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Case Report

Successful Ablation of Atrioventricular Nodal Re-entrant Tachycardia in a Patient With Interruption of Inferior Vena Cava and Azygos Continuation

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ABSTRACT

Congenital anomalies of the venous system are a challenge for cardiac catheterization and radiofrequency ablation. This article describes ablation of atrioventricular nodal re-entrant tachycardia performed solely through the azygos continuation in a patient with inferior vena cava interruption.

RÉSUMÉ

Les anomalies congénitales du système veineux représentent un défi pour le cathétérisme cardiaque et l'ablation par radiofréquence. Cet article décrit l'ablation de la tachycardie par réentrée nodale effectuée uniquement par la veine azygos chez un patient ayant une interruption de la veine cave inférieure.

Interruption of the inferior vena cava (IVC) with azygos continuation is an uncommon congenital venous abnormality. Accessing the heart through the transfemoral route for electrophysiological studies is really challenging in this anomaly. We report a case of atrioventricular nodal re-entrant tachycardia (AVNRT) ablation performed using a femoral approach through the azygos continuation.

Case Presentation

A 58-year-old female patient was referred to our institution for catheter ablation of drug-refractory recurrent supraventricular tachycardia. At the beginning of the procedure, a decapolar steerable catheter (Inquiry, 6F; St Jude Medical, St Paul, MN) was routinely advanced into the femoral vein. The catheter exhibited an unusual angulation at the abdominal level, and no electrical activity could be recorded when it reached the cardiac silhouette. When the catheter was advanced more distally, it passed into the superior vena cava and the right atrium. This route was suggestive of an interruption of the IVC with continuation of the azygos vein. Angiography with a pigtail catheter was performed to corroborate the diagnosis. Because it was not possible to advance a quadripolar catheter through the angulation of the azygos vein, a second steerable decapolar catheter (Inquiry, 6F) was used. One catheter was placed in the coronary sinus (CS) and the other one was placed in the right ventricle (Fig. 1, A and B). Programmed stimulation from the CS ostium induced AVNRT (started with a 104-ms AV jump and echo beat; RR cycle length, 471 ms; VA interval, 28 ms at the proximal CS).

Responses to entrainment with ventricular overdrive pacing indicated the diagnosis of AVNRT (Fig. 2A). Entrainment was repeated multiple times and similar results were obtained. Additionally, QRS complex fusion was not observed during ventricular entrainment. A 4-mm ablation catheter (7F Blazer II asymmetrical curve catheter; Boston Scientific, Natick, MA) was also advanced through the azygos continuation. After the compact AV node region was determined by recording His potential (Fig. 1C), radiofrequency energy was delivered (40 W, 60°C) at the posterior aspect of the Koch triangle, where the slow pathway potentials were observed (Figs. 1D and 2B). After ablation, there was no observation of dual AV node conduction properties and no arrhythmia was induced. Total procedure time was 106 minutes, and fluoroscopy time was 33.7 minutes. Contrast-enhanced computed tomography was performed to corroborate the diagnosis and rule out other abnormalities during follow-up (Fig 1E).

Discussion

The prevalence of interruption of the IVC with azygos continuation is 0.1%-0.3% in patients without congenital heart disease.[1,2] The IVC receives blood from both kidneys and lower extremities, passes posterior to the diaphragmatic

