Entrapment of a steerable diagnostic electrophysiologic catheter in the Thebesian valve during radiofrequency catheter ablation for atrial fibrillation

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Introduction

Radiofrequency catheter ablation (RFCA) is an effective treatment modality that is widely performed in patients with symptomatic atrial fibrillation (AF).[1] The overall acute complication rate of AF RFCA is 5%–6%.[2,3] Intracardiac entrapment of instruments is a rare event and has been reported in a few cases mostly associated with the Chiari network or mitral valve apparatus.[4–6] The Thebesian valve is located at the ostium of the coronary sinus (CS). It is well known that the valve can hinder cannulation of electrophysiologic catheters into the CS. However, entrapment of instruments in the Thebesian valve is rare. We report a case of entrapment of a steerable diagnostic electrophysiological catheter in the Thebesian valve before elective RFCA for AF that was successfully managed through open heart surgery.

KEY TEACHING POINTS

- The Thebesian valve, a remnant of the sinoatrial valve, has various morphologies. It can obstruct or narrow the ostium of the coronary sinus.
- The valve may disturb cannulation to the coronary sinus and preclude electrophysiologic procedures.
- Entrapment of instruments in the heart is a rare complication that often results in open heart surgery. Careful catheter manipulation is essential during the procedure.

Case report

A 57-year-old man with paroxysmal AF was admitted for RFCA. AF was incidentally detected on routine health checkup 2 years prior to admission. The patient had no significant medical history and comorbidities. Several episodes of paroxysmal AF were documented during ambulatory 24-hour Holter monitoring despite the use of propafenone. Apixaban was prescribed for anticoagulation. Preprocedural transthoracic echocardiography, transesophageal echocardiography, and cardiac computed tomography revealed no structural heart disease or significant variations of intracardiac structures. For signal recording and electrophysiological study, a 7F steerable duodecapolar catheter and 6F steerable decapolar catheter (both Livewire; St Jude Medical, St Paul, MN) were introduced through the left femoral vein and advanced into the right atrium (RA)–inferior vena cava junction. To place the duodecapolar catheter on the lower RA and CS, we advanced the catheter into the mid-RA. The shaft of the catheter was bent and rotated counterclockwise. The tip of the catheter was directed to the ostium of the CS several times, but unexpected resistance was encountered during catheter manipulation. Further clockwise rotation attempts and forceful retraction failed to release the catheter. Intracardiac echocardiography (ICE) revealed that the tip of the catheter touched interatrial septum without Chiari network or tricuspid valve damage. We pulled the entrapped catheter with counterforce using a combination of a decapolar catheter and long sheath (Swartz SL1; St Jude Medical), but the catheter was not released. Finally, we cut the handle of the catheter, and the SL1 sheath was introduced over the catheter. We tried to detach the duodecapolar catheter into the SL1 sheath, but this maneuver also failed.

KEYWORDS Catheter entrapment; Complication; Coronary sinus; Radiofrequency catheter ablation; Thebesian valve
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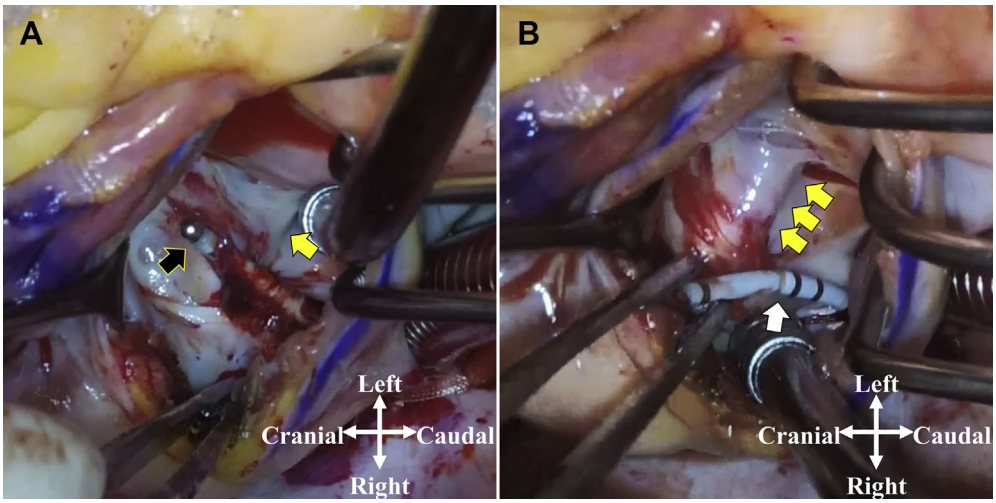

Figure 1 Intraoperative findings of the entrapped electrophysiologic catheter. The lateral wall of the right atrium was incised. **A:** Thin membrane-like tissue was wrapped around the tip of the catheter (*black arrow*). **B:** After removal of the thin tissue, a furrow (*white arrow*) was seen near the distal third electrode of the catheter. The catheter was tightened by the remnant of the Thebesian valve. The ostium of the coronary sinus was observed (indicated by *yellow arrow*).

