Epicardial deployment of right ventricular disk during perventricular device closure in a child with apical muscular ventricular septal defect

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ABSTRACT

We report a successful perventricular closure of an apical muscular ventricular septal defect (mVSD) by a modified technique. An eight-month-old infant, weighing 6.5 kilograms, presented with refractory heart failure. The transthoracic echocardiogram showed multiple apical mVSDs with the largest one measuring 10 mm. perventricular device closure using a 12 mm Amplatzer mVSD occluder was planned. The left ventricular disk was positioned approximating the interventricular septum; however, the right ventricular (RV) disk was deployed on the free wall of the RV due to an absent apical muscular septum and a small cavity at the apex. The RV disk of the device was covered using an autologous pericardium. His heart failure improved during follow-up.

Keywords: Hybrid muscular ventricular septal defect closure, muscular ventricular septal defect occluder, perventricular device closure

INTRODUCTION

Various methods of surgical closure of muscular ventricular septal defects (mVSDs) have been described; however, the risk of ventricular dysfunction due to ventriculotomy and residual VSD is always present.[1-3] Transcatheter closure of mVSD is a well-established procedure, but technically demanding, due to larger sheaths and a need for the formation of arteriovenous loop.[4-6] Perventricular device closure has become an alternative option with minimal complications in infants with mVSD.[7] We report our experience of the difficulty we faced during perventricular device closure, which necessitated modification of the technique.

CASE REPORT

An eight-month-old infant (6.5 kilograms) presented with congestive heart failure. Transthoracic echocardiography (TTE) revealed a 10 mm apical mVSD [Figure 1a], two small additional mVSDs, and a 2 mm patent ductus arteriosus (PDA). The perventricular device closure of the mVSD was planned in view of the associated comorbid condition (gastroesophageal reflux disease with recurrent aspiration pneumonia). The procedure was performed in the Operating Room under TEE monitoring. After a mini sternotomy, the anterior free wall of the right ventricle (RV) was punctured using a 16G cannula. A 0.032" angulated glide wire (Terumo Corporation, Japan) was negotiated into the left ventricle (LV) and exchanged for an 8Fr sheath [Figure 1b]. A 12 mm Amplatzer mVSD occluder (St. Jude Medical, USA) was advanced into the sheath. The left ventricular (LV) disk was positioned approximating the interventricular septum; however, the RV disk could not be deployed due to the small space that was available in the right ventricular cavity at its apex. This led to protrusion of the RV disk outside the right ventricular anterior free wall. After several repeated failed attempts to deploy the RV disk within the RV apical cavity, it was decided to deploy the RV disk on the epicardial surface of the free wall. After the deployment, the LV disk was approximated as close as possible to the interventricular septum [Figure 1c] and the RV disk was deployed on the free wall [Figure 2]. The occluder was covered with the autologous pericardium on the free wall to prevent the seepage of blood or serum and contact to the chest wall [Figure 2b]. TEE showed no

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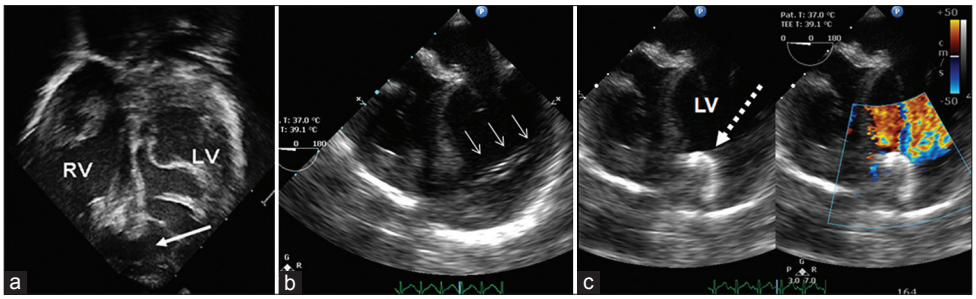

Figure 1: (a) TTE showing large apical mVSD (white arrow); (b) Intraoperative TEE showing a sheath across the mVSD in LV (small arrows); (c) Deployment of the LV disk close to the interventricular septum (broken arrow)