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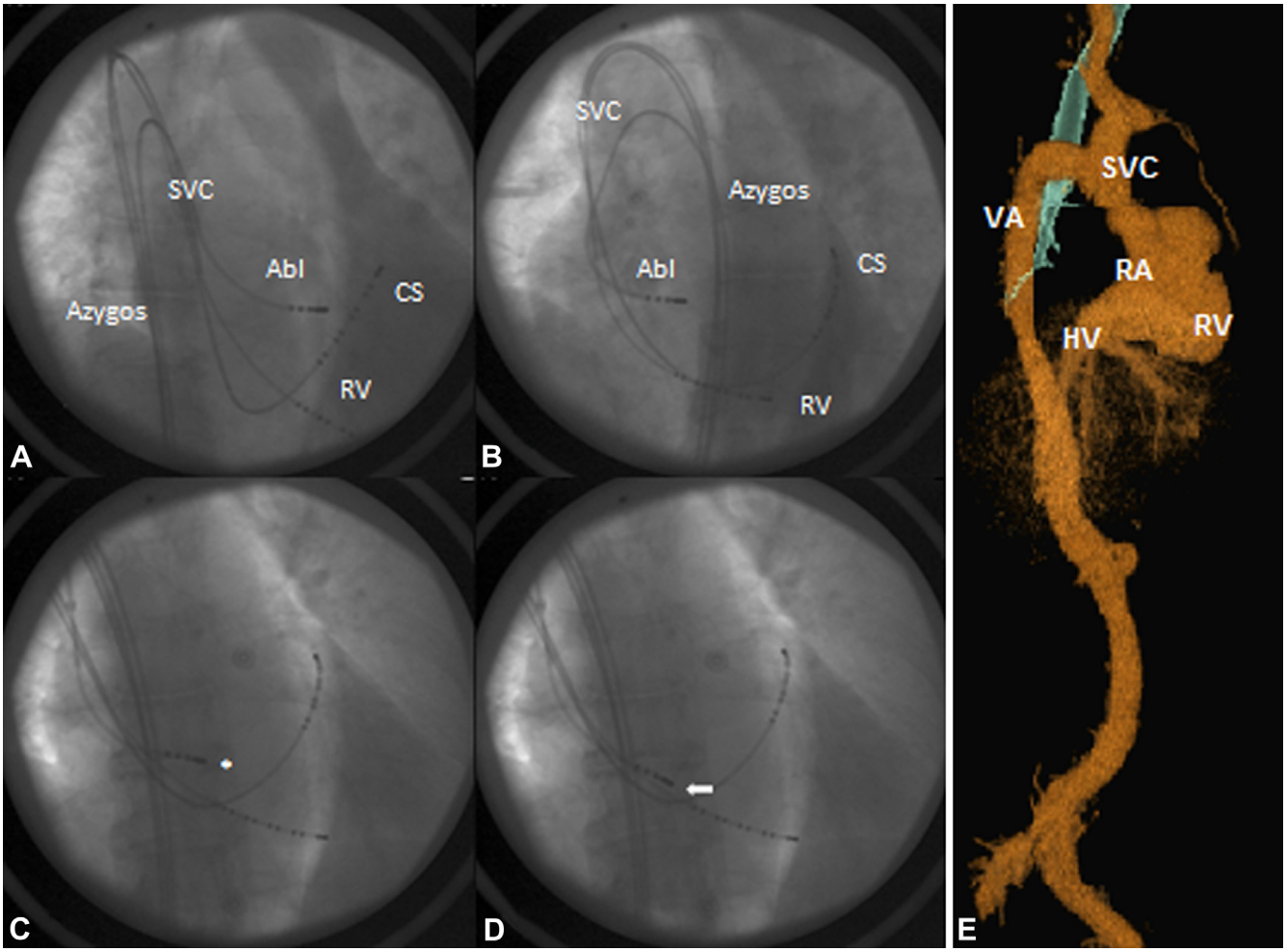

Figure 1. (**A**) Right anterior oblique and (**B**) left anterior oblique views showing the catheters advanced to heart chambers through azygos vein and superior vena cava, respectively. (**C**) Anterior-posterior view showing the ablation catheter at para-Hisian region (**asterisk**). (**D**) Anterior-posterior view showing the ablation catheter at slow pathway region (**arrow**). (**E**) Right posterior oblique view of 3-dimensional reconstruction of the contrast-enhanced computed tomographic scan. Note that the hepatic vein is connected directly to the right atrium. Abl, ablation catheter; CS, coronary sinus catheter; HV, hepatic vein; RA, right atrium; RV, right ventricle; SVC, superior vena cava; catheter; VA, azygos vein.

crura, and enters the thorax as the azygos vein. Occasionally, interruption starts at lower levels, and veins from these structures drain to the azygos vein. Afterward, the azygos vein joins the superior vena cava at the right paratracheal space.[3] A tortuous course of the azygos continuation complicates catheter ablation from the lower extremities. Successful slow pathway ablations have been reported through the jugular and subclavian veins in patients with interruption of the IVC with azygos continuation.[4] However, these ablation approaches are associated with increased radiation exposure and discomfort for both patient and physician. Orientation and manipulation of catheters is also different from usual procedures. In some cases, the IVC might not be truly occluded and the ablation catheter could be advanced through the permeable hypoplastic IVC.[5] All previously reported AVNRT ablations in patients with interruption of the IVC with azygos continuation were performed by a combined (superior and femoral) approach.[4,5] Fortunately, the azygos vein in our patient was enlarged enough to advance and manipulate 3 catheters. To the best of our knowledge, AVNRT ablation solely through the azygos continuation has not yet been reported.

