

Successful radiofrequency ablation of a right posteroseptal accessory pathway through an anomalous inferior vena cava and azygos continuation in a patient with incomplete situs inversus

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Abstract

We present a 43-year-old patient with paroxysmal supraventricular tachycardia. In the process of catheter ablation, we found interruption of the inferior vena cava with azygos continuation with incomplete situs inversus. In this patient, we adopted the lower approach via the anomalous inferior vena cava and azygos continuation to achieve stability of radiofrequency catheter for right posteroseptal accessory pathway, and successfully abolished the preexcitation. (Cardiol J 2009; 16, 2: 164–167)

Key words: ablation, congenital anomaly, accessory pathway, azygos vein

Introduction

Complete situs inversus is a rare anomaly with a prevalence of 0.02% in the general population [1]. Infrahepatic interruption of the inferior vena cava (IVC) is a congenital anomaly found in 1.3–3.0% of patients with congenital heart disease [2], and occurs in 8–18% of patients with dextrocardia [3, 4]. In this condition, the IVC is interrupted above the renal portion, and systemic venous flow from below the interruption usually drains into the superior vena cava (SVC) via an enlarged azygos vein [5]. Although there are a few reports of radiofrequency catheter ablation of cardiac arrhythmias via this anomalous IVC and azygos continuation [6–10], there is no report of catheter ablation in such a patient with isolated levoversion of the heart and incomplete situs inversus, to the best of our knowledge. In this case report, we describe a successful ablation of the right posteroseptal accessory pathway (AP) in a patient with such an anomaly.

Case report

A 43-year-old female patient was admitted to the Second Xiangya Hospital because of frequent tachycardia attacks accompanied by palpitation. Twelve-lead ECG showed discrete preexcitation with a positive delta wave in leads I, aVL, and V2 to V6, and negative delta wave in leads II, III, aVF, and V1, exhibiting a normal sinus rhythm, which suggested a posteroseptal AP. An ECG recorded during an episode of palpitations showed a narrow QRS complex tachycardia with a cycle length of 178 ms (Fig. 1), and a P wave followed the QRS complex during the tachycardia; the morphology of the P tachycardia wave was unable to be appreciated due to superimposition of the ST-T segment. Physical examination revealed no anomalous findings, and no enlargement of the cardiac silhouette was noted on routine chest X-ray.

After obtaining informed written consent, an electrophysiological study was performed. A quadri-

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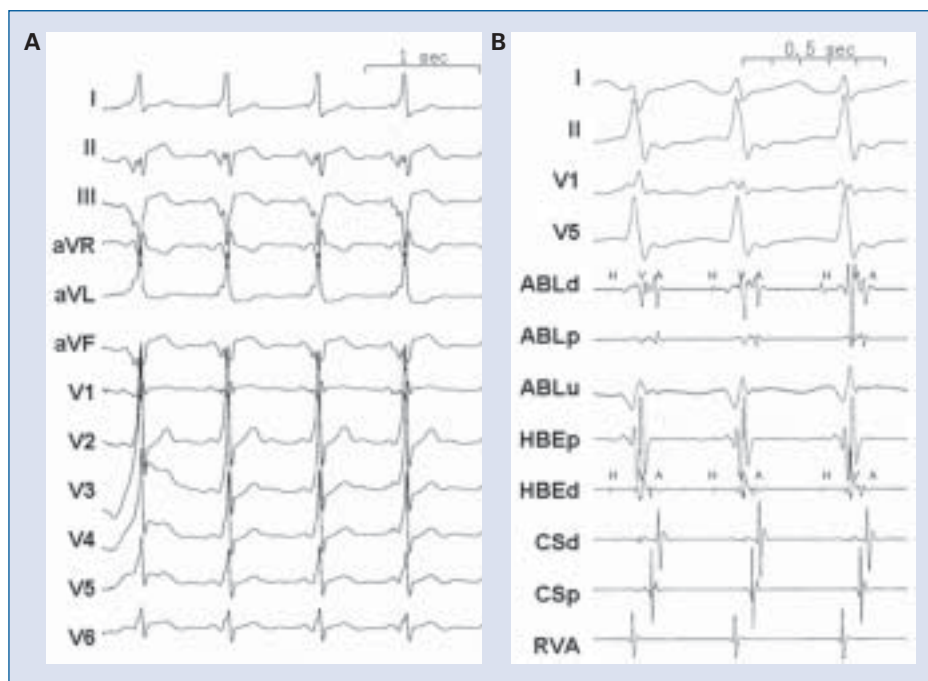


