is then excised leaving very little residual leaflet tissue. The subvalvar area is assessed to rule out any unsuspected left ventricular out-flow tract obstruction. Attention is then turned to the pulmonary artery and a transverse transection is performed just proximal to the bifurcation. Following this, the pulmonary valve can be easily assessed for suitability. Non-stenotic bicuspid valves and valves with few and isolated fenestrations are felt to be suitable for use. Calcification or moderate or larger fenestrations are felt to be incompatible with an acceptable pulmonary autograft.



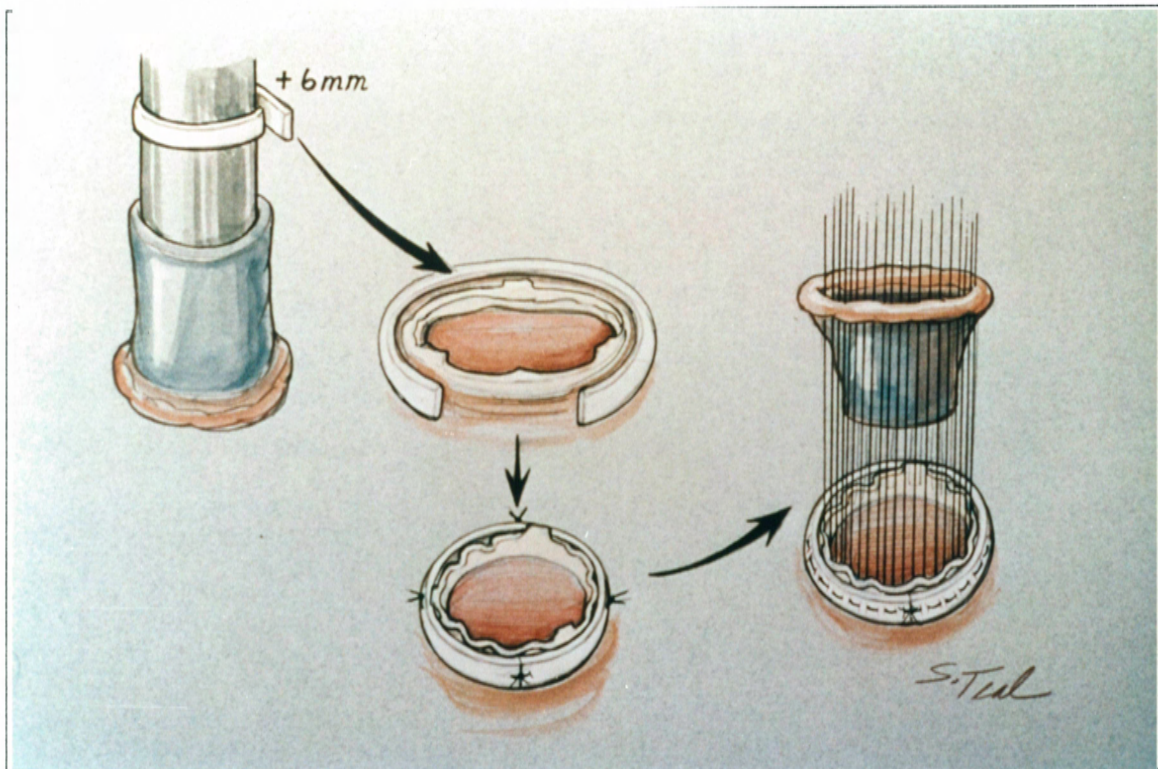
The pulmonary autograft is retracted anteriorly and the left main coronary artery is circumferentially dissected around its origin. The left main and proximal left anterior descending arteries are then identified and a small fat pad between the pulmonary artery and the LAD is carefully dissected with low level cautery. Care is taken to identify the first and possibly second septal perforators. The interface between the right ventricular muscle and septal muscle is identified and then the pulmonary autograft is completely mobilized to the base of the aorta. A transverse incision is made in the right ventricular free wall 5 to 8 mm below the pulmonary annulus. The muscle is sharply divided using tenotomy scissors and particular care is taken near the left anterior descending artery. At this level, the incision is somewhat in a tangential plane so as not to injure the septal perforators. With careful dissection, one will find that the right ventricular muscle will separate from the septal muscle leaving a nice uniform cuff on the pulmonary autograft posteriorly. The circumferential incision is complete and the autograft is sized with a Hegar dilator to determine the annular size. The autograft is then placed in the dependent portion of the pericardium to be bathed with cold blood.



