Nonsurgical Closure of Secundum Atrial Septal Defects in Adults and Children Using the Amplatzer Device

Secundum atrial septal defect (ASD), a communication between the upper chambers (right and left atria) of the heart, accounts for approximately 10 percent of all forms of congenital heart disease. It can be an incidental finding in children and young adults and can cause shortness of breath, congestive heart failure, and pulmonary vascular obstructive disease in adults.

Surgery for ASD using a midsternotomy approach is safe, with very low mortality (<1 percent). However, patients experience significant morbidity (scar, hospitalization for 3 to 5 days, pericardial effusion, and post-pericardiotomy syndrome) and the closure rate is not 100 percent.

The era of nonsurgical transcatheter closure of ASD began in 1975 when King and Mills reported on the use of double umbrellas to close a hole in a 17-year-old young adult. The large introducer size needed to insert the umbrella (22F) precluded the use of this device in most pediatric patients; however, the feasibility of nonsurgical closure of ASD was demonstrated. Subsequently, several devices...
have been used to close the ASD, including the clamshell umbrella, button device, and Angel Wings. The major drawbacks of these devices include a high incidence of residual shunt, cumbersome delivery systems, and the need for large delivery catheters.

To overcome such limitations, Amplatz developed a device with many favorable characteristics. The Amplatzer septal occluder is user- and patient-friendly; features a small delivery catheter; allows a high rate of complete closure; may be retrieved and repositioned prior to release from the cable; and does not create long-term morbidity from the presence of the device inside the heart. The device (see Figure 1, page 1) is made from nitinol wire and consists of two flat disks and a connecting waist. It is available in many different sizes, from 4 to 38 mm. The device size is dictated by the size of the connecting waist. The device requires a 7 to 12F sheath for delivery. At the University of Chicago Children's Hospital, my colleagues and I currently are using the Amplatzer septal occluder under a US Food and Drug Administration protocol.

Patients whose secundum ASD measures less than 34 mm, as diagnosed by transthoracic echocardiogram, are eligible to undergo ASD closure using the Amplatzer septal occluder. To be 100 percent certain of the eligibility of the ASD, we recommend a transesophageal echocardiogram (TEE) either before or at the time of closure. The procedure is performed under general endotracheal anesthesia with continuous TEE monitoring. The femoral vein is accessed and a line in the femoral artery is placed for arterial monitoring. Routine heart catheterization is performed to assess the pressures in the heart and lung and the amount of shunt is calculated. Angiography is performed to assess the location of the ASD and profile the atrial septum. One important step in the procedure is to accurately measure the "stretched" diameter of the ASD. Then the proper size device (either equal to or 1 to 2 mm larger than the stretched diameter) is chosen. The device is screwed on the cable and introduced in the sheath.

Deployment of the device is done under fluoroscopic and TEE guidance. The left atrial disc is deployed in the left atrium and the waist is deployed in the ASD itself, in essence to stent the defect. The right atrial disc then is deployed in the right atrium. Up to this point, the procedure is totally reversible. To ensure proper device position, the device is wiggled forward and backward (Minnesota wiggle). Stable device position is confirmed by the absence of device movement in either direction. Once proper device position is confirmed, the cable is turned counterclockwise. TEE is performed after the device is released to assess device position and any degree of residual shunting. An angiogram with pulmonary levophase is performed in the right atrium to assess device position and any residual shunt. Figure 2 is an example of a 27-year-old patient with a large ASD (measuring approximately 23 mm) and congestive heart failure. This ASD was closed completely using a 32 mm Amplatzer septal occluder device.

After ensuring complete closure, catheters are removed and hemostasis is achieved with a bandage. The procedure takes an average of 4 to 7
I have performed more than 270 nonsurgical closures of ASD in children and adults using the Amplatzer septal occluder. The patients range in age from 5 months to 87.5 years and in weight from 5.4 to 120 kg. The immediate complete closure rate is 80 percent, and within 24 hours the complete closure rate is 95 percent. At 6 months following the procedure the success rate is greater than 97 percent. Our complication rate is very low (only 3 patients out of 270 had complications). In 2, the device embolized after release; in both we were able to retrieve the device and successfully place two devices during a separate procedure. The third patient experienced a problem with the electrical system of the heart, which was treated effectively.

We have taught this technique to physicians in the United States and abroad. The device (or a modification thereof) also can be applied in some patients who experienced a stroke due to a passage of clot from the right atrium to the left atrium through a patent foramen ovale.

References