Electrophysiological characteristics of a left atrial anomalous muscular band in a case with paroxysmal atrial fibrillation

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Introduction

Anomalous fibromuscular bands located in the left ventricle or the right atrium have been demonstrated by echocardiography and are reported to have a relationship with specific types of tachycardias. Although a left atrial (LA) anomalous band is found in approximately 2% of the cases by necropsy,[1] it is rare to be diagnosed clinically. Therefore, its clinical significance, particularly in the development of atrial fibrillation (AF), is unclear. Furthermore, the electrophysiological characteristics have not been revealed. We experienced a case with a prominent anomalous band in the LA in a patient with paroxysmal AF in whom catheter ablation was performed. During the ablation session, we assessed its electrophysiological characteristics.

Case report

A 72-year-old man with symptomatic paroxysmal AF and atrial flutter, which were resistant to antiarrhythmic drugs including flecainide and cibenzoline, was referred to our hospital for catheter ablation. Preoperative transesophageal echocardiography demonstrated an anomalous band in the LA (Figure 1). Three-dimensional cardiac computed tomography revealed that the anomalous band had a diameter of 3 mm and an overall length of 39 mm and was connected between the LA septum and the posterior LA wall near the right pulmonary vein (PV) (Figure 1).

An electrophysiological study was performed under deep sedation. A transseptal puncture was performed guided by intracardiac echocardiography (Ultra ICE, Boston Scientific, Inc, Natick, MA) at the oval foramen just anterior to the site where the anomalous band attached, and 3 long sheaths were advanced into the LA. Electroanatomical mapping (CARTO, Biosense Webster, Inc, Diamond Bar, CA) and subsequent radiofrequency ablation were performed using an open-irrigated catheter (ThermoCool EZ Steer, Biosense Webster, Inc). The activation map of the anomalous band was merged with the computed tomographic images. The contact of the mapping catheter with the anomalous band was confirmed by intracardiac echocardiography advanced in the LA (Figure 1). An activation map during sinus rhythm revealed that electrical activation propagated from both ends of the anomalous band and collided at the middle (Figure 1). For further evaluation, a decapolar electrode catheter with an interelectrode distance of 2.5 mm (Biosense Webster, Inc) was positioned along the anomalous band (Supplemental Figure S). During sinus rhythm, electrical activation propagated from both ends of the anomalous band and the 2 wave fronts collided in the middle (Figure 2). During pacing from the lateral right atrium or from the interatrial septum, activation propagated from the septal to the posterior end, and during pacing from the roof of the LA, it propagated from the posterior to the septal end (Figure 2). During incremental burst pacing from the roof of the LA at rates starting from 100 beats/min, 1:1 conduction from the LA to the anomalous band was observed until the pacing rate increased to 250 beats/min. The conduction time in the anomalous band, measured from the distal pair to the proximal pair of the decapolar catheter, did not show any obvious decremental properties. The estimated conduction velocity of the anomalous band was 0.88–1.0 m/s, which was consistent with normal working atrial muscle (Figure 3).

During AF, the activation frequency of the anomalous band was lower than that of any other locations including the PVs, the coronary sinus, and the right atrium, suggesting that the anomalous band was excited passively during AF. No macroreentrant tachycardias involving the anomalous band as the reentrant circuit were induced. After evaluating the electrophysiology of the anomalous band, circumferential antral PV isolation and LA roof linear ablation were performed. We paid attention not to mechanically damage the anomalous band with the ablation catheter or to entrap it with the ring catheters. The activation sequence of the anomalous band after that ablation exhibited septal to posterior conduction, suggesting that the entrance from the posterior end was blocked by the linear lesion of the LA roof (Figure 2). Again, no macroreentrant atrial tachycardias

KEYWORDS Arrhythmogenesis; Left atrium; electrophysiological study; Working cardiac muscle; Atrial fibrillation; Intracardiac echocardiography; Transesophageal echocardiogram

ABBREVIATIONS **AF** = atrial fibrillation; **LA** = left atrium/atrial; **PV** = pulmonary vein (Heart Rhythm Case Reports 2015;1:78–81)

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KEY TEACHING POINTS

- Left atrial anomalous band (AB) is a rare anomaly that is found in approximately 2% of the cases by necropsy.
- Histopathological studies showed that the AB was composed of fibrous and muscular tissue with no Purkinje cells.
- The present case showed that the AB had electrophysiological properties consistent with normal working atrial muscle and had no arrhythmogenic activities.
- Caution should be exercised to avoid any mechanical damage to the AB while manipulating the catheters as well as entrapment of ring catheters.

involving the anomalous band as a reentrant circuit were induced by programmed stimulus. At the end of the study, we tried to induce non-PV ectopic beats using isoproterenol and adenosine triphosphate. However, no ectopic activity from the anomalous band was induced.