Figure 1. Surface 12-lead ECG and intracardiac recordings during tachycardia; **A.** Surface 12-lead ECG shows preexcitation with a positive delta wave in I, aVL, and V2–V6 leads, and delta wave initially positive in II, III, aVF, and V1 leads, suggesting a posteroseptal accessory pathway; **B.** Tracing during atrioventricular reentrant tachycardia are ECG leads I, II, V1, V5, and intracardiac electrograms recorded from a map catheter close to the HB region with earliest atrial activation in the posteroseptal area (ABLd, ABLp, ABLu). A catheter at the HB region (HBEP, HBEd), a catheter in the coronary sinus (CSp, CSd), and a catheter at the right ventricular apex (RVA). Note the earliest atrial activation at the HB region.

polar catheter (Biosense-Webster, USA) was inserted from the right internal jugular vein and advanced into the coronary sinus (CS). When another quadripolar catheter was inserted from the right femoral vein, it could not reach the right atrium directly from the IVC. When the catheters reached the level of the cardiac silhouette, no electrical activity could be recorded. Subsequently, a pigtail catheter was advanced throughout by the same approach and inferior venocavography revealed an azygos continuation of the IVC, in which the IVC was interrupted above the renal segment and the venous flow drained into the SVC through a dilated azygos vein (Fig. 2). Two catheters were advanced and placed at the right ventricular apex and the HB region via the anomalous inferior vena cava and azygos continuation. The anterograde and retrograde effective refractory periods of the AP were 220 ms and 320 ms, respectively. An orthodromic atrioventricular reciprocating tachycardia (AVRT) was induced repeatedly during programmed right ventricular stimulation. The earliest ventricular and atrial activation site were the proximal CS during sinus rhythm and AVRT, respectively.

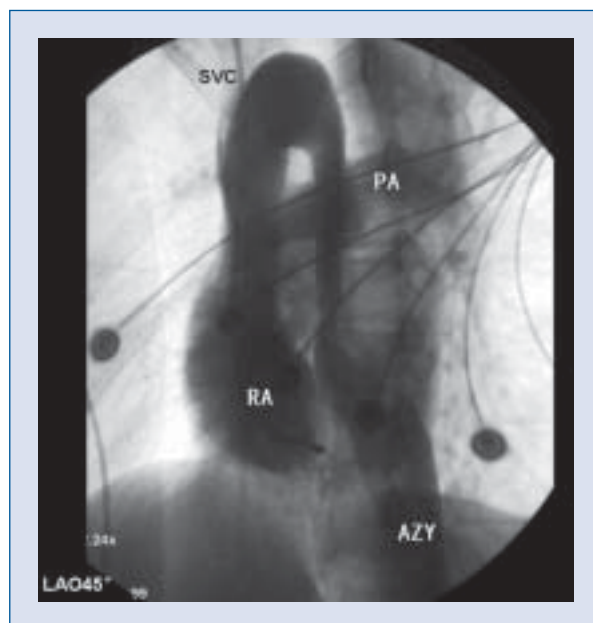


Figure 2. Left (45°) anterior oblique radiographic viewer showing the interruption of the inferior vena cava and azygos continuation to the superior vena cava (SVC) by digital angiography; AZY — azygos vein; RA — right atrium; PA — pulmonary artery.