Congenital anomalies of the venous system may limit catheter ablation of AVNRT. This report highlights the importance of identifying these anomalies during the procedure as well as a proper approach depending on the anatomy.

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Disclosures

The authors have no conflicts of interest to disclose.

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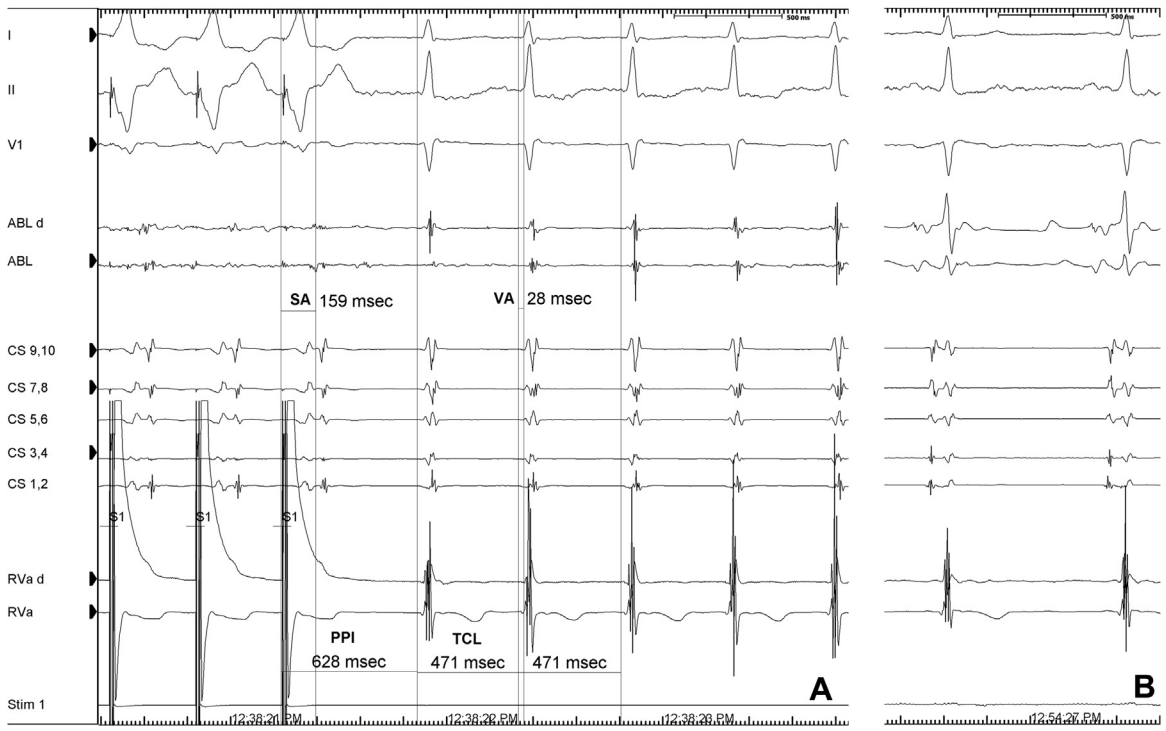

Figure 2. Intracardiac tracings consistent with atrioventricular nodal re-entrant tachycardia (AVNRT). (**A**) VAV (ventricle-atrium-ventricle) response after cessation of right ventricular overdrive pacing excludes a diagnosis of atrial tachycardia. Post-pacing interval—tachycardia cycle length difference (PPI-TCL) was 157 ms, stimulus-to-atrial—ventriculoatrial differences (SA-VA) was 131 ms and indicate the diagnosis of AVNRT. (**B**) Slow pathway potentials were observed at the site of successful ablation. PPI, post-pacing interval; SA, stimulus-to-atrial interval; TCL, tachycardia cycle length; VA, ventriculoatrial interval.

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