Case Report

Intracardiac Echocardiography-Facilitated Ablation of a Left-Lateral Bypass Tract in a Patient with Atrial Septal Aneurysm

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Intracardiac echocardiography (ICE) has been used as an adjunctive tool during electrophysiological procedures, mainly to increase the safety of transseptal puncture. We present the case of a young patient with a left-lateral bypass tract and atrial septal aneurysm, in whom ICE delineated the underlying anatomy, excluded the presence of thrombus and facilitated access to the left atrium through a small atrial septal defect, avoiding the risk of needle puncture for interatrial septal crossing.

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Intracardiac echocardiography (ICE) has been used as an adjunctive tool during electrophysiological procedures, mainly to increase the safety of transseptal puncture. We present a case where ICE facilitated ablation of a left-sided accessory pathway by providing important real-time anatomical information that allowed safe passage of the ablation catheter into the left atrium.

Case presentation

A 23-year-old male patient came to our department with paroxysmal syncopal palpitations and manifest preexcitation on the 12-lead ECG, indicative of a left-lateral accessory bypass tract. The patient had experienced several episodes of palpitations over the last few years and presented two syncopal spells during the last two months, which were witnessed by his father. These syncopal spells occurred after episodes of paroxysmal palpitations and were followed by complete loss of consciousness and seizures of brief duration at the end of each episode. However, there was no electrocardiographic evidence of the underlying cardiac rhythm during or after the episodes.

Neurological evaluation, including electroencephalographic monitoring and computed tomography scanning, had revealed no neurological disorders that could be associated with the reported symptoms. Transthoracic echocardiography had demonstrated redundancy of the anterior mitral leaflet without regurgitation and the presence of a mobile atrial septal aneurysm with a 10 mm deviation from the plane of the septum. Although atrial septal aneurysms are associated with the presence of patent *foramen ovale* (PFO) or atrial septal defect (ASD) in almost 75% of cases, initial evaluation with transthoracic color-flow imaging showed a structurally intact atrial septum, without interatrial shunting.

We performed a diagnostic electrophysiological study, following standard techniques and protocols, which localized the accessory pathway to the free wall of the left ventricle. The antegrade refractory period during incremental atrial pacing was measured at 260 ms, while there was no evidence of retrograde conduction over

this accessory pathway. The latter finding is rather rare, since only 5% of patients with preexcitation have only antegrade conducting bypass tracts.[1] Atrioventricular nodal conduction did not exhibit dual pathway physiology, and finally no circus movement tachycardia could be initiated. Based on the patients' worrisome symptoms, which were suggestive of a rapid pre-excited tachycardia, we decided to proceed with radiofrequency catheter ablation of this uncommon accessory pathway.

Ablation of a left-sided pathway can be accomplished using either a transseptal (antegrade) or a trans-aortic (retrograde-left ventricular) approach. The transseptal puncture, using a retained long sheath in the left atrium, has been demonstrated to offer advantages, such as high success rate, more stable positioning and easier manipulation of the ablation catheter, shorter radiation exposure and less need for crossover to the trans-aortic technique.[3] However, these advantages should be weighed against an increased rate of complications, including cardiac tamponade and death, related to transseptal puncture, which may occur even with experienced operators.[2,4] Furthermore, the presence of an interatrial aneurysm and the related substantial risk of preformed thrombi in the pouches of the aneurysmal tissue would further increase the risk of paradoxical embolism in the case of transseptal puncture. In order to overcome the above-mentioned caveats, to reduce the fluoroscopy time in the case of our young patient, and to acquire detailed anatomical imaging that would ensure a safe transseptal puncture, we resorted to the use of ICE imaging (ACUSON system, AcuNav^{TM} diagnostic ultrasound catheter, Siemens Medical, Germany).

Following insertion of the intracardiac ultrasound catheter using a femoral vein approach and proper positioning, the interatrial aneurysm was imaged, while color flow imaging confirmed a minor degree of left-to-right flow through the interatrial septum, consistent with a small ASD which was not evident from transthoracic imaging (Figure 1).

