

Ablation of a Focal Atrial Tachycardia originated in the Tip of a Left Atrial Appendage ligation stump by LAA electrical isolation using a cryo-balloon

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October 5, 2020

Abstract

Left atrial appendage (LAA) has been known as a source of focal atrial tachycardias (AT). Radio-frequency (RF) energy based focal ablation of these arrhythmias was a common strategy in most cases. However, catheter ablation in these foci remains challenging due to the complexity of the LAA anatomy. Sometimes an epicardial approach is an alternative when endocardial ablation of LAA fails. Cryo-balloon based LAA isolation may be considered before epicardial access³. We report a patient with focal atrial tachycardia originated in the tip of a LAA ligation stump (he underwent a heart valve mitral bio-prostheses replacement and had his LAA ligated during the operation years ago), who, being refractory to focal RF ablation, received a LAA isolation using a cryo-balloon which successfully terminated the tachycardia and converted the patient to sinus rhythm.

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Conflicts of all authors:

The authors report no conflicts of interest. All authors have participated in the work and have reviewed and have agreed with the content of the article. The authors alone are responsible for the content and writing of the paper.

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INTRODUCTION

Left atrial appendage (LAA) has been known as a source of focal atrial tachycardias (AT)^{1, 2}. Radio-frequency (RF) energy based focal ablation of these arrhythmias was a common strategy in most cases. However, catheter ablation in these foci remains challenging due to the complexity of the LAA anatomy. Sometimes an epicardial approach is an alternative when endocardial ablation of LAA fails². Cryo-balloon based LAA isolation may be considered before epicardial access³. We report a patient with focal atrial tachycardia originated in the tip of a LAA ligation stump (he underwent a heart valve mitral bio-prostheses replacement and had his LAA ligated during the operation years ago), who, being refractory to focal RF ablation, received a LAA isolation using a cryo-balloon which successfully terminated the tachycardia and converted the patient to sinus rhythm.

Key words: atrial tachycardia; left atrial appendage stump; cryo-ablation; anti-coagulation, Rhythmia system

Case description

A 70-year-old man presented with recurrent drug-refractory atrial tachycardia, who had underwent Mitral valve replacement, Tricuspid valvuloplasty, and ligation of the LAA years ago. The 12-lead electrocardiography demonstrated long RP tachycardia with a negative P wave in I and aVL, a positive P wave in inferior leads and a positive P wave in V1 (**Figure 1A**). The coronary sinus mapping revealed a distal-to-proximal atrial activation sequence during the AT (**Figure 1B**). After trans-septal puncture, an Orion basket catheter (64 electrodes of 0.4 mm² area; 2.5 mm spacing) was placed into the left atrium. Using an ultra-high resolution mapping system, (Rhythmia system), 16947 points were achieved which revealed that the earliest atrial activation was inside the tip of the LAA stump (**Figure 1C**). Angiographic revealed the LAA ligation stump (**Figure 1D**). Then, an irrigated tip 3.5 mm ablation catheter (Thermocool SF, Biosense Webster, Diamond Bar, CA, USA) was introduced to the earliest activation point (**Figure 2**). Unfortunately the catheter mechanically terminated the tachycardia, and the atrial tachycardia could not be induced by programmed stimulations. RF energy was given under sinus rhythm with the energy of 10-15 W at the earliest activation spot. However, we were not sure about the end point due to a failure to induce the atrial tachycardia. We were also concerned about the potential risk of pericardial tamponade of a fragile LAA stump wall during ablation, so ablation time was limited. But the atrial tachycardia recurred 2 days later. A second mapping confirmed the tachycardia was originated from the same foci. Concerning the difficulties of focal ablation strategy, we decided to electrically isolate the whole LAA stump using a second generation 28-mm cryo-balloon (CB2; Arctic Front Advance, Medtronic, USA). After placing the inner lumen circular map catheter (Achieve 15mm, Medtronic Inc., Minneapolis, USA) into the LAA stump, the CB was inflated and the complete LAA occlusion was confirmed using angiography. During the CB ablation, the atrial tachycardia terminated and the sinus rhythm was restored (**Figure 3**). After ablation, pacing was performed to verify the left atrial appendage stump electrical isolation (**Figure 3C**). The patient was put on a continual oral anticoagulation after the procedure. Our follow-up of 6 months confirmed no recurrence of the tachycardia, nor any ischemic embolism.