Discussion

LA anomalous bands were initially described in the literature[2] in 1896 as a cord attached to the septal wall beside the fossa ovalis and left auricular wall below the appendage in 2 necropsy cases. More recently, Yamashita et al[1] reported a series of 1100 cases with necropsy, and an LA anomalous band was found in 22 cases (2%). In 19 cases (1.7%), the anomalous band connected to 2 areas in the LA, one of which was the LA side of the fossa ovalis and the other was the anterior (6 cases), superior (5 cases), posterior (6 cases), and inferior (2 cases) endocardium. The sizes ranged from 1.5 to 4 mm in width, from 0.5 to 2 mm in thickness, and from 4 to 55 mm in length.[1] Histopatholgical studies showed that the anomalous bands were composed of fibrous and muscular tissue with no Purkinje cells,[1,3] which is consistent

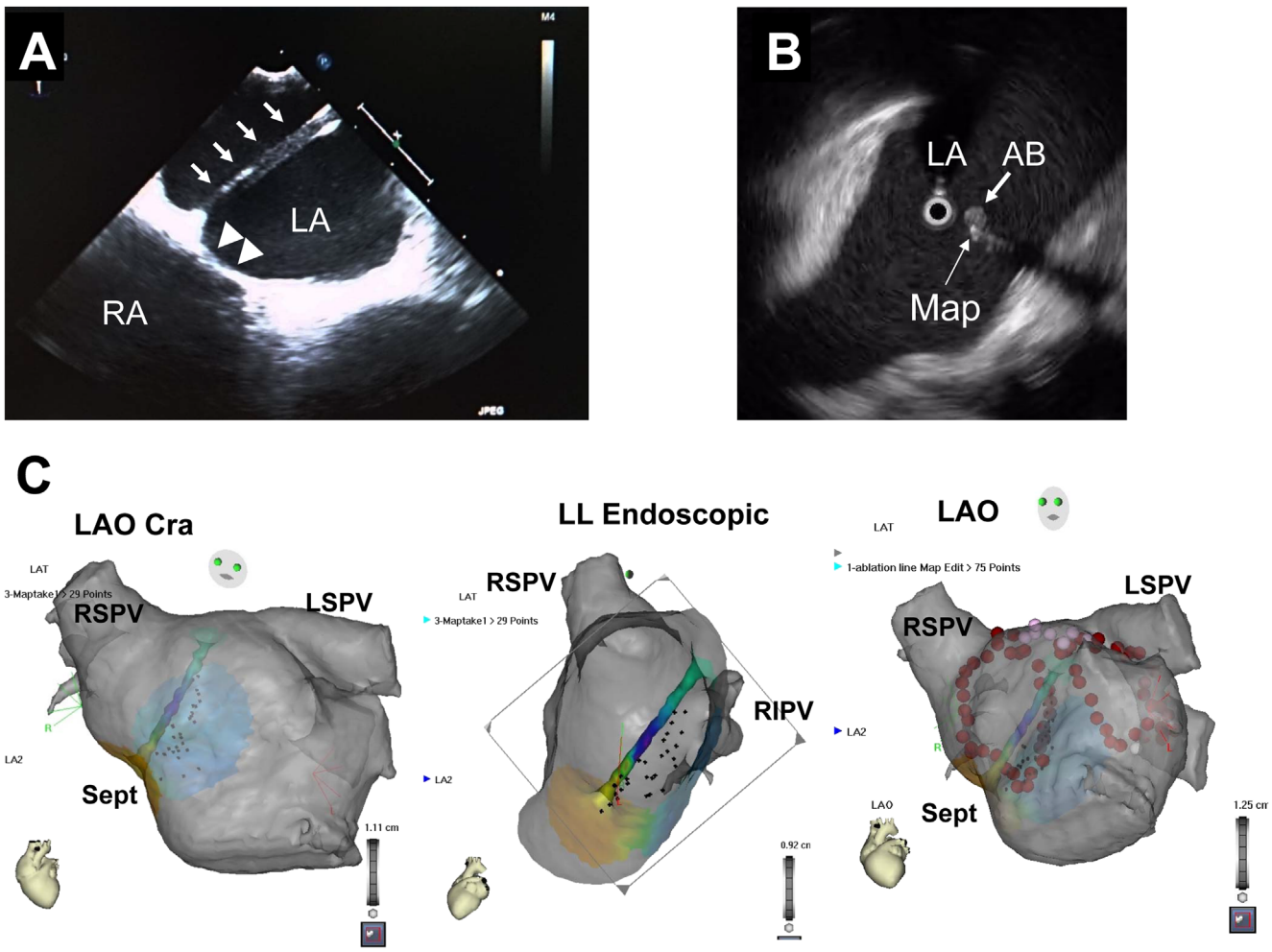

Figure 1 **A:** Transesophageal echocardiogram. The anomalous band, indicated by the arrows, was attached to the posterior rim of the fossa ovalis (arrowheads). **B:** Intracardiac echocardiogram from the left atrium (LA), showing a cross-section of the anomalous band (AB). Note that the map catheter (Map) was in contact with the AB. **C:** Left anterior oblique (LAO) cranial view (left panel) and left lateral (LL) endoscopic view (middle panel) of the activation map of the AB during sinus rhythm merged with the 3-dimensional computed tomographic image, showing that activation propagates from both ends of the AB and collides in the middle. The right panel shows the ablation lesion sets. Red and pink tags represent the ablation sites for the circumferential PV isolation and LA roof line, respectively. Cra = cranial; LSPV = left superior pulmonary vein; RA = right atrium; RIPV = right inferior pulmonary vein; RSPV = right superior pulmonary vein; Sept = septal.