Successful ablation of focal atrial tachycardia originating from the left atrial appendage using 23-mm second-generation cryoballoon

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Introduction

Focal atrial tachycardias (AT) originating from the left atrial appendage (LAA) constitute a minor part of all ATs. However, successful catheter ablation in these foci remains challenging owing to the complexity of the LAA anatomy, and sometimes even surgical LAA excision or epicardial ablation are required to eliminate the AT.[1,2] Cryoballoon (CB) is a safe and effective tool to achieve pulmonary vein isolation. Recently, the second-generation CB (CB2) has been used to perform the isolation of LAA in addition to pulmonary vein isolation during the atrial fibrillation (AF) ablation.[3] However, there are no data available regarding CB2 ablation of the AT originating from the LAA. We described a case of 23-mm CB2 ablation of AT originating from the LAA without LAA isolation.

KEY TEACHING POINTS

- Catheter ablation of atrial tachycardia foci arising from the left atrial appendage (LAA) remains challenging owing to the complex anatomy of the LAA and potential complications.
- The 23-mm second-generation cryoballoon may be safely and effectively used for atrial tachycardia originating from the proximal portion of the LAA.
- The delay or isolation of the LAA is avoided with the use of the 23-mm cryoballoon.

Case report

A 34-year-old man presented with palpitations and was found to have frequent AT (Figure 1). He was admitted to our institution for catheter ablation of frequent AT despite antiarrhythmic medications of propafenone and metoprolol. The patient had been healthy, with absence of structural heart disease. All antiarrhythmic medications were discontinued for at least 5 half-lives. After informed consent was obtained, a conventional ablation attempt was performed in fasting state under sedation with continuous infusion of fentanyl and midazolam. A 6F decapolar catheter was introduced into the coronary sinus (CS). Earliest CS activation was observed at the distal CS. The transseptal approach was performed using a Brockenbrough needle and SL1 transseptal sheath (St. Jude Medical, St. Paul, MN). Results of CARTO activation mapping (Biosense Webster, Diamond Bar, CA) showed the earliest atrial activation located in the proximal portion of the LAA (Figure 2A). The earliest atrial activation preceded the P wave on the surface electrocardiogram by 38 ms (Figure 2B). Radiofrequency energy was delivered with a NaviStar ThermoCool catheter (Biosense Webster) by using a power setting of 30 W at temperature limit of 43°C with a saline irrigation at a flow rate of 17 mL/min. However, sinus rhythm was not restored by several radiofrequency energy applications.

A second ablation procedure was performed using the CB (Arctic Front Advance, Medtronic, Minneapolis, MN). A selective LAA angiography was performed (Figure 3A). Then, a 23-mm CB2 was chosen and advanced into the left atrium over an inner lumen circumferential multipolar catheter (Achieve 20 mm, Medtronic). The CB2 was inflated and placed at the proximal portion of the LAA. Occlusion angiography revealed minor contrast leakage at the inferior aspect of the LAA (Figure 3B). Real-time assessment of LAA potential was achieved using the Achieve catheter. Fifteen seconds of cryoablation at this position resulted in termination of the tachycardia without LAA isolation

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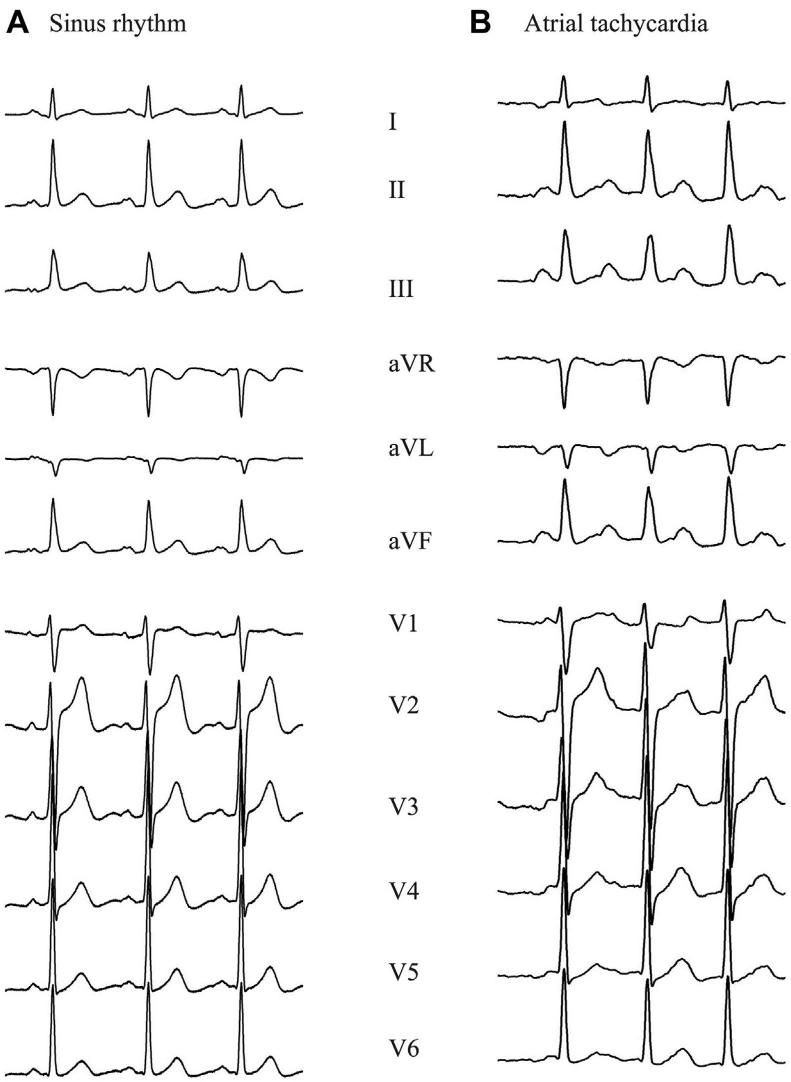