After confirming the absence of thrombus in the septal aneurysm using intracardiac echo-imaging, we proceeded with the navigation of the ablation catheter through the ASD and gained access to the left atrium, avoiding the risk of needle puncture for crossing the interatrial septum. However, as the ablation catheter could not readily be stabilized on the mitral annulus, a long introducer sheath (Fastcath SR0, Daig, St Jude, Mineapolis MN, USA) was inserted into the left atrium via the septal defect, and through this sheath the

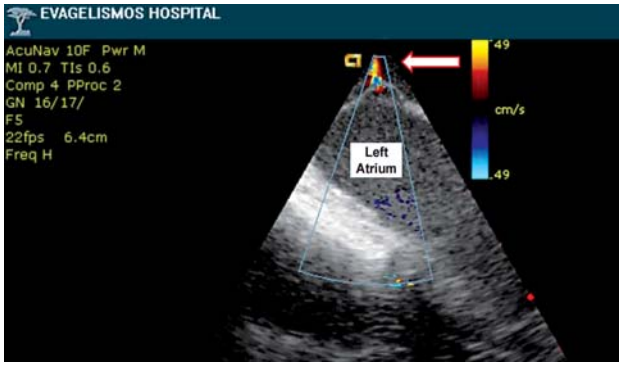

Figure 1. Left-to-right flow through the small atrial septal defect (leftward arrow).

ablation catheter was reintroduced into the left atrium. This effort was guided by real-time and stored images acquired by the ICE (Figure 2). After a short period of mapping, we proceeded with radiofrequency catheter ablation of the accessory pathway on the atrial side of the mitral annulus. Pre-excitation disappeared following 4.3 seconds of the first radiofrequency energy application (Figure 3).

The procedure was uncomplicated and the patient was discharged from the hospital 48 hours later without electrocardiographic evidence of pre-excitation on the 12-lead ECG. Two days later the patient underwent brain scanning with magnetic resonance

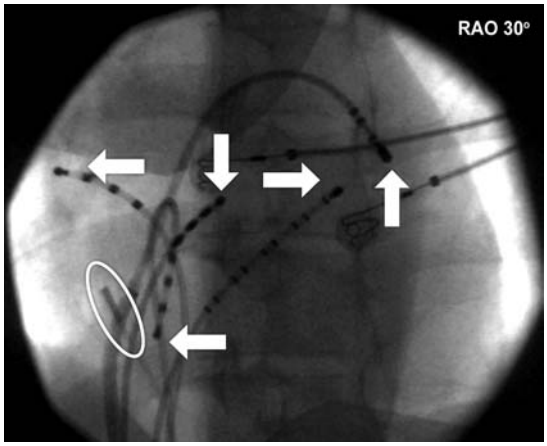

Figure 2. Fluoroscopic view of the ablation site. The intracardiac echocardiography catheter is located at the low atrium close to the inferior vena cava (white ring). Upper and lower leftward horizontal arrows indicate the high right atrium and right ventricular 4-polar catheters, respectively. The downward arrow indicates the area where the His electrogram was recorded and the rightward arrow the 10-polar catheter that was placed into the coronary sinus. The ablation catheter (upward arrow) is located distally to the distal pole of the coronary sinus catheter in accordance with the polarity of the manifest pre-excitation on 12-lead ECG.

