

Successful catheter ablation of atrial fibrillation from superior venous approach

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Abstract:

Background: Trans-catheter ablation of drug refractory Atrial Fibrillation (AF) is an effective and safe treatment to avoid arrhythmia recurrences. However, some patients may present anatomic variant making impossible an inferior venous approach. We report a case of Pulmonary Veins Isolation (PVI) with cryoballoon technology *via* Right Internal Jugular Vein (RIJV) access.

Methods: After the first transcatheter PVI attempt was failed due to Inferior Vena Cava (IVC) hypoplasia, cryoballoon ablation with a 28-mm cryoballoon (AFAPRO-Medtronic CryoCath LP, Quebec, Canada) *via* superior venous access was performed. A quadripolar electrode was inserted in coronary sinus from left basilic vein. The right internal jugular vein was accessed with Seldinger technique and Left Atrial (LA) catheterization was performed *via* single Trans-septal Puncture (TP) under Trans-esophageal Echocardiographic (TOE) and fluoroscopy guidance using an SL2 (St. Jude Medical) trans-septal sheath with a BRK2 (St. Jude Medical) needle. All Pulmonary Veins (PVs) were engaged. Cryothermal energy was delivered after checking the correct occlusion and PVI was successfully obtained for all PVs. The procedure lasted 210 min, fluoroscopy time was 55 min. During the 16-month follow-up no sustained atrial arrhythmia recurrence was detected.

Conclusion: PVI with cryoballoon technology in patients with hypoplasia of IVC can be safely and successfully performed using right internal jugular access.

Keywords: Axillary vein • Leads implantation • Cardiac pacing • Anatomical landmark • Fluoroscopic landmark

Introduction

Catheter ablation has been validated as treatment for refractory Atrial Fibrillation (AF) and its use has increased exponentially in the clinical field [1]. The standard procedure is performed *via* the right femoral vein, and all devices are designed to be delivered *via* the femoral venous approach. However, in patients with anatomical obstruction of IVC, i.e. IVC hypoplasia, an alternative technique and vascular access are required. It has been reported that trans-jugular vein access is feasible for catheter ablation of AF, with both technology (cryoballoon and radiofrequency) [2-6]. We report successful cryoablation of paroxysmal AF *via* RIJV in a patient with hypoplasia of IVC. We describe our technique to perform the TP and to accomplish cryoballoon ablation from superior venous access.

Case Study

A 54-year-old male with a history of hypertension was admitted to the hospital with a diagnosis of paroxysmal AF for over 4 years. The paroxysms of AF were becoming more frequent despite treatment with Class 1C antiarrhythmic drugs in combination with β -blockers. Echocardiography

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showed no underlying structural heart disease with the LA antero-posterior diameter of 3.9 cm. After considering potential risks and benefits, cryoballoon ablation for treatment of the AF was strongly suggested. After written informed consent was obtained, we planned an electrophysiological study and cryoablation procedure *via* the right femoral vein. However, the procedure could not be performed because the guidewire did not pass upward through the IVC. Venography revealed a completely hypoplasia of IVC (Figure 1) that drained into the superior vena cava *via* the azygos vein (Figure 1). At this stage, we decided to perform LA ablation in another session through the RIJV.

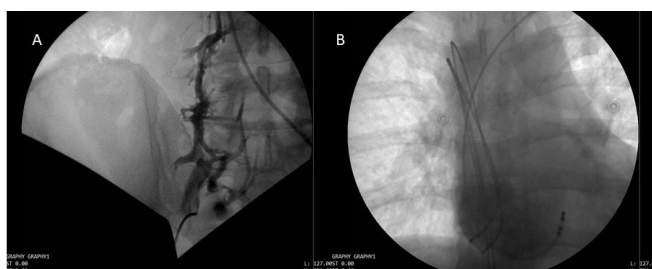


Figure 1: 1A: The images show the hypoplasia of IVC and 1B: the access to right atrium *via* azygos vein.

Cryoablation procedure

Cryoablation was started in the left superior pulmonary vein. This vein was engaged by increasing the Flexcath angle to around 120°. A 28 mm second-generation cryoballoon catheter (AFAPRO, Medtronic) was positioned in the vein over the octapolar inner-lumen mapping catheter (Achieve VR, Medtronic). After checking the complete occlusion, cryothermal energy was delivered for 240 seconds (temperature nadir -45°C), with a time to isolation (TTI) of 41 sec (Figure 2A). Subsequently, with a counter-clockwise rotation of the Flexcath, a mapping catheter was positioned in the right superior pulmonary vein (Figure 2B). The cryoballoon was inflated and complete occlusion of the pulmonary vein was confirmed. A single 240-second application of cryothermal energy was delivered with a temperature nadir of -55°C and a TTI of 38 sec. The right inferior pulmonary vein was engaged by decreasing the Flexcath angle. A single 240-second application of cryothermal energy was delivered with a temperature nadir of -49°C (Figure 2C) and a TTI of 43 sec. In the 90th second of cryoablation, the balloon was slightly pushed forward to further improve the tissue contact in the inferior portion of the vein. To prevent injury to the phrenic nerve, the quadripolar catheter was withdrawn from his bundle and cryoablations of the right veins were performed under continuous phrenic stimulation. Finally, the left inferior pulmonary vein was engaged in changing the balloon size to 24 mm (Figure 2D) because the steric hindrance of the 28 mm balloon due to the relationship between the TP and left inferior PV ostium on the frontal plane. At the end of the procedure, all PVs were checked with the Achieve mapping catheter. Bidirectional blocks were

