Entrapment and retrieval of a diagnostic electrophysiological catheter in the Chiari network

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Abstract
The Chiari networks are reticulated fibers of embryological remnant venous valves in the right atrium. In patients with this congenital variation, manipulation of diagnostic catheters can be difficult, and there is a substantial risk of entrapment during electrophysiological studies. We report a case of successful retraction of a diagnostic catheter entangled in the Chiari network with the use of a lead extraction tool during a scheduled atrial fibrillation ablation. Rescheduled cryoablation was performed without complication and provided a good outcome.

KEYWORDS
Chiari networks, diagnostic catheter, lead extraction tool

1 | INTRODUCTION

The Chiari networks, known as the embryological remnants of venous valves in the right atrium (RA), are among the most common congenital variations. We report a case of entrapment of a diagnostic electrophysiological catheter in the Chiari network prior to intended catheter ablation of atrial fibrillation (AF) and successful retraction by a lead extraction tool.

2 | CASE REPORT

A 36-year-old male was admitted for ablation of symptomatic paroxysmal AF. Routine transthoracic echocardiography (TTE) reported no remarkable abnormality in the intracardiac structure.

After informed consent was obtained, an electrophysiological study under conscious sedation was performed. A 7-Fr steerable duodecapolar catheter (Livewire, Daig, St. Jude Medical) was introduced from the right femoral vein. At the attempt to position the catheter around the tricuspid annulus and enter the coronary sinus (CS), the catheter seemed to be stuck and was impossible to manipulate. No ventricular extra systole was observed on electrocardiogram, and no abnormality was shown on fluoroscopic imaging; therefore, we judged the possibility of the catheter being entangled in the tricuspid valve to be low. This was later confirmed by transesophageal echocardiography (TEE), which showed that the tricuspid valve was intact with no insufficiency. Instead, the catheter was found to be entrapped in the Chiari network. The powerful network fibers extended throughout the RA (Figure 1). We tried to encircle the entrapped catheter and retrieve it with an ablation catheter without success (Figure 1). We then decided to use a lead extraction tool to help. With the presence of a thoracic surgeon, we removed the handle of the diagnostic catheter, exposed the cable conductors, pinpointed and locked the conductors into the loop of the lead extender (width <2 mm; Bulldog, Cook Medical, Bloomington, IN) (Figure 2). After the locked catheter and the lead extender were fit into a long sheath (inner diameter 8.5 Fr, FastCath™ SLO; Abbott, Abbott Park, IL), we introduced the long sheath into the RA along the lead extender and the cut catheter. With the support of the long sheath, we finally managed to retract the catheter. No further attempt at ablation was made. Repeated TEE and TTE showed no damage to the tricuspid valve or RA, and no pericardial effusion was found. The patient was discharged with no sequelae. In addition, although the trans-thoracic echocardiography (TEE) findings before the first procedure might have been neglected or regarded as a...
normal variation by the echocardiography operator, we had the TTE performed after the retraction of the catheter and the Chiari network could be observed in the TTE.

In spite of knowing that the presence of congenital structures had made the intracardiac procedure difficult, the patient had a strong intention to undergo AF ablation. After thorough assessment of the
potential benefits and risks, we rescheduled cryoablation two months later. We introduced a long sheath into the RA beyond the level of the Chiari network to protect the duodecapolar diagnostic catheter and carefully positioned it into the CS. A cryoballoon was then introduced through the routine transseptal approach, and the pulmonary veins were isolated uneventfully. At the 3-month follow-up, the patient reported no symptoms. No AF except for a few supraventricular premature beats was recorded in the 24-hour Holter.

3 | DISCUSSION

The Chiari network is a group of reticulated fibers resulting from incomplete reabsorption of the embryological right valve of the sinus venosus. It is most commonly present as connections between the RA and inferior vena cava and might include strands extending to the Eustachian and Thebesian valves and the crista terminalis. The reported prevalence of Chiari network is approximately 2%, and estimated rates vary between 0.3% and 9.5% in TTE studies. Indeed, among all of the imaging techniques, echocardiography is considered an accurate and convenient tool for the diagnosis of the Chiari network. However, it can sometimes be overlooked or misdiagnosed as thrombi, tumors or vegetations.

The Chiari network is mostly an incidental finding, which per se has no major clinical significance unless it is associated with other congenital anomalies. However, during various invasive intracardiac procedures, different devices have been reported to get entrapped in the structure. Under most of these circumstances, thoracotomy and surgical removal were necessary. In another case, percutaneous wire extraction using radiofrequency energy was described.

In this case, we did not realize that a Chiari network was present prior to the first procedure. Fluoroscopic images cannot provide valuable information about intracardiac structure; TEE helped us finally recognize this abnormality. While it might be challenging to demonstrate the presence of the Chiari network during routine pre-procedural echocardiography, high-quality echocardiographic imaging with robust conclusions about the structures before the performance of an invasive procedure could be critical. A tailored strategy could have been prepared, and the rare complication as described might have been avoided. Just as in the second procedure, we performed a successful cryo-ablation, with protection of the long sheath of the diagnostic catheter in advance. As an alternative to our routine using duodecapolar catheters (to guide the transeptal puncture without TEE) one might simply use a thinner and shorter catheter in patients with complex intracardiac structures.

Our case is also a rare report of a successful retraction of an entrapped catheter in the Chiari network with the assistance of a lead extraction tool. None of the previous similar complications were treated using this approach. With the development of novel tools and accumulated experience in lead extraction, we have been inspired to use this method to solve the problem of catheter entrapment. This method reduces the necessity of open-heart surgery, with less invasive intervention and lower complication risks.

In conclusion, handling of complex multi-polar catheters in the RA has a potential risk of entrapment in the Chiari network. Understanding of the specific intracardiac anatomy prior to ablation is recommended to prevent this complication. However, once the complication occurs, existing extraction tools are helpful for retracting the device and avoiding a more invasive surgical approach.

CONFLICTS OF INTEREST

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