

Transhepatic radiofrequency ablation of a cavotricuspid isthmus–dependent atrial flutter



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Introduction

Atrial flutter catheter ablation in patients with a normal-size or mildly enlarged left atrium is associated with a higher likelihood of persistence of sinus rhythm, improvement of quality of life and symptoms scores, decreased atrial fibrillation, and decreased rehospitalization at follow-up. Because of the higher efficacy and the lower persistence of atrial flutter and atrial fibrillation than is observed with conventional medical management, catheter ablation is considered a first-line therapy for atrial flutter.¹ Typically, catheter ablation of atrial flutter is performed via femoral vein access. In the setting of inferior vena cava obstruction, there are reports of alternate routes of access, via the right subclavian and jugular veins and, rarely, the hepatic vein.^{2,3} The percutaneous transhepatic approach has been described in pediatric patients,⁴ and 1 case was found documenting this approach in adults.³ This case report describes the percutaneous transhepatic approach to radiofrequency ablation of a typical right atrial flutter circuit in a 32-year-old African American woman.

Case description

A 32-year-old African American female patient with a past medical history of hypertension, congestive heart failure, paroxysmal atrial fibrillation, mitral regurgitation, and end-stage renal disease on renal replacement therapy (hemodialysis for 11 years) presented with normal sinus rhythm at the beginning of her dialysis session. After she developed symptoms of chest pain, dyspnea, and palpitations 1.5 hours into the dialysis session, she was transferred to a tertiary care

center. Atrial flutter was noted on a 12-lead electrocardiogram (Figure 1A).

On clinical examination, a 2/6 systolic murmur was heard, and a nonfunctioning left upper-extremity fistula was observed (Figure 1B). The rest of the physical examination was unremarkable. The patient had multiple failed dialysis access points, including those in her bilateral groins, and current access was through a right-tunneled brachiocephalic dialysis catheter (Video 1, Video 1 Still). The left innominate vein and both jugular veins were also chronically occluded. Echocardiogram demonstrated severe left ventricular systolic dysfunction with an estimated ejection fraction of <20%, severe biatrial dilation, and severe mitral regurgitation.

The patient had needed repeated hospitalizations for ventricular rate control in atrial flutter. The only option for medical therapy for her was amiodarone. Antiarrhythmic therapy with sotalol and dronedarone were contraindicated with severe left ventricular systolic dysfunction. It was unlikely that cardioversion would keep her in sinus rhythm and, at 32 years of age, she was very likely to develop side effects from the long-term use of amiodarone. Ablation was deemed to be the optimal approach in treating her atrial flutter. She was placed under general anesthesia during the procedure. Vascular interventional radiology was consulted for transhepatic venous access, and using computed tomography guidance, a 22-gauge Chiba needle was placed into the right lobe of the liver at the midaxillary line. Two catheters were used, and they were placed in the coronary sinus and on the cavotricuspid isthmus for ablation (Figures 2A–2C, Video 2). Postablation bidirectional conduction block assessed by pacing the lateral free wall and then recording at the coronary sinus, as well as pacing the atrium at the coronary sinus and recording at the lateral free wall should the activation of atrium on the other side of the block be delayed, demonstrated that the wave of depolarization should transmit and travel around the atrium counterclockwise to the other side of the block.

KEYWORDS Atrial flutter; Catheter ablation
(Heart Rhythm Case Reports 2016;2:241–243)

Conflicts of interest: No conflicts of interests for all authors. Funding: No sources of financial support. **Address reprint requests and correspondence:** Dr Zahra Iqbal, 104 Fawn Circle, Bluefield, VA 24605. E-mail address: zahraiqbalvcu@gmail.com.

KEY TEACHING POINTS

- Percutaneous transhepatic access can be used in adult patients to treat a variety of arrhythmias.
- Transhepatic access offers an approach that allows for greater catheter stability and maneuverability.
- This case study provides an example of the utility of a transhepatic approach under fluoroscopic guidance in a patient with end-stage renal disease and unusable access points.

Atrial flutter was terminated during energy delivery to the isthmus. Postprocedure, sheaths were removed by vascular interventional radiology with coil embolization of the tracts (Figure 2D). The patient had no episodes of bleeding, and she remained in sinus rhythm throughout the rest of her hospital stay (Figure 1C).

