Rare life-threatening complication of device closure of ventricular septal defect in a child

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Devices are being increasingly used for closure of ventricular septal defects (VSD) in children.^{1,2} We describe a rare but catastrophic complication of a VSD closure device in a child that manifested as recurrent flash pulmonary edema in the postoperative period after hybrid implantation in the operating room.

CLINICAL SUMMARY

A 13-month-old child, weighing 5.8 kg and with a diagnosis of partial atrioventricular canal and multiple apical muscular VSDs was seen for surgical repair. She had initially undergone palliation with a pulmonary artery band secondary to multiple comorbidities. The VSDs were multiple and located close to the apex, with the largest defect measuring 6 mm. A hybrid approach to closure of the VSDs on cardiopulmonary bypass (CPB) was planned. After a re sternotomy, the patient was placed on CPB. The anterior wall of the right ventricle was punctured with a needle, and a guidewire was passed through the needle across the VSDs under the guidance of transesophageal echocardiography. A 6-mm Amplatzer muscular VSD occluder (AGA Medical Corporation, Golden Valley, Minn) was then deployed across the largest defect with a standard technique by the interventional cardiology team.³ The cleft in the mitral valve was repaired, the ostium primum defect was closed, and the pulmonary artery band was removed. Completion transesophageal echocardiography demonstrated a small residual leak across the device with good biventricular function and trivial to mild mitral regurgitation only. After extubation the next morning, the patient had acute pulmonary edema requiring reintubation. A check echocardiograph revealed appropriate positioning of the device with no residual defects.

After resolution of the pulmonary edema and medical optimization, a second attempt at extubation was made 48 hours later. Once again the patient had flash pulmonary edema and respiratory distress develop, necessitating reintubation. This sequence of events recurred for a third

Echocardiographic view of device tethering the lateral wall of left ventricle.

Central Message

Devices are increasingly being used for closure of ventricular septal defects; however, they can have unfavorable hemodynamic effects.

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time. A closer look at the echocardiograph this time revealed moderate to severe diastolic dysfunction of the left ventricle (LV) caused by the tethering of the lateral wall of the LV by the left disk of the Amplatzer device (Figure 1). Moderate mitral insufficiency was also noted at this point. The flash pulmonary edema was explained by the unmasking of the diastolic dysfunction after extubation each time. An attempt was made in the cardiac catheterization laboratory to disengage the left disk of the device from the trabeculation of the LV free wall. This was unsuccessful, and the patient was taken to the operating room for an emergency reoperation 12 days after the previous surgery. A small incision was then made over the apex of the LV parallel to the left anterior descending artery.⁴ Through this left ventriculotomy, the left disk of the device was noted to be impacted within the free wall of the LV close to the papillary muscle. This was freed, and the device was removed carefully. The VSD was closed primarily with 5.0 polypropylene sutures with pledgets. An immediate improvement was noted in the movement of the LV free wall, with no signs of diastolic dysfunction on postoperative transesophageal echocardiography (Figure 2). The patient was extubated uneventfully and was discharged 4 days later. Follow-up echocardiography 2 years later revealed normal LV systolic and diastolic function with trivial mitral regurgitation.

FIGURE 1. Echocardiographic view of device tethering the lateral wall of left ventricle.

DISCUSSION

The Amplatzer VSD occluder is a self-expandable, double-disk device made from nitinol wire mesh. The 2 disks are linked together by a short cylindrical waist corresponding to the size of the VSD. The device is indicated for use in patients with a complex VSD of significant size to warrant closure (large volume left-to-right shunt, pulmonary hypertension, or clinical symptoms of congestive heart failure) but who are considered to be at high risk for standard surgical closure. The VSD occluder may be deployed percutaneously or by the perventricular route in a hybrid procedure.^{1,2} An open heart approach with placement of the device on CPB and arrested heart has also been described.³

A number of cardiac adverse events have been listed and reported previously.^{1,2,5} These include cardiac perforation, third-degree heart block, paroxysmal ventricular tachycardia, subaortic stenosis, device embolization, stroke, and death. Our case report highlights a hitherto undescribed hemodynamic adverse event of LV diastolic dysfunction. This complication seems related to the positioning of the device rather than to any malfunction of the device itself. It is quite possible that this complication could have been avoided by placing the VSD device occluder before starting CPB. It is important to recognize such subtle unfavorable

FIGURE 2. Four-chamber echocardiographic view showing improved movement of the lateral wall of left ventricle after removal of the device.

effects of devices on the heart and to compare the use of devices with the traditional surgical approach of a left apical ventriculotomy or right infundibulotomy. Left apical ventriculotomy can be performed safely with good preservation of LV function in both the early and intermediate follow-up periods.⁴

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