Modified technique for Melody valve implantation in the mitral position

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Surgical options for children with irreparable mitral valve (MV) disease are limited, consisting primarily of fixed-diameter valves or homografts that cannot grow, have poor longevity, or require anticoagulation. To avoid these problems, multiple groups have reported surgically implanting transcatheter valves in the mitral position.¹⁻⁴ The most widely used is the Melody valve (Medtronic Inc, Parsippany, NJ), a stented, valved bovine jugular vein graft. Because of its design, specifically its length, the Melody valve presents unique challenges when used for MV replacement, including left ventricular outflow tract (LVOT) and pulmonary vein (PV) obstruction. We present a modified technique for Melody valve implantation in the mitral position that simplifies previous techniques and minimizes these complications.

SURGICAL TECHNIQUE

We implanted 4 Melody valves with the distal stent fixed to the mitral annulus and the remainder of the device within the left atrium (Figure 1). To do this, the proximal and distal portions of the stent are folded to achieve a device length of 18 to 20 mm. With interrupted sutures, a CorMatrix (Aziyo Biologics, Silver Spring, Md) or Cardiocel (Admedus, Eagan, Minn) skirt is secured to the distal end of the stent as a sewing cuff, taking care not to injure the leaflets. The patient's left atrium is opened through the Sondergaard groove, and the MV and subvalvular apparatus are resected. Then 5-0 polypropylene, nonpledgeted mattress sutures are passed through the mitral annulus and the sewing cuff, taking care not to catch any component of the valve apparatus. The valve is then partially expanded, tied in place, and balloon dilated to the desired final diameter. This is determined by adding 3 mm to the native valve annular diameter, as measured intraoperatively with Amato dilators. Potential

"High-riding" Melody valve with folded ends and distal end affixed to the mitral annulus.

Central Message

Mitral valve replacement with a Melody valve has unique advantages and technical challenges. We present a simplified technique that minimizes the risk of outflow tract or pulmonary vein obstruction.

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PV obstruction is avoided by augmenting the left atrium with CorMatrix or Cardiocel. Finally, we create a small atrial septal defect, as posterior as possible, to allow percutaneous balloon dilation of the valve.

CLINICAL SUMMARY

Patient characteristics are presented in Table 1. All patients underwent MV replacement as described. There were no instances of significant paravalvular leakage, nor

FIGURE 1. Transesophageal echocardiogram of a "high-riding" Melody valve in the mitral position. Arrow highlights valve prosthesis.

TABLE 1. Patient characteristics

Case	Sex	Age (mo)	Weight (kg)	Surgical indication	Prior operations	CPB time (min)	XC time (min)	Final valve diameter (mm)	Paravalvular leak	Transvalvular gradient (mm Hg)	Central mitral regurgitation
1	M	2	5.6	Arcade MV, moderate MR, severe MS	MV repair	102	73	16	None	6	Trace-mild
2	M	12	7.3	Shone complex, severe MR/MS	Stage I palliation with RV-PA conduit, DKS takedown with Ross-Konno and MV plasty	107	73	18	None	3.5	Mild
3	M	4	5.5	Dysplastic MV, severe MR	None	189	137	18	None	6	Mild
4	M	28	13.2	Shone complex, severe MR/MS	MV repair + aortic arch plasty	98	72	20	None	4	None

Reported transvalvular gradients and degree of central mitral regurgitation are from each patient's most recent follow-up echocardiogram. CPB, Cardiopulmonary bypass; XC, aortic crossclamp; MV, mitral valve; MR, mitral regurgitation; MS, mitral stenosis; RV, right ventricle; PA, pulmonary artery; DKS, Damus-Kaye-Stansel.

any of LVOT or PV obstruction. All patients were given daily aspirin on postoperative day 1, which continued after discharge. Patient 1 required slow weaning from inotropic support and inhaled nitric oxide as a result of severe preoperative pulmonary hypertension but was successfully discharged home on room air on postoperative day 25. Patients 2, 3, and 4 were discharged home without supplemental oxygen after uneventful postoperative courses on postoperative days 17, 10, and 10, respectively. After 6, 5, 2, and 1 months, for patients 1 through 4 respectively, follow-up echocardiograms showed no significant change in valve function.

DISCUSSION

In children who require MV replacement, the Melody valve is an attractive option because of the potential for balloon expansion during childhood growth and the avoidance of anticoagulation. This valve can obstruct the LVOT or PVs, however, especially in small children or those with small cardiac chambers. Here we report a modified procedure that we believe is applicable to all patients because of several important differences from previously described techniques. In their reports, the Boston group avoided LVOT obstruction by suturing the distal stent to the posterior left ventricular wall, trimming the crown of the device, or incising the LVOT-facing valve sinus.^{2,5} Although effective, these steps complicate valve implantation and carry potential dangers, including suture rupture with subsequent LVOT obstruction and damage to the Melody device. For all patients, regardless of chamber size, we shorten the device by folding the stent, which is effective and avoids potential valve damage.³ Furthermore, by implanting the device entirely within the left atrium, we avoid LVOT obstruction. This “high-riding” implantation

has not caused significant movement of the prosthesis during the cardiac cycle or any significant paravalvular leakage. Patch augmentation of the left atrium is technically straightforward and prevents obstruction of valve inflow by the atrial wall or PV obstruction by the valve itself, so we believe that this technique is applicable even in patients with small left-sided chambers. We have not yet, however, used this technique in a neonate with a purely stenotic MV and small left atrium. Long-term follow-up is warranted to assess the impact of this “high-riding” implantation on the potential for further transcatheter balloon dilation.

CONCLUSIONS

A “high-riding” implantation of the Melody valve, along with left atrial patch augmentation, preserves the important advantages of the Melody valve in the mitral position while simplifying the overall procedure and avoiding potential LVOT and PV obstruction. This modified technique is an additional option for surgeons when faced with the challenge of MV replacement in small children.

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