Radiofrequency wire–facilitated transseptal access using a superior approach for atrial fibrillation ablation in a patient with inferior vena cava obstruction

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Introduction
The standard approach to contemporary atrial fibrillation ablation involves obtaining trans-septal access to the left atrium from an inferior approach using percutaneous femoral venous access. Rarely, access to the heart from the inferior approach is not possible due to vascular anomalies or venous occlusions. In these unusual cases, a superior approach to pulmonary vein isolation could be considered. In the case report herein, we describe a novel technique for performing trans-septal access from the right internal jugular vein in a patient with bilateral internal iliac/IVC occlusion using radiofrequency and exchange pigtail wires.

Case report
A 54-year-old man with a history of factor V Leiden deficiency, bilateral iliac deep vein thrombosis with venous occlusion extending to the inferior vena cava, and highly symptomatic drug-refractory paroxysmal atrial fibrillation was referred to our institution for catheter ablation. A superior approach was considered. Two right axillary vein accesses were used to advance a phased-array intracardiac echocardiography (ICE) catheter (AcuNav; Biosense Webster, Diamond Bar, CA) and a duodecapolar deflectable catheter to the mid right atrium and coronary sinus, respectively. The right internal jugular vein was accessed, and a steerable sheath (Agilis 40 cm length; St Jude Medical, St Paul, MN) was advanced to the right atrium and deflected to engage the interatrial septum, as visualized by ICE. A 0.035-inch endovascular radiofrequency wire (PowerWire; Baylis Medical Inc, Montreal, Canada) was advanced to the tip of the dilator (Figure, A–C), and the interatrial septum was crossed. Then, radiofrequency energy was applied at the tip of the wire (10 watts for 2 seconds). The dilator was then advanced into the left atrium over the radiofrequency wire (Figure, D). In order to facilitate the advancement of the transseptal sheath over the dilator, the radiofrequency wire was exchanged for a 0.025-inch pigtail wire (ProTrack; Baylis Medical Inc) (Figure, E). This allowed safe advancement of the sheath over the dilator to obtain transseptal access. A 3-dimensional electroanatomic map of the left atrium was created with the Pentaray (Biosense Webster) catheter (Figure, F) and wide antral pulmonary vein isolation was accomplished with an open-irrigated mapping and ablation catheter (Thermocool SmartTouch; Biosense Webster) (Figure, G–I). The total procedural time was 3 hours with a fluoroscopy time of 25 minutes.

Discussion
A transjugular transseptal approach for pulmonary vein isolation has been previously described using a manually curved standard Brockenbrough needle and nonsteerable sheaths, and without ICE guidance. Such an approach can be challenging, since it is highly dependent on the individual patient anatomy and ability to engage the fossa ovalis with nonsteerable sheaths and standard transseptal needles. Advancement of the transseptal dilator and sheath in the left atrium over a standard needle may also be difficult, and lack of direct visualization of the access site with ICE may increase the procedural risks. We describe a novel approach to obtain transseptal catheterization from the right internal jugular vein facilitated by the use of an endovascular radiofrequency wire and an exchange pigtail wire specifically designed to provide increased support to the transseptal apparatus. It is important to emphasize that the radiofrequency wire is primarily designed to allow crossing of totally occluded peripheral vessels, and particular caution should be exercised when advancing the wire while radiofrequency energy is turned on. Careful imaging of the radiopaque tip of the guidewire with fluoroscopy and ICE is crucial to minimize the risk of atrial or aortic root perforation. In this regard, both the radiofrequency needle (Baylis Medical Inc) and the SafeSept guidewire (Pressure Products Inc, San
Pedro, CA) may be valid alternatives to obtain transseptal access from a superior approach. However, both the radiofrequency needle and the standard Brockenbrough needle (for the SafeSept guidewire) may need to be manually bent by more than 120 degrees to allow engagement of the fossa ovalis from a superior approach.1

Finally, although catheter manipulation for a left atrial ablative procedure can be challenging using the superior approach, we found no significant differences in terms of catheter maneuverability, stability, degree of contact, and total procedural and fluoroscopy time compared to a standard femoral venous approach. This was facilitated by the use of a steerable sheath and an ablation catheter with real-time contact-force information. In patients with inferior vena cava obstruction, other options such as a percutaneous transhepatic approach or a surgical ablation could also be considered.2–4 Although feasible, the transhepatic approach has been associated with up to 4% risk of major complications.3 Similarly, surgical ablation has been reported to have significantly higher complication rates compared to percutaneous ablation.5

**KEY TEACHING POINTS**

- The standard approach to atrial fibrillation ablation involves obtaining transseptal access to the left atrium from an inferior approach via a transfemoral venous access. In rare cases, access to the heart through the inferior vena cava is not possible, and a superior approach can be considered.

- We describe a novel approach to transseptal catheterization from a superior approach facilitated by the use of an endovascular radiofrequency wire and an exchange stiff pigtail wire.

- The radiofrequency wire allowed for safe puncture of the interatrial septum without difficulty under direct intracardiac echocardiography visualization, and the exchange pigtail wire allowed for advancement of the transseptal sheath in the left atrium with minimal risk of perforation.

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Figure  A: Intracardiac echocardiography (ICE) image showing the right atrium (RA), left atrium (LA) with the left pulmonary veins (LPV), and the dilator tenting the fossa ovalis (FO). B: Corresponding anteroposterior fluoroscopic view of the dilator at the fossa ovalis. The duodecapolar catheter in the crista terminalis and coronary sinus (CS) positions and ICE catheter are also shown. C: The radiofrequency wire is advanced at the tip of the dilator, and is used to cross the septum. D: The dilator tip is advanced in the left atrium over the radiofrequency wire. E: The radiofrequency wire is exchanged for a stiff pigtail wire, which is used to advance the transseptal sheath into the left atrium. F: A 3-dimensional electroanatomic map of the left atrium is created with the Pentaray catheter. G–I: Catheter ablation is performed with a circumferential wide antral approach.