Figure 1 Baseline 12-lead electrocardiogram presents **A:** sinus rhythm and **B:** atrial tachycardia.

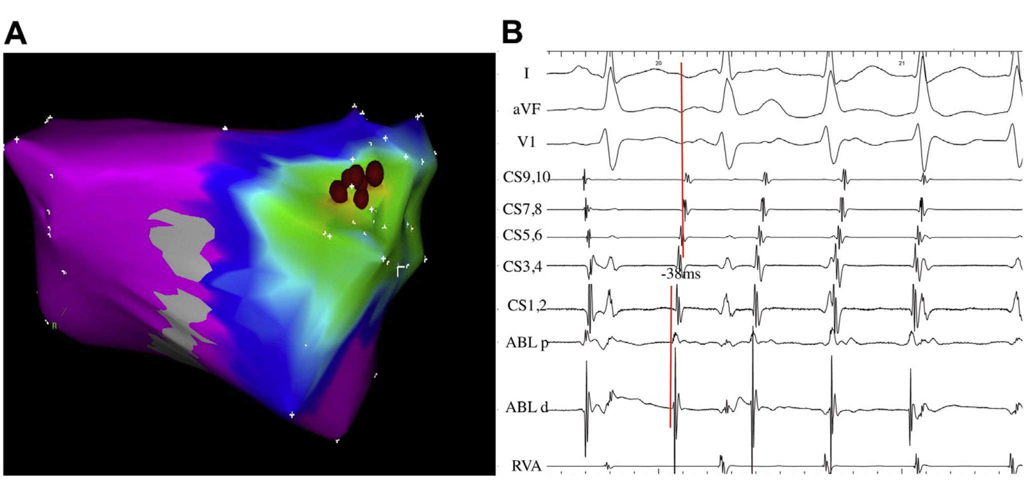

Figure 2 **A:** Activation map of the left atrium and ablation points in the left atrial appendage. **B:** The earliest local electrogram recorded in the ablation catheter precedes the onset of the P wave by 38 ms. ABL = ablation catheter; CS = coronary sinus; RVA = right ventricular apex.