Discussion

To the best of our knowledge, this is the first report of the CB ablation of focal AT originated in the tip of the LAA stump after LAA ligation. Due to the complex anatomic structure of the surgical LAA ligation stump, it is difficult to manipulate the catheter and deliver the effective energy to the target. Moreover, the thinness and fragility of the LAA stump increases the risks of cardiac perforation and tamponade. Successful electrical isolations of both RAA and LAA with CBs have been previously reported^{4 5}, which suggests that cryo-ablation could be an alternative treatment for these patients. However, LAA electrical isolation might increase the thromboembolic risk⁶, further, the risk of embolic events increases in patients with incomplete surgical LAA ligation⁷. This case is especially at high thromboembolic risk for both incomplete LAA ligation and LAA isolation. So we deem it necessary that the patient take long-term anticoagulants. In conclusion, the CB2 electrical isolation could be safe and effective in treating focal AT originating in the tip of LAA stump after LAA ligation.

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Figure legends:

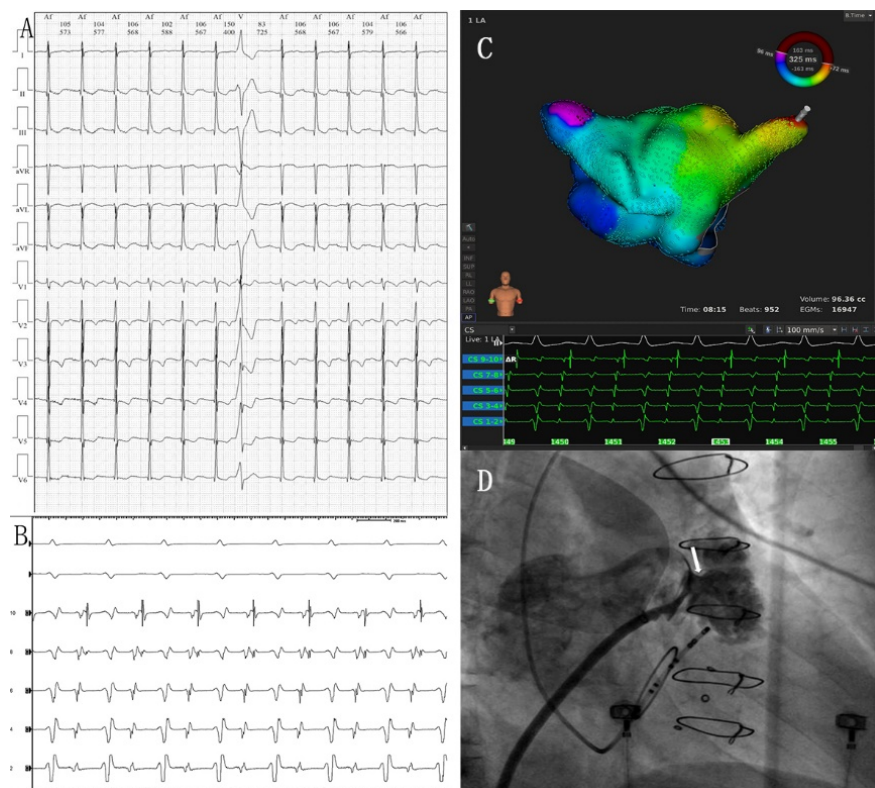


Figure1: A: Baseline 12-lead electrocardiography demonstrated tachycardia with a negative P wave morphology in I and aVL, positive P wave morphology in inferior leads and positive P wave in V1 derivation. B: The coronary sinus mapping revealed a distal-to-proximal atrial activation sequence during the AT. Figure1C: Ultra-high resolution mapping (Rhythmia) showed the earliest activation to be in the distal portion of LAA stump from the view of AP. Figure3: Angiographic of the LAA stump imaging at RAO 30°.