demonstrated for all PVs. A post procedural echo-cardiography control revealed no pericardial effusion. The total procedure and fluoroscopy times were 210 minutes and 81 minutes, respectively. The patient was discharged from the hospital on the third day after.

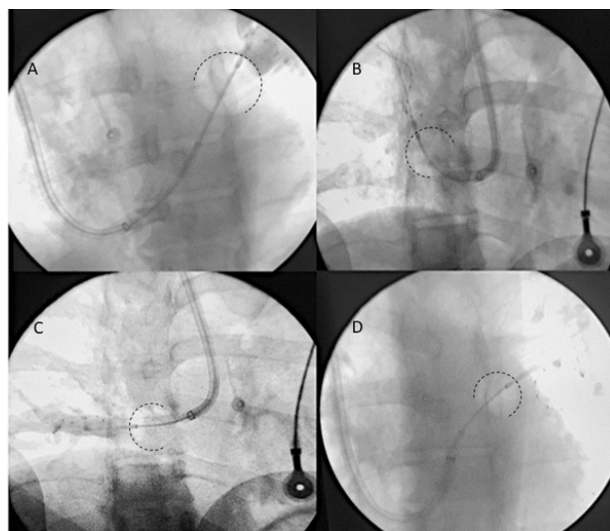


Figure 2: The images show the fluoroscopic views of the balloon during cryoablation of the veins: 1A: left superior PV; 1B: right superior PV; 1C: right inferior PV; 1D: left inferior PV. Transseptal puncture from the jugular vein.

Follow Up

Follow-up was performed according to our usual planning at 3, 6 and 12 months as well as in case of symptoms suggestive of arrhythmia recurrence and included a 24 h-Holter recording. After Blanking Period (BP) the Class 1C antiarrhythmic drug was withdrawn. Any documented sustained episode of AF and/or Atrial Tachycardia (AT) and/or Atrial Flutter (AFL) after BP were considered as a recurrent arrhythmic event. After 16 months of follow-up only a self-terminated no sustained episode of AFL was recorded in BP.

Discussion

Hypoplasia of the IVC is uncommon [7] and it is usually associated with direct hepatic venous drainage into the RA and venous drainage of the lower body into the azygos system at the level of the renal veins.⁸ For management of drug refractory symptomatic AF in patients with complete interruption of the IVC, several treatment strategies, such as His bundle ablation and pacemaker implantation or surgical AF ablation, could be considered. Furthermore, on the basis of our experience, AF catheter ablation *via* the superior venous approach may be considered as a therapeutic option when a femoral venous approach is not available.

In cases of the superior approach, due to different distance between SVC-RA and fossa ovalis an angulated sheath, such as SL2 SJM is needed. Also, a steerable sheath may make transseptal puncture a little easier, although we have not used it in our patients. In cases of difficult transseptal puncture, transseptal puncture guided by TOE can be easily and safely performed with the identification of

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all adjacent structures, which helps prevent major complications such as aortic or atrial perforation or laceration. Alternatively, Intracardiac Echocardiography (ICE) would provide important anatomical details of the interatrial septum and greater certainty of a safe puncture site and of introducing the long sheath into the LA. However, in cases of the superior approach, the use of ICE is limited because it requires a separate vascular access. In the present cases the use of TOE is sufficient to support the optimal position of the needle tip and to enable us to perform a safe TP. After successful TP, we easily introduce the steerable sheath into the LA using a stiff guide-wire. There are several descriptions of TP with superior venous approach and all the cases described a more angulated needle and sheaths are needed. The electrical isolation was achieved for all the PVs. The principal difficulty was encountered to achieve a complete occlusion of left inferior PV because the relationship between the TP and left inferior PV ostium on the frontal plane. We reached it changing balloon size from 28 mm to 24 mm. The smallest balloon diameter, in our case, leads to easier occlusion of the left inferior PV ostium.

Conclusion

We described the safety and feasibility of balloon cryoablation for AF *via* RIJV in a patient with an interrupted IVC.

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Disclosure Statement

None

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