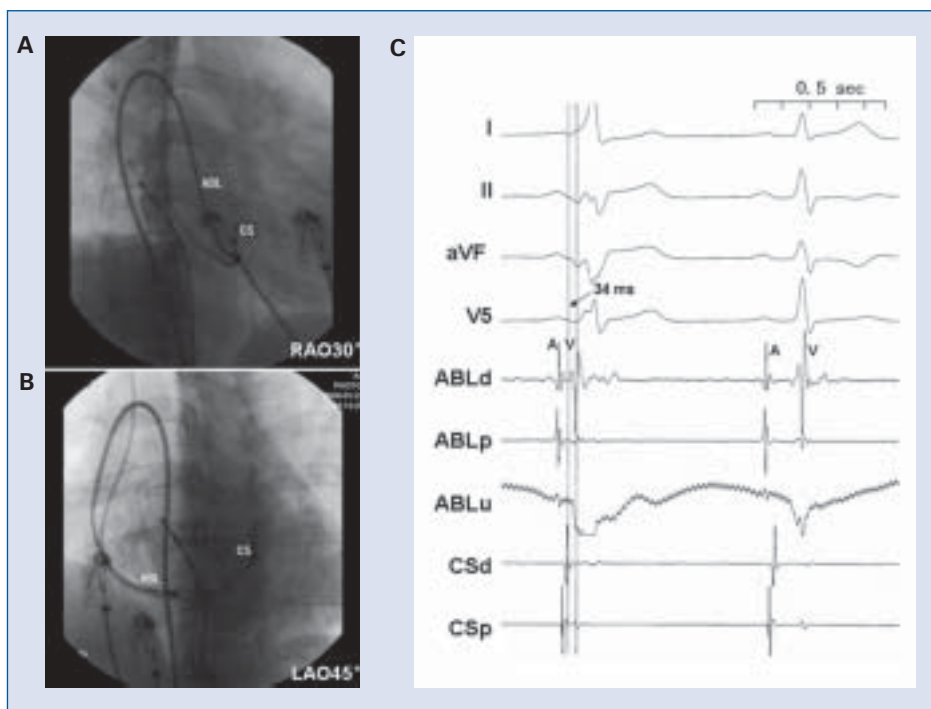


Figure 3. Right (30°) and left (45°) anterior oblique radiographic viewer show the mapping catheter (ABL) at the successful ablation site in the ostium of coronary sinus (CS), a multipolar catheter inside the CS, and an ablation catheter at the ostium of CS (A, B). Recording at the site of successful ablation, a single radiofrequency delivery at the site resulted in the accessory pathway being eliminated after 5 s. From above to below: four surface ECG leads (I, II, aVF, V5), ablation catheter distal, proximal and unipolar (ABLd, ABLp, ABLu), and CS catheter distal, proximal (CSd, CSp) recordings (C).

Following that, a deflectable 7 F 4-mm tip catheter (Biosense-Webster Inc, USA) was advanced into the ostium of the CS via the azygos vein and SVC, which drew back the electrode in right ventricular and HB owing to interference with the ablation catheter. The local ventricular activation preceded the onset of the delta wave by 34 ms. A radiofrequency ablation target temperature of 55°C was started at 30 W and increased to 50 W for 60 s under continuous fluoroscopy to reach the target temperature. The preexcitation was successfully eliminated 5 s from the onset of the energy delivery (Fig. 3), then right ventricular pacing demonstrated retrograde atrioventricular conduction block also post ablation.

Follow up Doppler echocardiographic examination was performed, with isolated levoverision of the heart, reversely positioned liver and spleen, and signs of interruption of the IVC with azygos continuation (the contrast injected at the femoral vein entered the right atrium by the SVC). However, no other anomaly was found including polysplenia or asplenia. The patient was free of palpitation attacks and recurrence of the preexcitation observable on

the 12-lead ECG during 12 months post-ablation follow-up.

Discussion

The most common anomaly involving IVC is the absence of its infrahepatic segment and connection to the SVC through the azygos vein [1–4]. Azygos continuation is seen in 0.6% of patients with congenital heart disease [11]. In this condition, the IVC is interrupted above the level of the renal veins and, as a result, the systemic venous drainage below the interruption is via an enlarged azygos vein, usually into the SVC; in contrast, the hepatic veins typically drain through the residual orifice of the IVC into the right atrium [2]. The anomaly is often associated with other cyanotic or acyanotic congenital cardiac disorders and abnormalities of cardiac position such as dextrocardia and polysplenia or asplenia [5]. However, incomplete situs inversus was only found in this type of patient. There have been a few case reports of radiofrequency catheter ablation of supraventricular arrhythmias in patients with dextrocardia [6–10], complete situs

inversus, and no other cardiac and systemic venous abnormalities. In such cases, radiofrequency ablation could be successfully performed with no particular difficulties (e.g. right instead of left, clockwise instead of counter-clockwise). It has been reported that successful radiofrequency ablation of AP and atrial flutter through an anomalous inferior vena cava and azygos continuation. Recently Taniguchi et al. [9] reported that in a patient with dextrocardia with complete situs inversus, an accessory connection between the coronary sinus and left ventricle was achieved with a right cubital vein approach.

