Pulmonary valve allografts have been used successfully to reconstruct or repair the right ventricular outflow tract in a variety of pediatric cardiac conditions. One of the most attractive features of pulmonary allografts is their versatility. Allografts are available in a wide variety of sizes and are relatively easy to implant because the tissue is characteristically pliable. Allografts can be placed in critically ill neonates and infants for whom there are limited surgical options but whose congenital defects require surgical attention. Pulmonary allografts are used as a simple valved conduit to replace an existing right ventricular outflow tract as in a pulmonary allograft procedure, or in the presence of pulmonary stenosis, tetralogy of Fallot, or isolated pulmonary valvar atresia. Bifurcated pulmonary allografts can be used to repair stenosis or hypoplasia of the distal main, left and right pulmonary arteries. Complex repairs that involve de novo creation of a functional right ventricular outflow such as with truncus arteriosus, complex pulmonary atresia, transposition of the great arteries, or double outlet right ventricle are also treatable with allograft placement. Pulmonary allografts are hemodynamically more efficient than mechanical prostheses, do not require anticoagulation that can be problematic in an active pediatric patient and are proving more durable than other bioprostheses in most patients.

Right Ventricular Outflow Tract Replacement with the Pulmonary Autograft Procedure

The simplest right ventricular outflow tract procedure that uses a pulmonary allograft is a required consequence of pulmonary autograft replacement of the aortic valve. The technique was first described by Ross in 1967 and includes excision and transplantation of the native pulmonary valve and varied lengths of proximal main pulmonary artery, into the left ventricular outflow tract using one of several techniques. Use of the Ross procedure is based on the premise that the best available aortic valve replacement is autologous tissue that is resistant to calcification and degeneration and can likely grow. In theory, allograft implantation into the lower pressure right side of the heart should result in a decreased incidence of degeneration and less severe consequences of failure than with a left sided implant. Originally, Ross described the use of an aortic allograft to reconstruct the right ventricular outflow tract but more recently, a pulmonary allograft valve conduit is preferred.

Indications
The pulmonary autograft is a surgical alternative for children with congenital anomalies of
the aortic valve and/or left ventricular outflow tract that are not amenable to balloon valvuloplasty or surgical valvotomy. Recent implementation of the autograft procedure as an aortic root replacement has expanded indications for the procedure to include the presence of endocarditis as well as various aortic root pathologies such as aneurysm, dissection and multiple level obstruction that previously were considered contraindications. The pulmonary autograft is not advised in the presence of native pulmonary valve dysfunction, annuloaortic ectasia, Marfan’s syndrome, or autoimmune disease.

Perioperative Issues

The appropriate size pulmonary allograft can be determined by patient weight prior to surgery as illustrated in Figure 55.1. In most cases, an acceptable range of sizes is estimated. An allograft oversized by 2 mm to 3 mm is preferred with the pulmonary autograft procedure. Because the ABO compatibility issue remains unresolved, donor-recipient blood type specificity or compatibility is maintained when possible. During initial phases of the surgical procedure, the chosen cryopreserved pulmonary allograft is thawed according to processing recommendations. Enclosed in a triple pouch, the allograft valve is submersed in a 37°C to 42°C waterbath until all ice crystals are dissolved. Thawing usually takes 15 to 22 minutes. The outer pouch is dried and cut open with scissors. The second pouch is peeled open to expose the inner pouch that is passed aseptically onto the sterile field. The third pouch is cut open and the allograft is extracted and placed into a sterile basin that contains one liter of 5% dextrose and lactated Ringer’s. The allograft is allowed to passively soak for a minimum of five minutes to dilute the dimethylsulfoxide and is then ready for implantation.

Surgical Technique

Right ventricular outflow tract reconstruction with a pulmonary allograft is the final step of the pulmonary autograft procedure. Through a median sternotomy, cardiopulmonary bypass is instituted. The diseased aortic valve is excised, the native pulmonary valve and artery are

![Figure 55.1. Before surgery, a range of appropriate pulmonary allograft sizes can be determined by patient weight.](image-url)