Discussion

We report a case of typical right atrial flutter in a female patient on hemodialysis for end-stage renal disease. Successful ablation was achieved in the electrophysiology laboratory via percutaneous hepatic vein access. This route was chosen as the patient had multiple failed hemodialysis access points, including those in her bilateral groins. In previous studies, a transhepatic approach had been explored in 2 patients: 1 patient had atrial flutter in the setting of complex congenital heart disease and the other had atrial fibrillation with inferior vena cava interruption. The

percutaneous transhepatic approach was successfully employed in both cases to eliminate atrial arrhythmias³.

The hepatic vein has been used as a long-term access route for noncardiovascular interventions, including hemodialysis and total parenteral nutrition.^{5,6} This technique has also been well documented in pediatric patients for catheterization of the left side of the heart. The anatomical location of the hepatic vein provides for catheter stability and the large size of the vessel makes it suitable for introduction of the sheath required in this procedure. Complications associated with hepatic vein access for catheter ablation are minimal to none.³ Use of the hepatic vein has also been reported in cases of permanent-pacemaker-lead insertion in pediatric patients with Fontan circulation.⁷ The complications associated with a transhepatic approach include hemorrhage, sepsis, thrombosis, and pancreatitis.⁵

The use of a transhepatic approach for catheter ablation has been previously described in 6 adult patients, both with and without congenital heart disease.⁷ Of these patients, 4 had D-transposition of the great vessels and required systemic arterial circulation to complete a cavotricuspid isthmus ablation line from the tricuspid valve to the inferior vena cava. A transhepatic approach is more inferior and allows for greater maneuverability. However, the site is less compressible, should hemostasis be required. It is an approach that can be useful for catheter ablation of different arrhythmias. This approach, although widely utilized in the pediatric population, is not as readily used in the adult population. Careful selection of patients should be done, and the procedure is preferably approached in a more experienced center, although as demonstrated, it may be used when