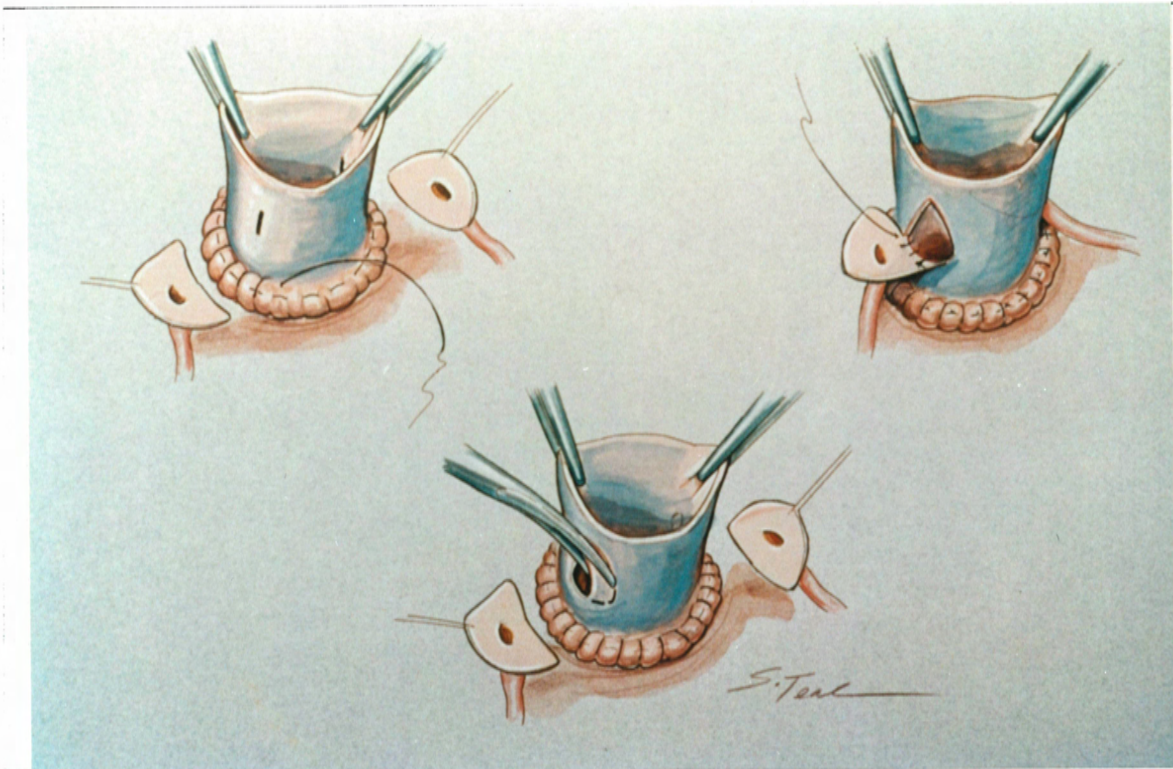
The coronary ostia are cut out on buttons of aortic wall tissue and the remaining aorta is excised. Generally, we like to leave 3 to 4 mm of aortic wall in place in order to anchor a second hemostatic suture line. The tops of the commissures are cut off in order to establish an essentially circular annular configuration.



