Transcatheter closure of perimembranous ventricular septal defect in a patient with abnormal inferior vena cava return

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Abstract

An 8-year-old boy with a 3.8 mm perimembranous ventricular septal defect (PmVSD) and abnormal inferior vena cava return was attempted cardiac catheterization to occlude the VSD. Through the right jugular vein and right femoral artery approach, an 8 mm Amplatzer VSD occluder was successfully deployed under fluoroscopic and echocardiographic guidance. After a 2 year follow-up, the patient is symptom-free. Our report offers a new perspective to percutaneous treatment of PmVSD with abnormal inferior vena cava return.

Keywords: Ventricular septal defect; Transcatheter closure; Inferior vena cava; Multislice computed tomography

An 8-year-old boy (height, 125 cm; body weight, 34 kg) who presented with intractable pneumonia was admitted to our hospital after effective infection control. On clinical examination, the patient was in good general condition and had a degree III systolic murmur on the left sternal border. A chest X-ray revealed pulmonary plethora and mild cardiac enlargement. Transthoracic echocardiography (TTE) revealed a perimembranous ventricular septal defect (PmVSD) of 3.8 mm with mild to moderate left to right shunt. The left ventricle was normal, while the right ventricle was hypertrophied and dilated with normal systolic function (Fig. 1). Cardiac catheterization was undertaken in order to occlude the VSD by using devices. Prior to the intervention, a written informed consent was obtained from the patient’s parents.

The catheterization procedure was performed under local anesthesia and continuous sedation. Heparin (100 IU/kg) and antibiotics were administered intravenously during the procedure. Access was through the right femoral vein and right femoral artery. Angiography of the left ventricle at 55°/20° left anterior oblique projection/cranial was used to profile the VSD (Fig. 2A). The diameter of the VSD was measured as 4.5 mm with a moderate shunt. The distance between the VSD and aortic/tricuspid valve was more than 2 mm. The patient was considered suitable for transcatheter occlusion. However, while inserting the wire through the femoral vein into the inferior vena cava (IVC), this pathway appeared abnormal. Selected angiography and right ventriculography verified that the femoral vein connected to a hemiazygous vein and then to the superior vena cava (SVC) and the right atrium (Fig. 2B, C). A right jugular vein approach was then selected. VSD was passed from the left ventricle by a 6-Fr 3DRC catheter, and the wire was snared in the pulmonary artery and exteriorized through the right jugular vein (Fig. 2D). A 7-Fr long sheath was advanced to the left ventricle through a 6-Fr 3DRC catheter, and the wire was snared in the pulmonary artery and exteriorized through the right jugular vein (Fig. 2D). A 7-Fr long sheath was advanced to the left ventricle through the arteriovenous circuit (Fig. 2E). An 8-mm Amplatzer VSD occluder (AGA Medical Corporation, Golden Valley, Minnesota, USA) was deployed through the long sheath under fluoroscopic and echocardiographic guidance. Final angiogram revealed that the defect was successfully occluded with only a trivial residual shunt (Fig. 2F). The VSD occluder was then released, and the patient was transferred to the general ward immediately after the intervention. The patient was discharged...
the day after the procedure and was administered 5 mg/kg aspirin daily for 6 months. At 2 years of follow-up, he remains symptom-free. TTE demonstrated that the VSD occluder was well positioned without other pathological findings. Multislice computed tomography (MSCT) scan further verified the IVC pathway in the patient (Fig. 3).

Recently, Fu et al. reported on the U.S. phase I trial of transcatheter closure of PmVSD by using VSD occluders in 35 patients. Transcatheter closure of a PmVSD is technically feasible and appears reasonably safe in children [1]. Xumnin et al. compared the effectiveness, cost, and complications between surgical and Amplatzer device closure of PmVSD. Their results showed similar closure rates between two techniques, while transcatheter closure has the advantage of less hospital stay and home convalescent time [2]. There is limited literature on transcatheter VSD closure with vena cava

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Fig. 1. Echocardiogram showing the size and position of the perimembranous ventricular septal defect.

Fig. 2. A, The profile of the location and size of the PmVSD by angiography. B, Selected venous angiography showed that the femoral vein connected to the hemiazygous vein and then to the superior vena cava (SVC) and the right atrium. C, Right ventriculogram verified the inferior vena cava (IVC) pathway. D, Wire passed VSD was snared in the pulmonary artery and exteriorized through the right jugular vein. E, A 7-Fr long sheath was advanced to the left ventricle through the arteriovenous circuit. F, Left ventriculogram showed that the defect was successfully occluded with a trivial residual shunt.

Fig. 3. Computed tomography reconstruction showed that both the iliac veins converged at the hemiazygous vein and then drained into the SVC and right atrium (yellow arrows), while the renal veins converged at the IVC and directly drained into the right atrium (purple arrows). (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)
anomalies. Our report provides a new perspective on the percutaneous treatment of PmVSD with abnormal IVC return.

References