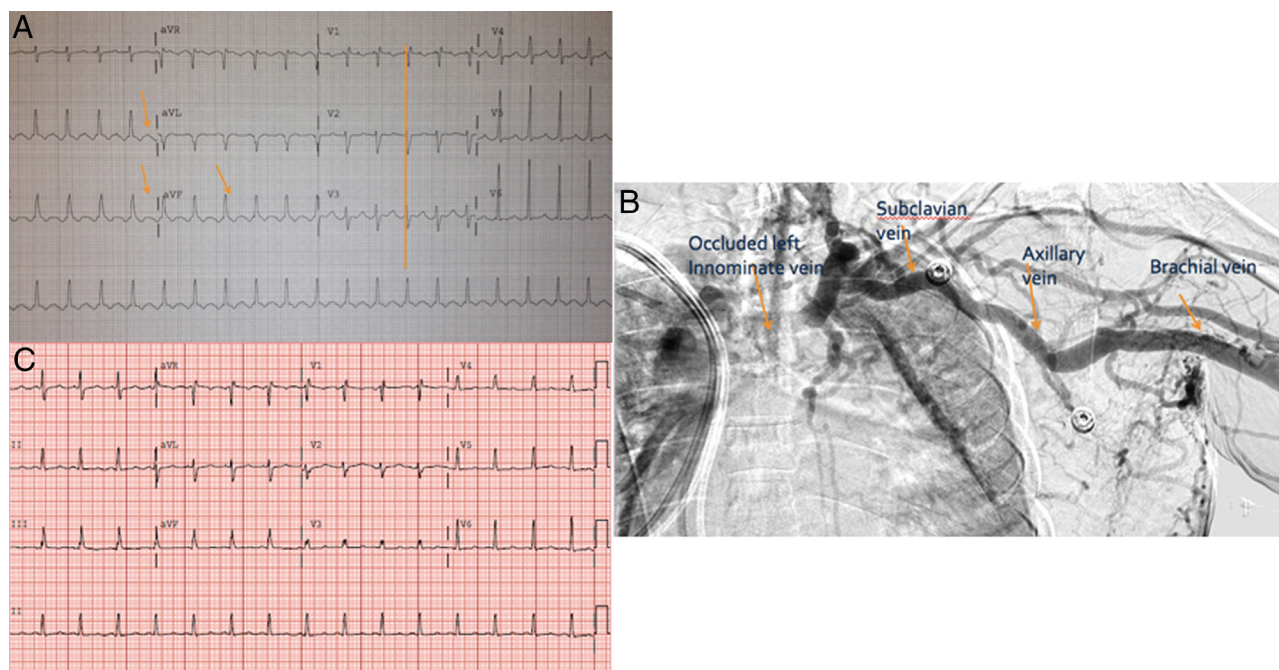


Figure 1 A: Negative deflections in II, III, and aVF (inferior leads) and positive deflections in V1 (criteria for flutter) suggesting cavotricuspid isthmus-dependent atrial flutter. B: Left internal jugular and left subclavian veins were the final access points still available, and losing this access was undesirable. C: Postprocedure electrocardiogram, which illustrates the termination of atrial flutter.

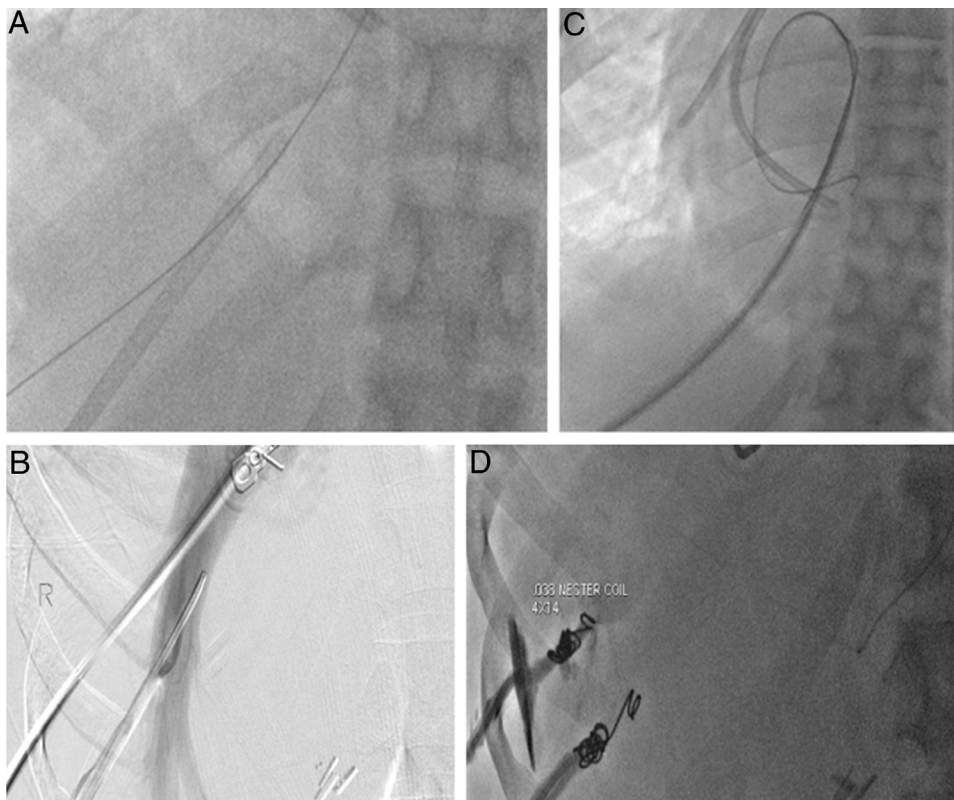


Figure 2 A: Placement of a second sheath with a 0.018 wire through a 22-gauge Chiba needle placed into a superficial hepatic vein via Doppler ultrasound and guided into the IVC. B: Coils being placed to prevent bleeding complications. C: 9F and 7F sheaths were placed into the right hepatic vein and middle hepatic vein, respectively, and advanced, as seen, with contrast to the right atrial junction. D: Two coils were placed to prevent peritoneal bleeding. IVC = inferior vena cava.

other options for access are not available.⁷ In conclusion, this case describes a unique approach to a routine procedure and illustrates that percutaneous transhepatic venous access is a viable alternative for catheter ablation in the face of difficult venous access.

Acknowledgments

Mihail Chelu MD, FHRS, Intermountain Healthcare, T. Jared Bunch MD, FHRS, Intermountain Healthcare, and Kenneth Ellenbogen, FHRS, Virginia Commonwealth University

Appendix

Supplementary data

Supplementary data associated with this article can be found in the online version at <http://dx.doi.org/10.1016/j.hrcr.2016.01.010>.

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