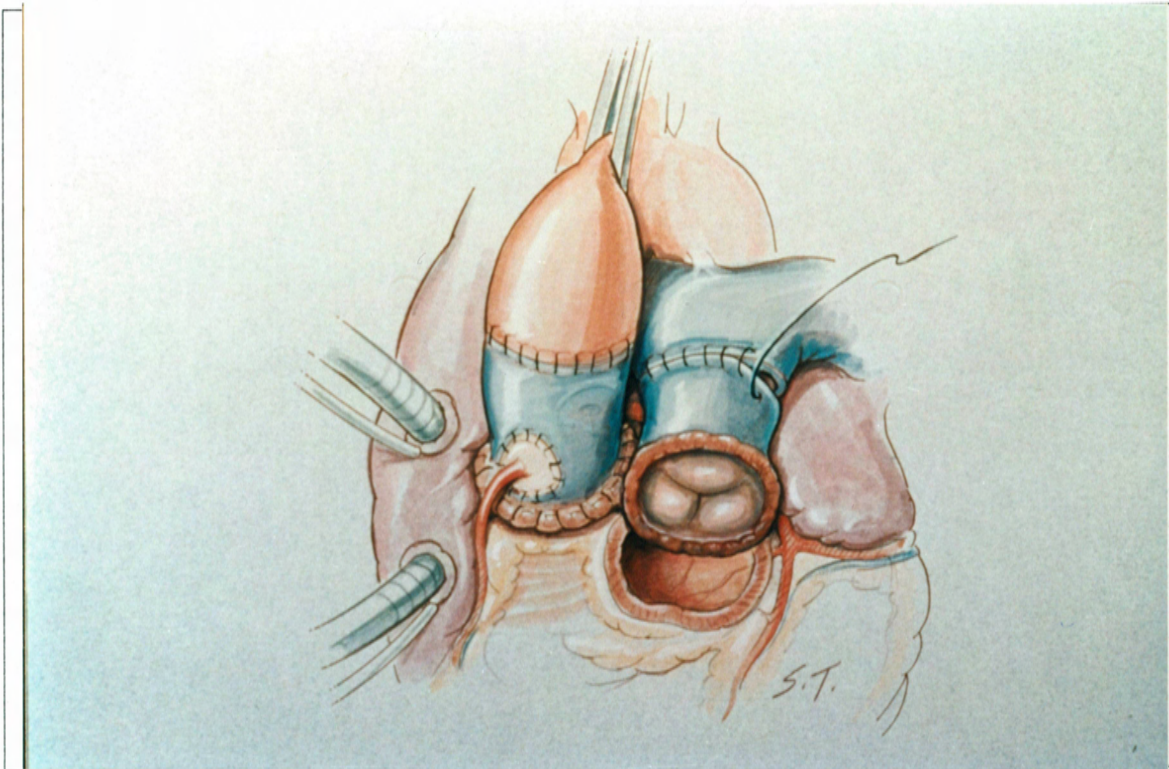
If there is annular size discrepancy, the aortic annulus can be downsized by using a Teflon felt strip approximately 6 mm longer than the estimated annular diameter of the pulmonary autograft. This felt is anchored into position by four quadrant sutures. It is currently our technique to use interrupted pledgeted horizontal mattress sutures placed through the outside of the aorto/annular area and the sutures are then passed through the base of the pulmonary autograft. The autograft is inverted into the left ventricular outflow tract and the sutures tied. A second row using 4-0 or 5-0 monofilament suture is used to run the edge of the pulmonary autograft to the residual aortic wall as a hemostatic stitch.



