Left ventricular endomyocardial biopsy guided by intracardiac echocardiography via a trans-septal approach

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DESCRIPTION

A 29-year-old woman was referred to our hospital for catheter ablation (CA) due to symptomatic atrial fibrillation (AF), after two failed CA attempts at another hospital. She had presented with left ventricular dysfunction at the age of 1 year, with a suspected diagnosis of endocardial fibroelastosis (EFE) based on the high echo brightness of the endocardium. She had subsequently undergone endomyocardial biopsy (EMB) of the right ventricle at the age of 18 years, with no histopathological evidence of EFE. Biopsy of the left ventricular myocardium, which was not possible at the previous hospital, was indicated to determine the need for heart transplantation. We planned to perform the biopsy during the CA procedure.

Transthoracic echocardiography revealed a left ventricular spherical dilation and wall motion

Figure 2 Intracardiac echocardiography images obtained during the procedure. (A) The tip of the bioprobe is shown next to the high echoic area of the thinned inferoseptal aspect of the left ventricle where repeated biopsy attempts failed (small arrowhead). (B) The chordae tendineae were visualised and the bioprobe manipulated to avoid injury, with subsequent advancement to the mid-posterior wall where endomyocardial biopsy was performed. LA, left atrium; LV, left ventricle.

Figure 1 (A) Transthoracic echocardiography showing spherical dilation and wall motion abnormality (long axis view). (B) Cardiac MRI showing thinning of the inferoseptal aspect of the left ventricle (small arrows) and an increased extracellular volume fraction (red lines). Ao, aorta; LA, left atrium; LV, left ventricle.

Video 2 The bioprobe was slipped at the high echoic thin lesion (intracardiac echocardiography images).

abnormality (figure 1A, video 1). Cardiac MRI revealed a thinning of the inferoseptal aspect of the left ventricle, with an increased extracellular volume fraction (figure 1B). Heart palpitation during AF negatively impacted her quality of life. Her heart failure status was associated with left ventricular dysfunction, although without evidence of pathological EFE findings. After careful consideration, we decided to perform, sequentially, left ventricular EMB for histopathological diagnosis and CA for AF, under general anaesthesia.

After trans-septal puncture, via the femoral vein, an 8-Fr intracardiac echocardiograph (ICE) (SOUNDSTAR, Biosense Webster, Diamond Bar, California) and an 8.5-Fr deflectable sheath (Agilis Sheath, St. Jude Medical, St. Paul, Minnesota) were placed in the left atrium. To approach the left ventricle, the trans-septal puncture was performed

Video 1 Transthoracic echocardiographic long axis views.

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Video 3 The endomyocardial biopsy was successfully performed (intracardiac echocardiography images).

at the point where the left atrial appendage could be observed in the ICE image. Under ICE guidance, the deflectable sheath was bent and aimed to the middle of the mitral valve annulus. Thereafter, the bioprobe was inserted into the left ventricle and directed to the high echoic lesion in the thinned region of the inferoseptal wall of the left ventricle. However, specimens could not be obtained from the site of the lesion due to slippage of the bioprobe (figure 2A, video 2). The bioprobe was then advanced to the mid-posterior wall of the left ventricle where EMB was successfully performed, with two specimens obtained for diagnostic purposes (figure 2B, video 3). The total EMB procedure time was 14 min and the dose area product was 95.1 mGy·cm². After EMB, CA was performed without complication, including no mitral valve regurgitation, and the sinus rhythm was restored.

Figure 3 Pathological examination confirming endocardial fibrous thickening and interstitial fibrosis of the left ventricle (Masson's trichrome stain). Scale bar, 100 µm.

Patient's perspective

I feel better after termination of the arrhythmias. It is important for me to diagnose with safety and accuracy.

Learning points

- ▶ Intracardiac echocardiograph guidance allows us to navigate the bioprobe to the ideal location.
- ▶ This method could improve the rate of success of diagnostic biopsy for cardiomyopathies.
- ▶ This technique could permit left ventricular biopsy when the transaortic approach is difficult, such as after aortic valve replacement or arterial vascular access problems.

Pathological examination of the specimens revealed an endocardial fibrous thickening and interstitial fibrosis of the left ventricle (figure 3). These findings were not observed in the previous specimens from the right ventricle and were indicative of secondary EFE.

The overall complication rate for EMB is low, at 1%–2% for experienced surgeons.¹ However, when complications do occur, such as cardiac perforation or valve regurgitation, these are occasionally lethal, especially in patients with previous heart disease. ICE-guided EMB has a potential to reduce EMB-related complication as it enables direct visualisation of the bioprobe to avoid performing a biopsy from critical locations. Notably, sampling errors do occur frequently in cases with a localised lesion, such as cardiac sarcoidosis.² ICE guidance for EMB can be helpful in this regard, with previous studies having described its benefit for EMB from the right atrium and ventricle.^{3,4} To our knowledge, this is the first report of ICE-guided EMB from the left ventricle, via a trans-septal approach.

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