Radiofrequency catheter ablation is the treatment of choice for symptomatic patients with a functional accessory pathway. The most common access to the heart is from the femoral approach. When the AP is located in the right septal region, close to the His bundle, the possibility of inadvertent atrioventricular block has to be taken into account. In normal circumstances, the reported rate of this complication is around 2–5% in most of the series [12]. The presence of a distorted anatomy may significantly increase this percentage, as may occur in the setting of congenital heart disease. In order to ablate successfully, therefore, some surgeons have recommended the upper approach (via the jugular or subclavian vein), and adopted a higher temperature in the tip tissue interface. In this patient, the radiofrequency current failed to abolish the preexcitation via the right internal jugular vein due to instability of the catheter. In our case, we think the lower approach leaving the upper approach via an anomalous IVC and azygos continuation allowed to achieve stability of radiofrequency catheter for right posteroseptal AP.

Conclusions

For a patient with right posteroseptal accessory pathway combined with an anomalous inferior vena cava and azygos continuation the ablation can be achieved successfully, but there are some difficulties including the instability of radiofrequency catheter and higher risk of complications, so it needs to be well-skilled.

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References

1. Nugent EW, Pauth WH, Edwards JE. The pathology, pathophysiology, recognition and treatment of congenital heart disease. In: Schlant RC ed. *Hurst's the heart*. McGraw-Hill, New York 1994: 1807–1808.
2. Mayo J, Gray R, St Louis E, Grosman H, McLoughlin M, Wise D. Anomalies of the inferior vena cava. *Am J Roentgenol*, 1983; 140: 339–345.
3. Garg N, Agarwal BL, Modi N, Radhakrishnan S, Sinha N. Dextrocardia: An analysis of cardiac structures in 125 patients. *Int J Cardiol*, 2003; 88: 143–155.
4. Fulcher AS, Turner MA. Abdominal manifestations of situs anomalies in adults. *Radiographics*, 2002; 22: 1439–1456.
5. Suthar AL, Nanda NC, Harris PJ. Two-dimensional and Doppler echocardiographic identification of infrahepatic interruption of inferior vena cava with azygos continuation. *Pacing Clin Electrophysiol*, 1983; 6: 963–971.
6. Pak HN, Hwang C, Kim YH. Twin atrioventricular node associated with interruption of the inferior vena cava and atrioventricular nodal reentrant tachycardia. *J Electrocardiol*, 2006; 39: 400–403.
7. Kilic A, Amasyali B, Kose S, Aytemir K, Kursaklioglu H, Lenk MK. Successful catheter ablation of a right-sided accessory pathway in a child with interruption of the inferior vena cava and azygos continuation. *Int Heart J*, 2005; 46: 537–541.
8. Malavasi VL, Casali E, Rossi L, Grazia Modena M. Radiofrequency catheter ablation of common atrial flutter in a patient with anomalous inferior vena cava and azygos continuation. *Pacing Clin Electrophysiol*, 2005; 28: 733–735.
9. Taniguchi H, Miyauchi Y, Kobayashi Y et al. Radiofrequency catheter ablation of a coronary sinus-ventricular accessory connection in dextrocardia with complete situs inversus and an anomalous inferior vena cava. *Pacing Clin Electrophysiol*, 2005; 28: 164–167.
10. Guerra Ramos JM, Font ER, Moya I, Mitjans A. Radiofrequency catheter ablation of an accessory pathway through an anomalous inferior vena cava with azygos continuation. *Europace*, 2004; 6: 134–137.
11. Anderson RC, Adams P Jr, Burke B. Anomalous inferior vena cava with azygos continuation (infrahepatic interruption of the inferior vena cava). Report of 15 new cases. *J Pediatr*, 1961; 59: 370–383.
12. Calkins H. Catheter ablation of anteroseptal and midseptal accessory pathways. In: Singer I et al. eds. *Nonpharmacological therapy of arrhythmias for the 21st century*. Futura Publishing Co., Inc. Armonk, NY 1998: 117–138.