Transseptal Puncture with Atrial Septal Occlusion Device in a Patient with Atrial Fibrillation: First Experience with the Peripheral Balloon

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Abstract

Transcatheter closure of atrial septal defect (ASD) has become a well-established surgical intervention for patients with atrial fibrillation (AF). The incidence of AF is still increased after ASD closure, compared with an age-matched general population. However, radiofrequency catheter ablation which has become an increasingly common therapy for AF is underutilized due to the difficulty of obtaining transseptal access in the presence of the closure device. We describe an extremely challenging case in which the transseptal puncture (TSP) was successfully completed with the use of a peripheral balloon dilatation catheter in the atrial septal defect (ASD) patient with an atrial septal occluder. For patients with fibrotic and thickened devices, peripheral balloon dilatation can facilitate transseptal passage safely and effectively.

Introduction:

Atrial septal defect is the most common congenital heart lesion in adults, and the surgical intervention of closure of the percutaneous atrial septal defect are increasing recently. Implantation of the atrial septal device may protect these patients from potential complications induced by ASD, but in a later stage can predispose them to other complications. AF is more common in patients with the occluder compared with the general population.[1] Radiofrequency ablation is recommended for AF, especially for the drug-refractory symptomatic AF.[2] Safe and easy access to the left atrium through the occlusion device is the basic and critical step for catheter ablation, which dissuades electrophysiologists from performing ablation in patients showing an alternation of septal anatomy or predisposed with a potential risk of complications. Here we describe the successful interventional strategy following a peripheral balloon created transseptal access for AF ablation in the setting of a large-sized septal occlusion device implantation.

Case Report:

A 40-year-old man was admitted to our institution because of paroxysmal atrial fibrillation. At the age of 24, he had been diagnosed with a secundum ASD, which was 19mm in diameter with the left to right shunt and was corrected with percutaneous atrial septal defect closure. During the last 7 years, the patient complained of palpitations, and a follow-up electrocardiogram demonstrated the atrial flutter in September 2016. A further electrophysiological mapping revealed the CTI-dependent atrial flutter. Subsequently, he had undergone the tricuspid isthmus ablation. His symptoms were relieved but reported with transient palpitations sometimes. AF was diagnosed on an electrocardiogram in 2019, and the patient then opted for AF ablation. The patient had undergone 1 attempt to perform AF ablation in 2019, and TSP which was attempted initially at a site posteroinferior to the ASD occlude guided by intracardiac echocardiography (ICE) failed. Moreover, the occluder with 11mm thickness and a 34 mm diameter, which was oversized with respect

to the native interatrial septum further increased the risks of direct TSP through the occluder. Finally, the ablation was terminated due to unsuccessful access to the LA. The patient's paroxysmal atrial arrhythmias were treated initially with propafenone, followed by dronedarone. However, AF became aggravated and the condition transformed into a drug-refractory stage. The patient was referred to our institution for a second attempt at LA ablation.

The LA ablation procedure was performed under general anesthesia. An ICE was performed to rule out the left atrial appendage thrombus and for visual assistance during transseptal puncture. A 7-F multipolar electrode catheter was placed in the coronary sinus via the left femoral vein. TSP using a Brockenbrough needle was guided by fluoroscopy and ICE. We performed the direct TSP through the occluder device posteroinferior to its waist. Initially, the transseptal needle succeeded to traverse the device confirmed by contrast injection and a guidewire was positioned in the left superior pulmonary vein. Repeated attempts to pass through the 8.5F long sheath into the LA were unsuccessful because of significant resistance induced by severe fibrosis, which indicated a change to be made in the strategy. We could successively advance a 2.0-, 3.0-, 4.5-mm percutaneous coronary intervention (PCI) balloon over the guidewire across the septum. Moreover, the position of the non-compliant balloon on either side of the septum was confirmed by fluoroscopy and ICE, which also ensured that the balloon was placed perpendicularly to the transseptal access site created by the needle and the dilator. The sequential dilatation was performed by an inflation pressure of up to 12atm, whereas the thickened occluder prevented the balloon from further enlarging the access site. The PCI balloon was then withdrawn and a Passeo-35 (*Biotronik AG*) peripheral balloon with a 6mm diameter was advanced through the puncture site. Subsequently, we inflated the peripheral balloon to its maximum size as the inflation pressure reached 10 atm. Finally, the 8.5F transseptal sheath could easily be passed into the mid-cavity of the LA without any resistance. After successful TSP, the patient was continuously anticoagulated by intravenous heparin to maintain an activated clotting time of 250-300 seconds. A saline-irrigated ablation catheter was then advanced through the sheath, and the patient could tolerate the procedure well without any further complications. An electroanatomical mapping was made of the LA and pulmonary veins and showed successful isolation of the pulmonary veins. The total procedure time and transseptal time were 360 minutes, and 215 minutes, respectively. No interatrial shunt or device deformation was seen and was confirmed by ICE at the end of the ablation procedure and by the transthoracic echocardiography the next day. At 3 months of follow-up, the patient remained in sinus rhythm and showed no residual shunt.

Discussion:

Patients with an ASD are at high risk of developing AF which remains considerable even after ASD closure[3], mostly due to structural atrial remodeling generating a favorable substrate for macroreentry.[4,5] Clinical evidence supports that long-standing volume overload, pulmonary hypertension, and prolonged atrial stretch significantly increase the risk of AF in patients with ASD. Catheter ablation has emerged as an effective treatment strategy for these patients, especially in those with drug-refractory and symptomatic AF. The ability to perform a targeted transseptal puncture is vital to the successful outcome of such a procedure, which may thereby influence therapeutic options.