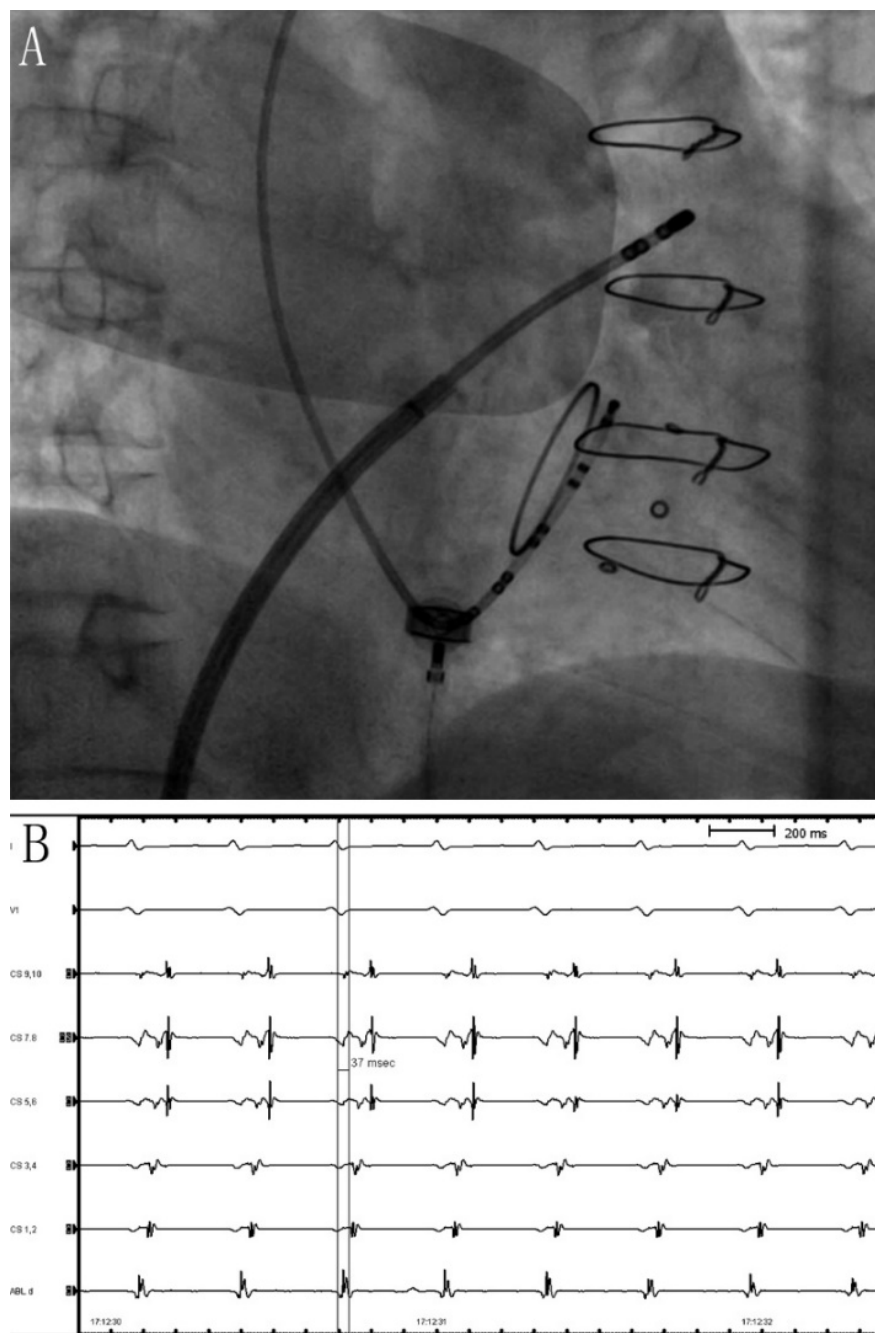


Figure2: A: The earliest activation point was located in the tip of the LAA stump. B: The atrial potential here was 37ms earlier than the CS1-2 electrode.