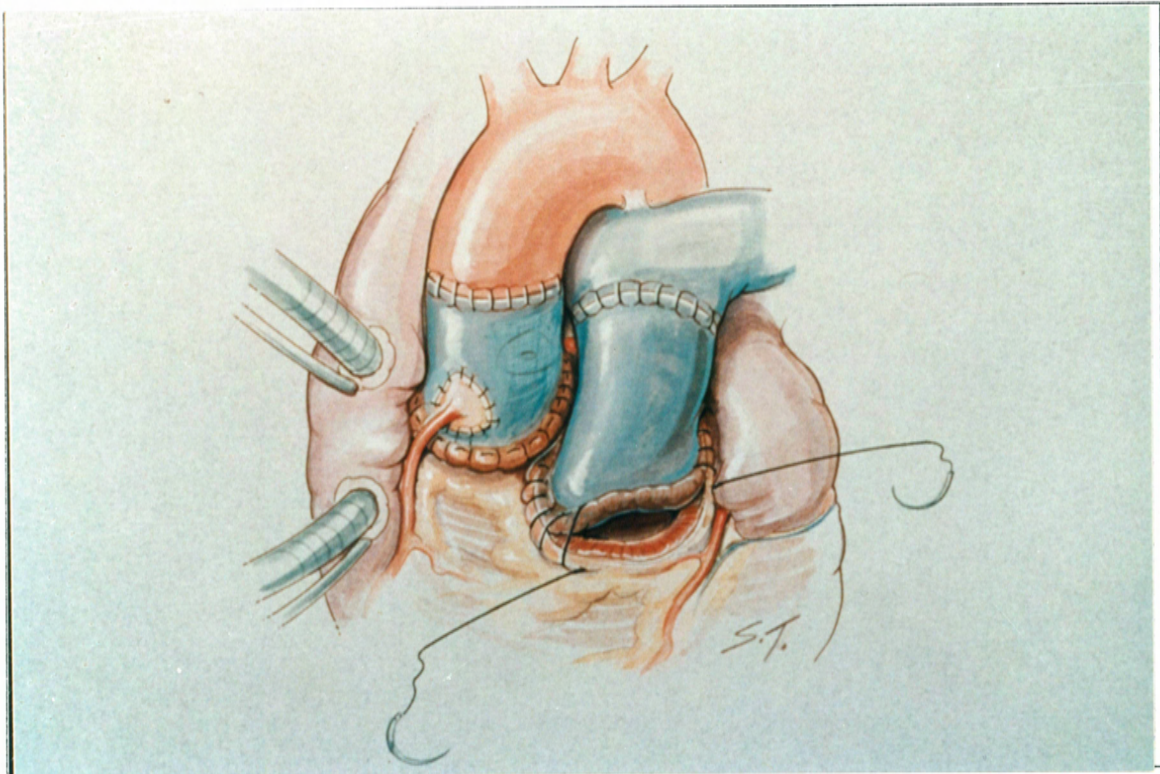
The autograft is then withdrawn from the left ventricular outflow tract and the valve assessed. The autograft generally requires a 60 to 90 degree clockwise rotation with implantation in order to position a valve sinus anteriorly. A corresponding valve sinus will then match up with the left coronary artery. A small aortotomy for the left coronary button is made just superior to the suture line. This is opened with an aortic punch to an appropriate size. The coronary cuff is then anastomosed to the autograft with continuous running 5-0 monofilament suture. The distal aortic anastomosis may then be performed with subsequent implantation of the right coronary cuff or vice-versa.



An appropriate size pulmonary homograft is then prepared in standard fashion. We prefer to over size the pulmonary homografts relative to the size of the patient's native pulmonary valve. The pulmonary homograft is transected at the pulmonary bifurcation and the distal anastomosis is performed with continuous running 4-0 monofilament suture technique. This is easier done with the heart still arrested. The retrograde cardioplegia is again used to identify any final bleeding points in the posterior dissection plane near the coronary artery.



The proximal homograft suture line is initiated posteriorly with a 3-0 monofilament suture. This is carefully passed through the right ventricular septum so as not to gather up any septal perforators. Following completion of the posterior suture line, the cross clamp is removed and systemic re-warming initiated. The suture line is then completed anteriorly as shown.



The Completed Procedure

