Catheter Ablation of Atrial Flutter in a Patient with Azygos Continuation of the Inferior Vena Cava after Failed Surgical Cryolesions

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ABSTRACT. A 79-year-old woman was referred for a catheter ablation because of a recurrence of atrial flutter. She had previously undergone cardiac bypass surgery and cryolesions for her atrial flutter. She had also been diagnosed with an azygos continuation of the inferior vena cava to the superior vena cava, so was successfully ablated from the right internal jugular vein.

KEYWORDS. ablation, atrial flutter azygos continuation, inferior vena cava.

Introduction
Ablation of atrial flutter (AFL) requires radiofrequency lesions that are delivered from the tricuspid annulus to the inferior vena cava (IVC) by catheters introduced through the femoral vein. Congenital anomalies of this venous system may limit catheter ablation when the IVC does not connect to the right atrium. This report presents an unusual approach to ablation of AFL because of a congenital IVC interruption. The AFL was successfully ablated via the internal jugular vein, as has been reported in only three other cases in the literature.

Case report

A 79-year-old woman with history of paroxysmal AFL was referred for an ablation. She had a history of diabetes, hypertension, hyperlipidemia, and peripheral vascular disease, and no family history of congenital heart disease. She was initially diagnosed 3 weeks before presentation with new-onset AFL by electrocardiogram (Figure 1). At that time, her physical examination was unremarkable, and an echocardiogram showed no structural abnormalities.

After informed consent, the patient was brought to the electrophysiology laboratory. An ablation catheter was inserted through the right femoral vein. The catheter was advanced through the venous system, but it could not be advanced into the right atrium. This report presents an unusual approach to ablation of AFL because of a congenital IVC interruption. The AFL was successfully ablated via the internal jugular vein, as has been reported in only three other cases in the literature.
Figure 1: The electrocardiogram from admission showed atrial flutter.

Figure 2: Venogram during catheter ablation that demonstrates (a) an enlarged azygos vein (arrow) compatible with (b) azygos continuation of the inferior vena cava to the superior vena cava (arrow).
for a percutaneous catheter ablation. Owing to the known congenital abnormality, venous access was obtained through the right internal jugular vein. Two catheters were used: a Duodecapolar Livewire (St. Jude Medical, St. Paul, MN) with 2–5–2 mm spacing, and the ablation catheter. The duodecapolar catheter was positioned in the coronary sinus and draped across the “isthmus”. Concealed entrainment from this area was confirmed, demonstrating this was a critical part of the circuit. Activation mapping was also performed using the three-dimensional mapping system that confirmed a counterclockwise circuit around the tricuspid valve. A gap in the previous surgical line was not pursued, as a new line was just redrawn from the tricuspid valve to the coronary sinus which terminated the AFL. Patient was subsequently discharged home with no recurrence of symptoms.

**Discussion**

The presence of congenital anomalies of the IVC may be challenging to electrophysiologists during catheter ablation procedures.1–3 The most common anomalies of the IVC are 1) left IVC, usually draining into the suprahepatic vein system, 2) double IVC, where both the right and left IVCs coexist, and 3) IVC interruption, where venous return drains into the azygos system. However, the frequency of these anomalies is not well known in patients undergoing catheter ablation, where it is usually an incidental finding. The incidence of IVC interruption in the general population is <0.3%.4 The dilated azygos vein may be misinterpreted as a paracardiac mass on chest radiography. This anomaly is associated with recurrent deep venous thrombosis of lower extremities, sick sinus syndrome, and AFL.

Recognition of this unusual anomaly is important as it can pose technical challenges during invasive procedures.5 As in our case, a total IVC interruption may lead electrophysiologists to try alternative approaches such as a jugular or subclavian vein approach due to difficult catheter manipulation through the tortuous course of the azygos continuation.6,7 However, these ablation approaches are associated with increased fluoroscopy radiation exposure for the operator and less comfort for both the patient and the operator. Ablation of atrioventricular nodal re-entrant tachycardia and accessory pathway through the azygos continuation has been previously reported without significant difficulties.3,8–10 However, AFL ablation can be more challenging since it often requires multiple or linear radio frequency (RF) applications. To the best of our knowledge, AFL ablation in patients with azygos continuation has been previously reported in only three other patients,4,7,11 and none of them had previously undergone right-sided surgical cryolesions. In our patient, AFL ablation was achieved without complications through the internal jugular vein. Activation mapping was also performed using the three-dimensional mapping system that confirmed a counterclockwise circuit around the tricuspid valve. Therefore, our case demonstrates that the use of an advanced mapping system is feasible when performing AFL ablation through the SVC, despite the challenging venous access and extended procedure time.

Our case also illustrates the role of imaging in patients with unusual presentation of the anatomy of major blood
The identification of the accurate anatomy using imaging modalities such as MRI and three-dimensional image reconstruction using mapping systems may be useful to help the electrophysiologist gain optimal catheter access and perform a safe and successful catheter ablation procedure.

References