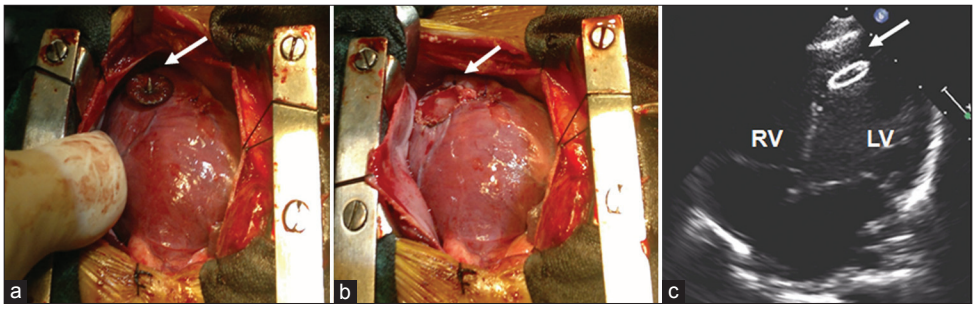

Figure 2: (a) Intraoperative picture showing RV disk on the free wall; (b) Covered with autologus pericardium; (c) TTE showing clamping of the septum and RV apex

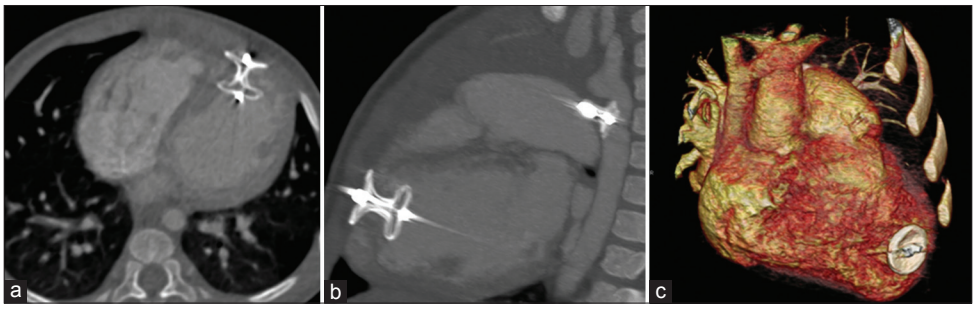

Figure 3: (a) Axial section of CT showing obliteration of the interventricular septum and RV apex; (b) Sagittal plane showing both the mVSD device and duct occluder; (c) Volume-rendered image demonstrating an RV disk on the free wall

residual shunt and the child was discharged on the fifth day. The PDA was closed using the 6/4 duct occluder after three months. Computerized tomography (CT) showed obliteration of the septum and the RV apical cavity by the device [Figure 3].

DISCUSSION

Perventricular device closure of mVSD is an established procedure in selected cases of VSD, where surgical closure carries a high risk. Bacha *et al.*, in multicenter study showed good results in three groups of patients. They did not encounter any complications and all the 12 patients were asymptomatic at a median follow-up of 12 months.[7] Bendley *et al.*, in their series of six patients showed successful closure in five patients and immediate embolization in one. Mid-term results after 39 months showed a tiny residual shunt in two and a significant shunt in one patient, with development of a pseudoaneurysm in one.[8]

Device closure is possible if adequate rims are present. In our case the apical ventricular septum was absent and the RV cavity appeared small at its apex. The RV disk could not be positioned within the right ventricular cavity and the only option that we thought was to deploy the RV disk on the free wall. The length of the mVSD occluder was 7 mm, as at least a minimum length of RV cavity had to be present to deploy the device within the RV cavity. Using the duct occluder or deployment of the RV disk outside the free wall were probable options in these difficult cases. Amin *et al.*, described access from the middle of the right ventricular free wall and directed the needle toward the apical defect, to avoid protrusion of the device in case of apical muscular VSD.[9] However, we opted to deploy on the free wall because the device could be anchored safely and

the additional small mVSDs could be obliterated. Surgical closure of the apical mVSD was technically demanding and sometimes needed either ventriculotomy or apical obliteration methods.[1-3] Black *et al.,* reported their experience of septal obliteration technique (SOT) in closing the apical mVSDs with encouraging results. All eight children improved well and none had a residual shunt.[10] Our case mimicked the surgical SOT. The follow-up CT scan demonstrated the septoapical obliteration; however this interventional right ventricular apical obliteration needs a long-term follow-up.

In conclusion, modified apical obliteration technique by deploying the RV disk on the free wall is probably an alternative method of perventricular closure in selected cases of apical mVSD. However, it needs more data and a longer follow-up of these cases.

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