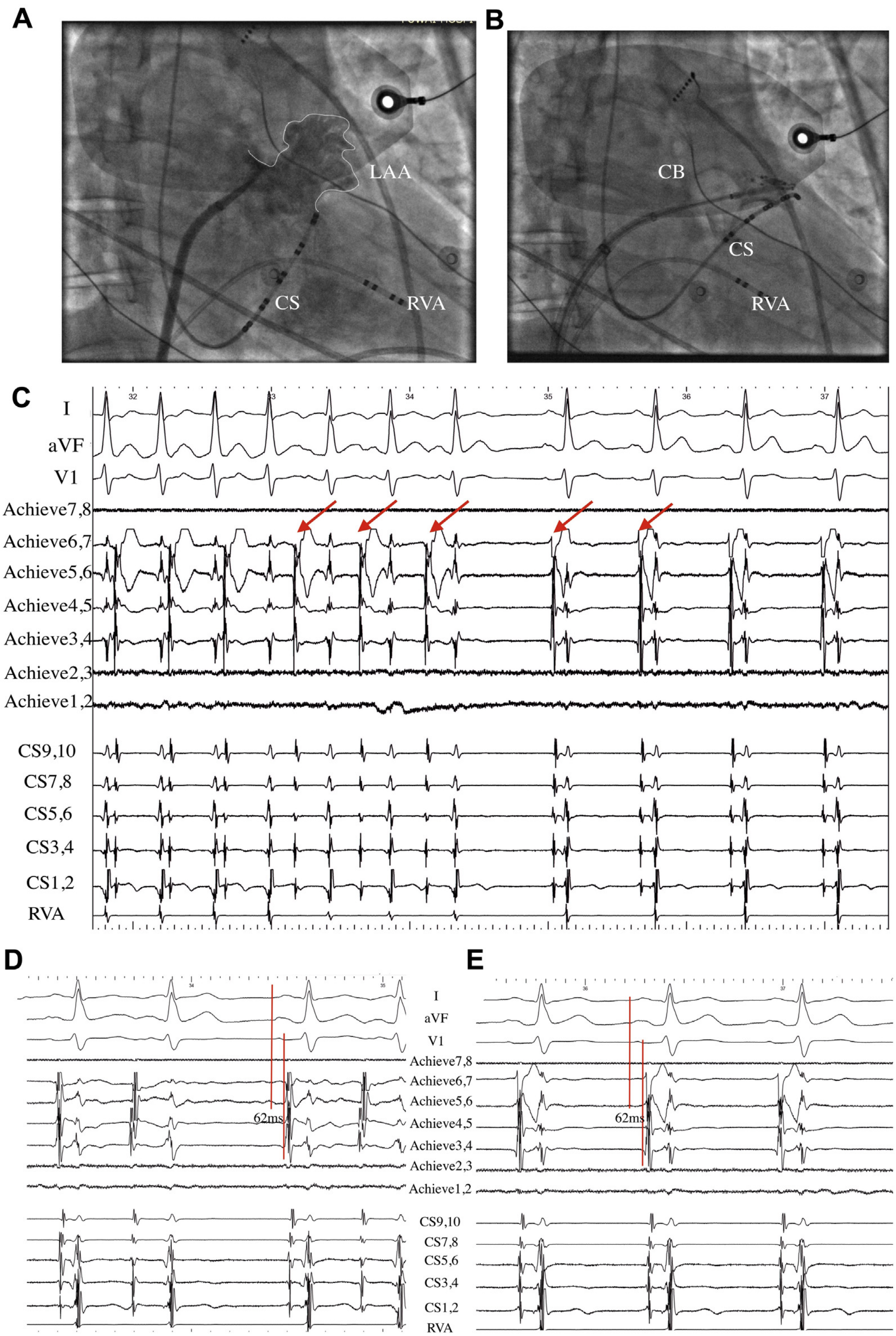

Figure 3 **A:** The morphology of the left atrial appendage (LAA) revealed by selective contrast angiography. **B:** Cryoballoon (CB) ablation of the base of the LAA. **C:** Termination of atrial tachycardia without LAA isolation (*red arrow*) during the CB ablation. **D, E:** The constant conduction time from the onset of P wave to LAA before (**D**) and after CB ablation (**E**) indicates no delay of LAA. CS = coronary sinus; RVA = right ventricular apex.

(Figure 3C). Cryoablation was limited to 180 seconds, reaching a nadir temperature of -35°C and repeated once. Figure 3D and E shows no delay of LAA before and after CB ablation. The left phrenic nerve was monitored by fluoroscopy during spontaneous breathing. After a 30-minute waiting period, the tachycardia was not inducible despite infusion of isoproterenol and burst atrial pacing. Additionally, electrical conduction into and out of the LAA was shown, which indicated no electrical isolation of the LAA. The patient was asymptomatic and free of arrhythmias for a follow-up of 18 months without antiarrhythmic medications.

Discussion

To the best of our knowledge, this is the first report of successful CB ablation of refractory LAA AT with use of a 23-mm CB2 and without isolation of the LAA.

Owing to the complex anatomic features of the LAA (densely organized pectinate muscle bands with intervening thin-walled myocardium), it is difficult to manipulate the catheter and deliver the effective energy to the target site. Moreover, the thin nature of the LAA increases the risks of cardiac perforation and tamponade. CB ablation has been shown to be safe and effective to eliminate the arrhythmias in the right atrial appendage.[4] Electrical isolation of the LAA using a 28-mm CB during the AF ablation procedure has been reported recently.[5] However, achievement of isolation of the LAA in patients with focal AT might not be needed because the mechanism in patients with AT arising from the LAA is focal, whereas in patients with AF these breakthroughs may be diffuse and the mechanism may be reentry, requiring more extensive ablation. Furthermore, LAA isolation might increase the thromboembolic risk.[6] In our case, we demonstrate successful cessation of AT originating from the proximal portion of the LAA using the 23-mm CB2 without LAA isolation. Although optimal occlusion could not be achieved with the use of the 23-mm CB during the procedure, LAA AT was terminated because the AT foci were covered with the CB. LAA isolation seems to have been avoided because the long tip of the catheter can physically impede sufficient occlusion. Besides, left diaphragm paralysis was not observed during the procedure. Therefore, the smaller CB2 might be safe and effective in treating AT originating from the proximal portion of the LAA without LAA isolation.

Conclusion

The 23-mm CB2 may be safely and effectively used for AT originating from the proximal portion of the LAA without LAA isolation.

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