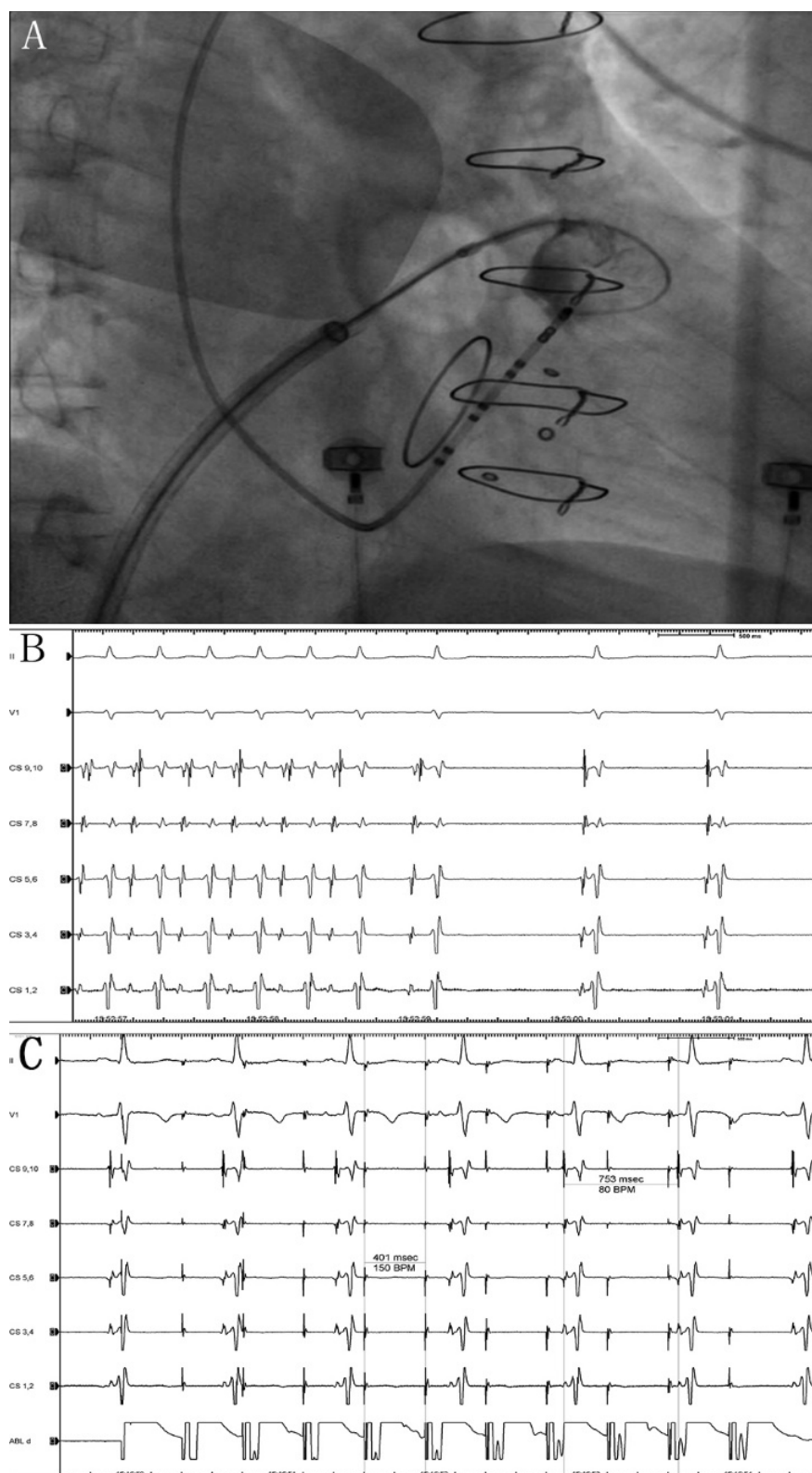


Figure3:A: The complete occlusion of the LAA opening was demonstrated with angiography at RAO 30°. B: AT was terminated and sinus rhythm was restored during the cryo-ablation. C: Left atrial appendage pacing suggests efferent block.