Neo-endothelialization and fibrous incorporation of the ASD closure device are generally completed within 1 to 3 months, and as described in a swine model,[6] 100% of the ASDs are generally closed at 3 months, even though the atrial fibrosis aggravates with the passage of time. Our patient with a history of percutaneous ASD occluder of 34-mm diameter which was implanted 16 years creates a great challenge for access to the LA in the ablation. Many different studies (Santangeli*et al.*[7] , Li *et al.*[8] , and Sang *et al.*[9]) have demonstrated the feasibility, safety, and efficacy of catheter ablation in such patients. In these studies, the TSP through the native septum was mostly performed, while some patients underwent direct puncture of the atrial septal occluder. Of note, different strategies were used to achieve left atrial access into the left atrium through the septal occlude. Santangeli *et al.*[7] reported on the technical feasibility of direct access through the device using an upsized dilator for AF ablation under intracardiac echocardiography (ICE) guidance. Li*et al.* [8]and Sang *et al.*[9]advanced an angioplasty guidewire in the left superior pulmonary vein. After the withdrawal of the 8 Fr dilator, they performed the sequential dilatations using a 2.5-5.0 mm non-compliant balloon under

the pressure of 12-18 atm to ease sheath manipulation. The median time from ASD closure to catheter ablation in the above cohorts was 46 (6-82), 16 (6-36), and 11 (6-72) months respectively. Consideration of the fibrotic and thickened occluder in our patient, we adopted the strategy of direct access through the occluder suggested by prior studies on AF ablation in patients with an ASD.

In this case study, we encountered two major operative considerations as follows: (1) With the help of ICE, we could visualize the landmarks of atrial septal anatomy to puncture accurately without any complications; (2) Dilatation at a site across the device using appropriate peripheral balloon could create just enough transseptal opening to allow subsequent passage of the 8.5F sheath. Finally, we could open up the blocked passage to the LA, and the AF was successfully ablated.

Conclusion:

Our case study demonstrates the safety, efficacy, and feasibility of using a peripheral balloon dilatation catheter to perforate an ASD device and highlights the possible solutions for the management of challenging situations among patients who need catheter ablation of AF after ASD closure.

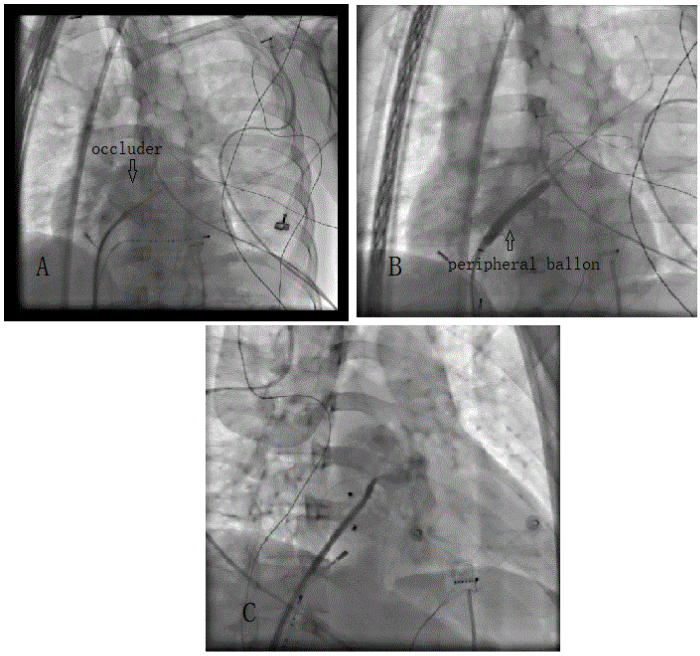

Figure1:A)the sheath couldn't traverse;B)the peripheral balloon dilated the channel;C)the sheath gained access to the LA.

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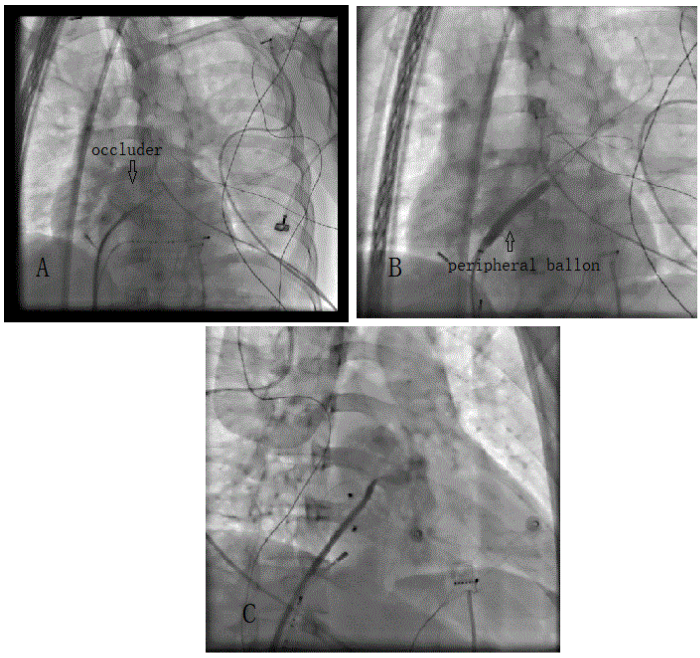

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