Catheter entrapment in the Chiari network during catheter ablation

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Introduction

Catheter entrapment in the Chiari network is a rare complication of catheterization procedures.[1] We describe successful retrieval of a PentaRay mapping catheter (Biosense Webster, Inc, Diamond Bar, CA) entrapped in a Chiari network during a catheter ablation procedure.

Case report

A 36-year-old man was referred to our hospital because of frequent palpitations. The 12-lead electrocardiogram showed normal sinus rhythm and frequent premature ventricular contractions (PVCs) with left bundle block morphology, transition in V_4, inferior axis, and negative QRS in leads I, aVL, and aVR. Transthoracic echocardiography (TTE) performed elsewhere was reported as showing normal ventricular function and no abnormality.

After written informed consent was obtained, an electrophysiological study was performed under sedation with midazolam and fentanyl. Three quadripolar catheters were positioned at the high right atrium (RA), His bundle region, and right ventricular apex.

An SR0 sheath (St. Jude Medical, Saint Paul, MN) was advanced into the RA, and a D-curve PentaRay mapping catheter (Biosense Webster) was advanced through the SR0 and became entrapped almost immediately near the junction between the inferior vena cava (IVC) and RA. Little or no catheter manipulation was performed before entrapment occurred. Atrial but no ventricular signals were recorded from the PentaRay catheter at the position of entrapment (Figure 1). The catheter could not be advanced or withdrawn with gentle manipulation. Therefore the sheath was advanced over the tips of the catheter splines and gentle traction was applied. The catheter was then removed from the sheath. A piece of gray-white tissue measuring 1 cm by 2 cm was entangled in the splines.

KEY TEACHING POINTS

- The PentaRay catheter (Biosense Webster, Inc, Diamond Bar, CA) can become entrapped in the Chiari network.
- A procedure for removing an entrapped PentaRay catheter is described.
- The presence of a Chiari network in a patient being considered for right-sided catheter ablation might be a relative contraindication to the use of a PentaRay catheter.

The specimen was sent for histologic examination (Figure 2). TTE showed no damage to the tricuspid valve and no pericardial effusion. Ablation of ectopy arising in the right ventricular outflow tract was performed successfully. A transesophageal echocardiogram was performed that showed no tricuspid regurgitation and no pericardial effusion. A prominent Eustachian valve was noted (Figure 3).

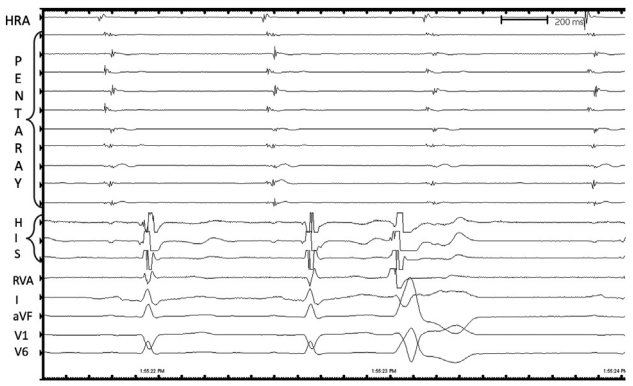

Figure 1 Electrograms recorded during the electrophysiology study: The PentaRay catheter (Biosense Webster, Inc, Diamond Bar, CA) has been entrapped near the inferior vena cava–right atrium RA junction. Note that atrial signals but no ventricular signals were recorded from the PentaRay catheter in this position. A premature ventricular contraction is shown. His = recording of His bundle potential; HRA = high right atrium; PENTARAY = signals from PentaRay catheter; RVA = right ventricular apex.

KEYWORDS Chiari network; catheter entrapment; catheter ablation; mapping; PentaRay
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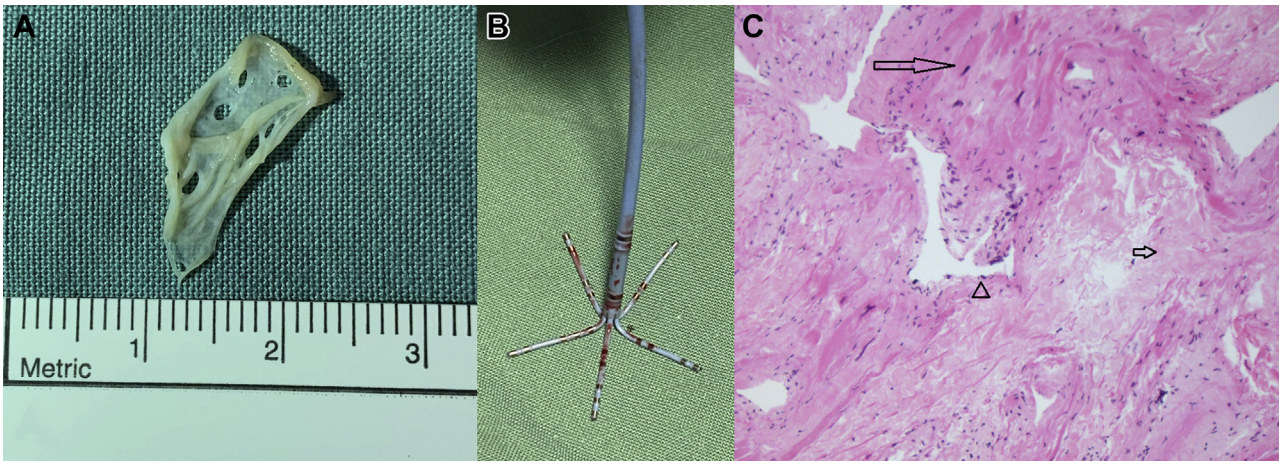

Figure 2 **A:** Tissue measuring 2 × 1 cm that was extracted with PentaRay catheter (Biosense Webster, Inc, Diamond Bar, CA). **B:** PentaRay catheter with no evident abnormalities. **C:** Microscopic examination of the tissue showing cardiac muscle fibers in short fascicles (*long arrow*) with a prominent intervening collagenous stroma (*short arrow*). Focally there is a reticulated architecture with overlying endocardial lining (*arrowhead*).

