

## Superior Transseptal Access for Atrial Fibrillation Ablation in Patients with Inferior Vena Cava Obstruction

► Electrophysiologists at Penn Medicine have developed an approach to percutaneous catheter ablation in patients with atrial fibrillation and inferior vena cava obstruction. This novel procedure features transseptal access to the left atrium from an access superior to the heart.

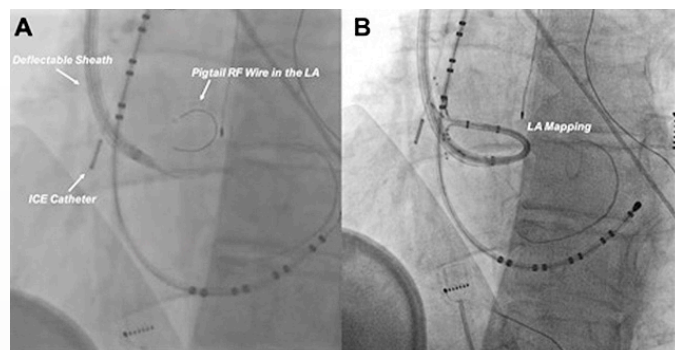
At this time, the standard procedure for AF ablation involves percutaneous access to the left atrium from the femoral vein via the inferior vena cava (IVC). Unfortunately, occlusion of either vein by vascular malformation, clotting or mechanical obstruction prevents a substantial subset of patients from the standard ablation procedure. Few options are available to these patients, however, such as transhepatic percutaneous ablation and more invasive surgical procedures, but these options are associated with higher complication rates than standard minimally invasive percutaneous ablation. In addition, when the occlusion of the IVC extends to the hepatic veins, transhepatic access is also not possible.

As an alternative to these procedures, a novel approach recently developed at Penn Electrophysiology by Pasquale Santangeli, MD, PhD, shows promise.

The new procedure involves transseptal access from the right internal jugular vein using devices with incorporated design innovations. Percutaneous catheter ablation of AF ablation from a superior access was introduced at Penn Medicine by Dr. Santangeli in 2015, where the first case was performed using intravascular radiofrequency wires initially designed to permit the traverse of occluded peripheral vessels, together with exchange pigtail wires. This new technique allowed electrophysiologists to safely obtain transseptal access from a superior approach with completion of the AF ablation procedure with no complications. The technique described above has been subsequently published.<sup>1</sup>

Following this index case, Dr. Santangeli collaborated in the pre-clinical development and testing of a dedicated pigtail radiofrequency wire currently approved for transseptal access from a superior approach.<sup>‡</sup>

Using this novel radiofrequency wire, Dr. Santangeli recently performed the second case of AF ablation from a superior access in a patient with occlusion of the IVC extending to the hepatic veins. This patient had contraindications to transhepatic access, and a superior access approach was thus the only percutaneous option available. Intraoperative comparisons to the standard femoral venous percutaneous procedure have found no significant differences in catheter maneuverability, stability, degree of contact and total procedural and fluoroscopy time.



► **Figure 1:** Fluoroscopic image illustrating the left atrial transseptal access using the novel pigtail radiofrequency wire from a superior access. The procedure is performed under fluoroscopic and intracardiac echocardiography (ICE) guidance. Once left atrial access is obtained, mapping is performed with a multipolar catheter.

### CASE STUDY

Mr. C, a 55-year-old man, was referred to Penn Electrophysiology for catheter ablation for highly symptomatic left atrial flutter and a medical history that included chronic thrombosis of the inferior vena cava extending to the hepatic veins, surgical mitral ring repair and atrial fibrillation with a prior open-heart surgical ablation. His medications at presentation included daily dose-adjusted warfarin, diltiazem 180 mg and losartan 100 mg.

Because the inferior vena cava thrombosis extending to the hepatic veins prevented any percutaneous approach from a standard inferior access (either via the femoral veins or with a transhepatic venous approach), Mr. C consented to the alternative superior approach. It was decided to continue his warfarin therapy during the procedure to minimize the risk of peri-procedural thromboembolism. Under general anesthesia, two right axillary vein accesses were used to advance a phased-array intracardiac echocardiography (ICE) catheter\* and a duodecapolar deflectable catheter to the mid-right atrium and coronary sinus, respectively.

The right internal jugular vein was then accessed, and a steerable sheath was advanced to the right atrium and deflected to engage the interatrial septum, as visualized by intracardiac echocardiography. Left atrial catheterization was obtained under ICE guidance utilizing a novel radiofrequency pigtail wire<sup>‡</sup> (Figure 1).

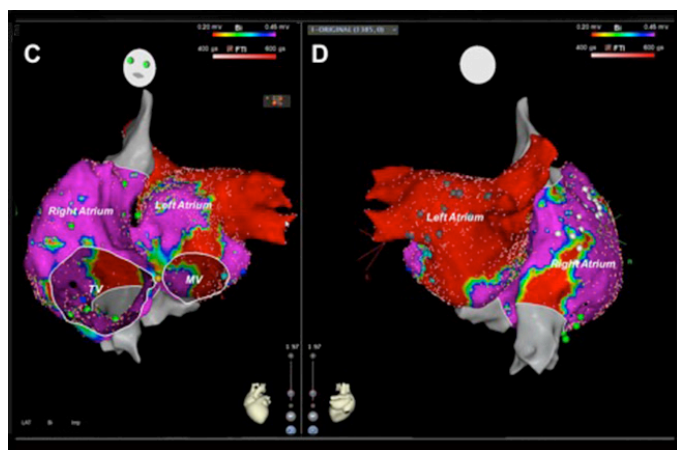
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### References

1. Betensky BP, Santangeli P. Radiofrequency wire-facilitated transseptal access using a superior approach for atrial fibrillation ablation in a patient with inferior vena cava obstruction. *Heart Rhythm Case Reports*. 2016;2:265-7.

\*AcuNav; Biosense Webster, Diamond Bar, CA;

‡Supracross; Baylis Medical Inc, Montreal, Canada.



► **Figure 2:** Illustrates the three-dimensional map of the right and left atria obtained at the end of the procedure. The color display to identify normal and abnormal voltage myocardium ranged from red (ablated tissue with amplitude  $<0.2$  mV), to purple (electroanatomic normal tissue; amplitude  $\geq 0.45$  mV).

### CASE STUDY *(Continued from cover)*

The procedure was completed entirely from a superior approach with a total time of 3 hours, including a fluoroscopy time of 25 minutes. At the completion of the procedure, three-dimensional voltage maps of the right and left atria were created to outline ablated (red) and normal (purple) tissue (Fig. 2). Mr. C remained in the hospital overnight for observation, and was released to home the next day. At his most recent follow-up, he showed no signs of atrial arrhythmia or its symptoms.

### ACCESS

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### FACULTY TEAM

Penn Medicine has the largest electrophysiology program on the East Coast and one of the largest hospital-based programs in the U.S. Comprised of full-time, board-certified electrophysiologists, specialized nurse practitioners and physician assistants, the EP team is dedicated exclusively to treating and eliminating serious and potentially life-threatening heart rhythm disturbances. The team's leadership in ablation and arrhythmia device therapy at the Hospital of the University of Pennsylvania is evident in their continuing commitment to research and large number of scientific publications that have changed the way arrhythmias are treated worldwide.

### ► Performing Superior Transseptal Access for Atrial Fibrillation Ablation at Penn Medicine

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