Modified transjugular approach for percutaneous atrial septal defect closure

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ABSTRACT

Femoral venous route is routinely used for percutaneous closure of atrial septal defects (ASDs). However, a situation may arise where transfemoral approach is not feasible. We describe a successful transjugular closure of a moderate-sized ASD in a 49-year-old symptomatic man with interrupted inferior vena cava, using a novel deployment technique, which helped in overcoming difficulties such as maintaining stable sheath position and minimizing risk of air embolism.

Keywords: Atrial septal defects device closure, congenital heart disease, pediatric cardiac intervention, transjugular route

INTRODUCTION

Transjugular approach for percutaneous closure of atrial septal defect (ASD) is important in patients, in which the procedure through the femoral access is not possible or difficult. The following case report describes the technique along with some modification, which helped in overcoming difficulties such as maintaining stable sheath position and minimizing risk of air embolism.

CASE REPORT

A 49-year-old male patient presented with New York Heart Association Class II dyspnea and intermittent episodic regular palpitations of 6 months duration. Clinical examination was remarkable for a wide and fixed split S2 with a grade 2/6 ejection systolic murmur at the upper left sternal border. An electrocardiogram revealed a low atrial rhythm, normal QRS axis, and right bundle branch block. A chest radiograph showed cardiomegaly with increased pulmonary vascularity. Transthoracic echocardiography followed by intraprocedural transesophageal echocardiography (TEE) confirmed the presence of an 18-mm ostium secundum ASD, suitable for percutaneous closure, with adequate rims, except for a deficient aortic rim. There was right ventricular volume overload, a large left-to-right shunt, mild pulmonary hypertension, and normal biventricular function. After obtaining informed consent, closure of ASD was attempted through a right femoral route when an interrupted inferior vena cava (IVC) with azygos continuation was detected. A transjugular approach for percutaneous closure (PCC) of ASD was planned at a second attempt.

After premedication with loading doses of aspirin (300 mg) and clopidogrel (300 mg), the procedure was performed under general anesthesia with TEE guidance. Intravenous heparin and cefazolin were administered. An 8F right internal jugular vein (IJV) and a 6F left femoral artery accesses were taken and pressures were recorded. The pressures were near-normal (right atrium [RA] and left atrium [LA], mean 8 mmHg, right ventricle 30/6 mmHg, pulmonary artery 30/15 mmHg, mean 20 mmHg, left ventricle [LV] 130/10 mmHg, aorta 130/80 mmHg, mean 100 mmHg). A 6 Fr Judkins right coronary artery (RCA) catheter with two customized side holes near its tip was

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quite easily negotiated through the ASD and placed in the LV. This was exchanged for a 0.035 inch, 260 cm long Amplatz Extra-Stiff Guidewire [Figure 1a]. Over this wire, after removing the 8F IJV sheath, a 9F Amplatzer delivery sheath with its dilator (St. Jude Medical, St Paul, MN, USA) was introduced and the delivery sheath placed in the LV [Figures 1b and 2a] ensuring a good backflow. Based on TEE assessment, a 22-mm Amplatzer Atrial Septal Occluder (ASO) (St. Jude Medical, St Paul, MN, USA) was chosen and passed through the delivery sheath till it almost reached its tip. The whole assembly was gently withdrawn toward the LV inflow. Under TEE guidance, the LA disc was then quickly deployed by unsheathing it in the LA just above the mitral annulus, pointing toward the LV inflow [Figures 1c and 2b], ensuring that there was no impingement on the mitral valve. After gently pulling the LA disc on the interatrial septum, the RA disc was deployed on the RA side [Figure 1d]. Just before release, proper alignment of device with captured rims was confirmed on TEE [Figure 2c]. There were no new mitral, tricuspid, or aortic regurgitation and no significant electrical or hemodynamic disturbances during or after the procedure. The procedural and fluoroscopy times were 40 min and 8.8 min, respectively. Aspirin 150 mg/day and clopidogrel 75 mg/day were continued for 6 months and 6 weeks, respectively. At 3-month follow-up, the patient is asymptomatic, in sinus rhythm and there is no residual shunt or any valvular regurgitation on echocardiography.

**DISCUSSION**

The devices and delivery systems for percutaneous closure of ASDs are designed to be used from the femoral venous side. However, situations may arise where femoral venous deployment is not feasible as in IVC interruption and thrombosis or unsuitable anatomical location. Transhepatic route for PCC of ASD device has been used in such situations.[1] However, the transhepatic access can lead to a higher incidence of complications such as retro- or intra-peritoneal bleeding, hemobilia, perforation of the gall bladder, pneumothorax, pleural effusions, and liver abscess or peritonitis[2]. The transjugular approach is a potentially safer alternative as described previously in some case reports. It has been used for patients with heterotaxy and interrupted IVC,[3] severe scoliosis,[4] patient with iatrogenic total occlusion of the IVC[5] and residual, posterolaterally located ASD, following total anomalous pulmonary venous connection repair.[5] Regarding the technique of transjugular approach for PCC of ASD, crossing the defect and retaining a stable wire position in the LA for sheath delivery appear to be the most crucial steps for successful closure.[6] Previous case reports utilizing the transjugular approach also mention the difficulty in maintaining a pulmonary venous wire position and suggest the feasibility of deploying the device from a sheath pointing toward the LV inflow or LA appendage.[6] Since we planned the procedure at a second attempt, learning from others’ experience, we were able to overcome this limitation by placing the delivery sheath in the LV. However, care has been taken to unsheath device only in LA, after withdrawing sheath just above the mitral valve, to prevent chordal injury. Another issue is with the risk of air embolism through the IJV route. A useful technique to prevent this is the underwater removal of dilator from the sheath. In the present case, maintaining the delivery sheath in the high-pressure LV without abutting the tip against the wall allowed a good back-bleed during removal of the dilator-wire assembly and passage of the ASO, thereby preventing air embolism. In addition, customizing the RCA catheter with side holes allowed a good backflow even during accidental abutment of the tip of the catheter to the LV wall. In the present case, there was

**Figure 1:** Fluoroscopic intraprocedural images of transjugular atrial septal defect device closure: (a) Amplatz Superstiff guidewire in left ventricle. (b) 8F Amplatz atrial septal defect sheath in left atrium pointing to left ventricle inflow. (c) Device deployment with device sheath facing left ventricle inflow. (d) Successful release of the device across the defect

**Figure 2:** Intraprocedural transesophageal echocardiography images: (a) Amplatz sheath loaded with the device in left ventricle inflow. (b) Device deployment across the defect. (c) Adequately deployed device with snug fitting to surrounding rims
a likelihood of failure since the aortic rim was deficient and using alternative techniques such as balloon-assist technique\(^6\) (due to lack of a second venous access), or placing the sheath in pulmonary vein was not a prospect.

In conclusion, percutaneous closure of ASD through the transjugular approach is safe, feasible, and effective if planned well using novel techniques, even with the usual hardware, and could be recommended as an alternative to surgical closure in patients with failed femoral venous approach but with adequate rims.

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Conflicts of interest
There are no conflicts of interest.

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