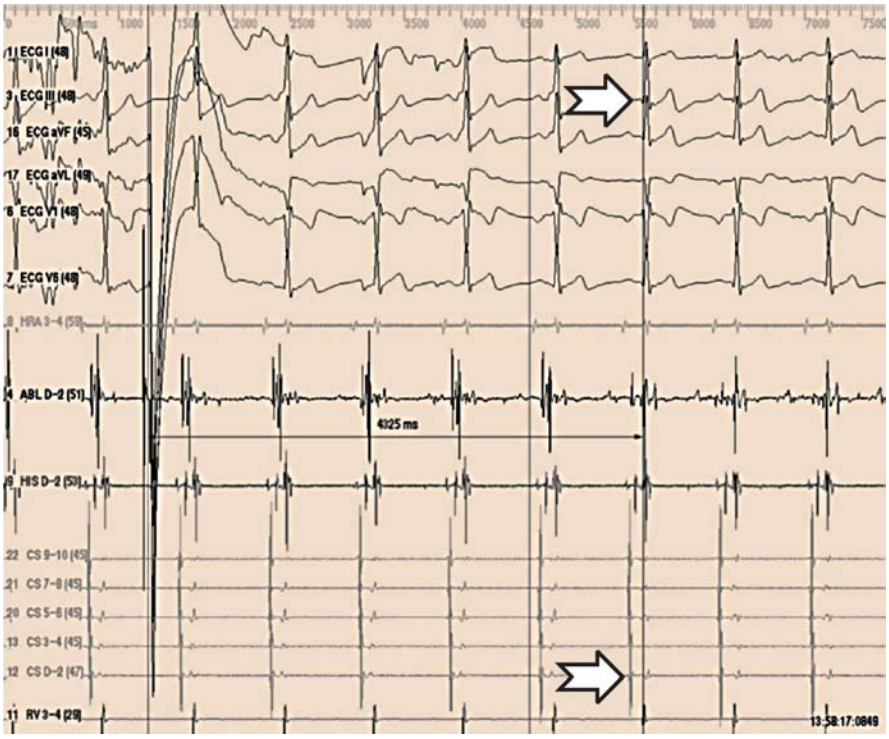

Figure 3. Electrograms obtained during application of radiofrequency ablation energy. Note that the pre-excitation disappears at the sixth QRS complex (upper arrow). At the same time, in the distal area of the coronary sinus catheter (CS-D2), A and V electrograms are separated (lower arrow).

imaging, which showed no congenital structural cerebral lesions and no evidence of previous infarcts. Given the negative neurological evaluation and the minor magnitude of interatrial shunting based on pulmonary-to-systemic flow ratio, percutaneous ASD closure was not considered at this time. One month later the patient was entirely asymptomatic, and there was no preexcitation on the 12-lead ECG.

Discussion

It has been shown previously that the application of ICE provides direct visualization of the interatrial septum and *fossa ovalis*, facilitating transseptal puncture and enabling safer access to the left intracardiac structures considered as key targets for arrhythmia therapy.[5] In sporadic cases presented in peer-reviewed journals, such a policy has been successfully used for ablation of left-sided accessory pathways.[6]

To our knowledge, this is the first case where ICE facilitated ablation of a left-sided accessory pathway in a young patient with syncopal spells and a mobile atrial septal aneurysm, by providing important real-time anatomical information that allowed safe passage of the ablation catheter into the left atrium. Eventually, the originally planned transseptal puncture was obviated due to ICE guidance, allowing safe navigation of the ablation catheter via the small ASD. It is noteworthy that, although the defect was very small, the ablation catheter was repeatedly passed through it under ICE guidance, whereas initial routine effort, not guided by ICE, was ineffective in this regard. This observation may have profound clinical importance, taking into consideration the increasing complexity of catheter ablation cases[7,8] and the high prevalence of asymptomatic PFOs and ASDs in the general population and in patients undergoing ablative procedures.[9]

Finally, before the broader use of ICE can be recommended for ablative procedures, which may confer increased efficacy and safety, cost-effectiveness issues need to be further investigated in future studies. Nevertheless, in selected cases, such as the one presented herein, the use of ICE could be considered an important adjunct to the ablation procedure.

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References

1. Hammill SC, Pritchett EL, Klein GJ, Smith WM, Gallagher JJ. Accessory atrioventricular pathways that conduct only in the antegrade direction. Circulation. 1980; 62: 1335-1340.
2. De Ponti R, Cappato R, Curnis A, et al. Trans-septal catheterization in the electrophysiology laboratory: data from a multicenter survey spanning 12 years. J Am Coll Cardiol. 2006; 47: 1037-1042.
3. Manolis AS, Wang PJ, Estes NA III. Radiofrequency ablation of left-sided accessory pathways: transaortic versus transseptal approach. Am Heart J. 1994; 128: 896-902.
4. Scheinman MM. NASPE survey on catheter ablation. Pacing Clin Electrophysiol. 1995; 18: 1474-1478.
5. Epstein LM, Smith TW, Tenhoff H. Nonfluoroscopic transseptal catheterization: safety and efficacy of intracardiac echocardiographic guidance. J Cardiovasc Electrophysiol. 1998; 9: 625-630.
6. Citro R, Ducceschi V, Salustri A, Santoro M, Salierno M, Gregorio G. Intracardiac echocardiography to guide transseptal catheterization for radiofrequency catheter ablation of left-sided accessory pathways: two case reports. Cardiovasc Ultrasound. 2004; 2: 20.
7. Kotsakis AA, Margos PN, Stefanidis AS, Kouvarakos DN, Papasteriadis EG. High power radiofrequency ablation of incessant atrioventricular re-entrant tachycardia in a patient with a para-Hisian accessory pathway. Hellenic J Cardiol. 2007; 48: 306-313.
8. Papagiannis J, Maounis T, Laskari C, Theodorakis GN, Rammos S. Ablation of atrial tachycardias with radiofrequency current after surgical repair of complex congenital heart defects. Hellenic J Cardiol. 2007; 48: 268-277.
9. Manolis AS, Andrikopoulos G, Tsagou V, Pyrros J, Kranidis A. Transcatheter closure of patent foramen ovale during a radiofrequency ablation procedure. Clin Cardiol. 2006; 29: 369-371.