We finally decided to perform open heart surgery to remove the catheter and a Cox maze operation concomitantly. The catheter and sheath on the left femoral vein remained, and systemic anticoagulation with intermittent heparin injections was given to prevent unwanted thromboembolic events. The open heart surgery was performed the next day. When the right atrium was incised, the tip of the catheter was observed on the interatrial septum. Thin membranous tissue was wrapped around the catheter. The tissue tightened just distal to the third electrode of the catheter (Figure 1). Simple manual retraction could not release the catheter, and electrocautery was applied to the neck of the tissue to release the catheter. A discrete furrow was observed between the second and third electrodes, which was the site at which the tissue had wrapped around the catheter (Figure 2). After catheter removal, the Cox maze III procedure using cryoablation was performed without complications. The patient recovered with no postoperative complications and was discharged in sinus rhythm on postoperative day 7. During the 20 months of follow-up, the AF did not recur, and antiarrhythmic agents were not required.

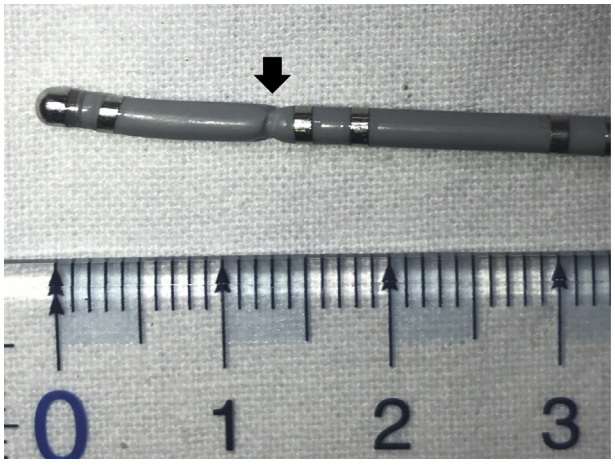

Figure 2 Magnified image of the electrophysiologic catheter. A furrow (*black arrow*) was observed just distal to the third electrode of the catheter.

Discussion

We report a case of entrapment of a diagnostic catheter in the Thebesian valve at the ostium of the CS. The Thebesian valve is an embryological remnant of the sinoatrial valves, located at the ostium of the CS. It was first described in the early 1700s, but its role in the heart remains unclear. It is found in 70%–80% of cadaveric specimens and has a variable morphology and size.[7–9] Around half of the Thebesian valve has a semilunar-shaped free edge.[7,10] Fenestrated Thebesian valves were found in 10%–20% of specimens.[9] The band or strand, remnant, and netlike types have also been reported in a few specimens.[8,9] The size of the Thebesian valve is also variable. In a study of 75 cadaveric specimens, Thebesian valves that covered more than half of the CS ostium were found in 45% of specimens.[8] Fenestrated- or threadlike-type Thebesian valves are usually considered nonobstructive, but the possibility of instrumental entrapment in the valve remains. Hill and colleagues[11] performed direct visualization of the CS ostium using flexible endoscopes and visualized a case of CS cannulation through a fenestration of the Thebesian valve. In our case, the diagnostic catheter seemed to be trapped in a threadlike-type Thebesian valve, which is considered to be less obstructive. The possibility of instrumental entrapment on the Thebesian valve was low.[12] We believe that when the tip of the catheter was directed toward the CS ostium, the tip was already located inside a hole of the fenestrated Thebesian valve. The valve appeared to be tied to the end of the catheter because of the additional rotation and pulling of the catheter. The excessive rotation might have broken the lower end of the valve, while the upper end of the valve remained intact. Sometimes, the Thebesian valve cannot be visualized during imaging workups because of its small structure. Prevalence of the Thebesian valve in multidetector

computed tomography scans ranged from 36% to 46%,[13,14] and these results were lower than those reported in other cadaveric studies.[7,15] This suggests that small-sized, mesh-type, or threadlike-type valves are not found in imaging studies.

Several reports described how to overcome the instrumental entrapment in the electrophysiologic procedure.[4–6] We only tried forceful pulling from right femoral access because of various limitations. We used the ICE and found that the catheter tip was attached to the interatrial septum. Abnormal echogenicity around the entrapped catheter or Chiari network was not observed, and the tricuspid valve was intact. After careful evaluation using ICE, we decided that right heart angiography would not give additional information. One case report described that circular catheter entrapment in the Chiari network has been successfully removed using a 20 mm circular snare and a guidewire from right internal jugular venous access.[6] This approach could alter the force vectors on the catheter and could be helpful to free the entrapped catheter. In our case, there was no free end to hook the snare because the catheter tip closely touched the interatrial septum. A 1-snare-1-catheter technique or double-snare technique could be considered as another option.

Conclusions

This is the first reported case of entrapment of a diagnostic catheter in the Thebesian valve. The Thebesian valve is usually present in the human heart but is difficult to locate during preprocedural imaging studies. Although the Thebesian valve rarely causes problems during intracardiac procedures, careful manipulation of instruments is essential near the CS ostium.

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