Microscopic examination of the tissue showed cardiac muscle fibers in short fascicles with a prominent intervening collagenous stroma. Focally there was a reticulated architecture with overlying endocardial lining (Figure 2C). The features were consistent with tissue from a Chiari network.

Discussion

A Chiari network is a congenital anatomical variation located at the junction of the RA and the IVC. In 1897, Hans Chiari described the intricate, fenestrated reticulum inserting on the anterior surface of Eustachian valve.[2] The Chiari network may provide a barrier to the insertion of catheters and is occasionally the site of vegetations in cases of infective endocarditis.[3]

The 20-pole PentaRay is a multipolar intracardiac mapping catheter that is designed to create highly detailed electroanatomical maps.[4] It has 5 linear splines, each of which contains 4 electrodes. Given its architecture and highly flexible arms, its risk of entrapment in valve apparatus is low, although previous reports have described entrapment of this catheter by mechanical heart valve replacements.[5] We chose this catheter to map this PVC because of its high-resolution mapping capacity, which allows for greater precision compared with a conventional linear catheter. Furthermore, we thought the source of this PVC was the right ventricular outflow tract in the context of a normal heart, so the risk of complication or entrapment of the PentaRay in native valves was thought to be low. To our knowledge this is the first case report of a PentaRay entrapment in a Chiari network. The mechanism for entrapment was likely to be penetration of the fenestrations of the Chiari network by 1 of the splines of the catheter. Owing to the net-like nature of the Chiari network, it is probable that the gentle traction applied caused further entrapment of tissue between splines.

We considered different options to remove the entangled catheter: Traction and rotation movements, snare catheter, endomyocardial biopsy forceps, and radiofrequency energy application have been used to assist in the removal of entrapped catheters.[6] A surgical approach may be required if these fail. These techniques have

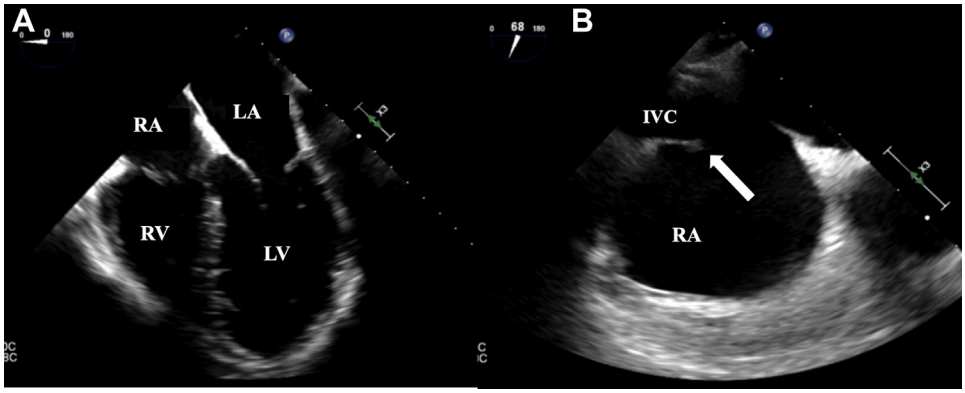

Figure 3 Transesophageal echocardiogram post-procedure. **A:** Four-chamber view, no evidence of pericardial effusion. **B:** Mid-esophageal right ventricular inflow 68 degrees showing a prominent Eustachian valve (*arrow*). IVC = inferior vena cava; LA = left atrium; LV = left ventricle; RA = right atrium; RV = right ventricle.

been described for entrapment of circular mapping catheters but may also apply to other multielectrode mapping catheters.[7] We felt it was likely that the catheter was entrapped by a Chiari network and was unlikely to be entangled in the tricuspid valve apparatus because (1) fluoroscopy demonstrated that the splines were located near the RA-IVC junction, (2) no ventricular signals were recorded by the electrodes from the site of entrapment, (3) cardiac pulsation was not transmitted along the shaft of the catheter, and (4) gentle traction of the catheter did not cause ventricular or atrial ectopy. It was decided to advance the sheath over the catheter splines in the hope that this might free the catheter. Upon doing this, the catheter became free and was removed with gentle traction.

This case highlights a potential risk of using complex multielectrode catheters. It also demonstrates the importance of imaging pre-procedure—in our case the Chiari network was not reported in the TTE performed at another hospital. We did not use a transesophageal echocardiogram from the beginning of the case, because the deep sedation needed for it can suppress PVCs during mapping. From this experience, in addition to a detailed analysis of echocardiography, we advance the SR0 across the tricuspid annulus before PentaRay deployment, to avoid entrapment of the catheter in the Chiari network.

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