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Rapid communication

Successful percutaneous epicardial catheter ablation of ventricular tachycardia arising from the crux of the heart in a patient with prior coronary artery bypass grafting ☆

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ABSTRACT

A 63-year-old man with a history of remote inferior myocardial infarction and coronary artery bypass grafting (CABG) underwent catheter ablation of ventricular tachycardia (VT). Epicardial catheter ablation of the VT was successful at the crux of the heart despite limited mapping within the pericardial space due to pericardial adhesion. Percutaneous subxiphoidal pericardial approach is usually impossible in patients with a history of open heart surgery due to pericardial adhesions. This report suggested that epicardial VT arising from the crux of the heart could be successfully treated by catheter ablation via subxiphoidal pericardial approach despite pericardial adhesions complicated by prior CABG.

1. Introduction

Ventricular tachycardia (VT) secondary to a myocardial infarction can arise from an epicardial substrate and may require treatment with epicardial catheter ablation. However, it has been reported that a percutaneous subxiphoidal pericardial approach is usually challenging in patients with a history of open heart surgery due to pericardial adhesions [1–5]. This case report illustrated a successful percutaneous epicardial catheter ablation of a VT arising from the crux of the heart in a patient with prior coronary artery bypass grafting (CABG).

2. Case report

A 63-year-old man with a history of remote inferior myocardial infarction, CABG, and implantation of a biventricular implantable cardioverter defibrillator underwent catheter ablation of drug-refractory sustained VT. He had experienced an inferior myocardial infarction 20 years prior and subsequently underwent a four-vessel CABG of the left internal mammary artery to the left anterior descending coronary artery; and saphenous vein grafts (SVGs) to the diagonal branch, obtuse marginal branch, and posterior descending coronary artery (PDA). A coronary arteriogram prior to the electrophysiological study revealed that the SVG to the PDA and the right coronary artery were occluded while the other grafts were patent.

A clinical VT was induced by extrastimulation from the right ventricle (RV) and exhibited a left bundle branch block and left superior axis QRS morphology with a QS pattern in the inferior leads and a cycle length of 440 ms (Fig. 1A). Activation and pace mapping was performed with a 7.5 French, 3.5 mm irrigated tip ablation catheter (Navistar ThermoCool™, Biosense Webster, Diamond Bar, CA, USA), and no pre-systolic ventricular activation or excellent pace map was observed in the RV, left ventricle (LV), or coronary sinus. A decision was then made to attempt subxiphoidal pericardial access despite a history of CABG. The access was successfully obtained through the inferior approach, but the guidewire could not be advanced beyond the left lateral region (Fig. 1B). Epicardial mapping with the ablation catheter was performed, but it was limited to the LV posterior region presumably due to a pericardial adhesion secondary to the CABG. The epicardial voltage map revealed a large scar in the infero-posterior LV wall (Fig. 2A). During the VT, an early-diastolic potential with an interval to QRS onset of 210 ms (48% of the VT cycle length) was recorded within the scar at the crux of the heart (Fig. 2B). Entrainment pacing was performed at this site, resulting in termination of the VT. A distinct and split isolated diastolic potential (IDP) was recorded at this site during a biventricular paced rhythm (Fig. 2C and D). Several irrigated radiofrequency applications

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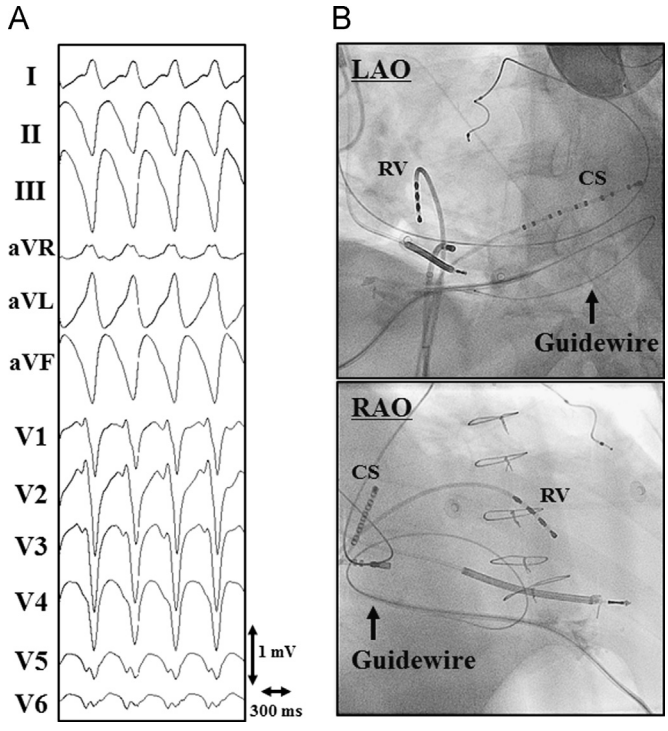

Fig. 1. (A) Twelve-lead ECG exhibiting the ventricular tachycardia (VT). (B) Fluoroscopic images exhibiting successful subxiphoidal pericardial access with the guidewire turned back in the left lateral region, suggesting the presence of a pericardial adhesion. CS=coronary sinus; LAO=left anterior oblique view; RAO=right anterior oblique view; RV=right ventricle.

targeting the IDPs were delivered, resulting in elimination of those IDPs. A coronary arteriogram was not performed prior to the ablation as both the bypass graft and native coronary artery feeding this area were occluded. Thereafter, the VT became non-inducible. The procedural and fluoroscopic times were 215 and 38 min, respectively. No complications occurred. During the one year of follow-up period, the patient has been free of any VT recurrences.

3. Discussion

Pericardial adhesions often develop after open heart surgery, rendering a percutaneous subxiphoidal pericardial approach challenging [1–5]. Such adhesions are anticipated to be less dense in the inferior wall than in the anterior wall of the LV [1]. Therefore, there may be a chance of mapping and catheter ablation in the epicardial inferior wall of the LV even after open heart surgery.

On the other hand, an inferior myocardial infarction is more often complicated by an epicardial VT than an anterior myocardial infarction [1–4]. It is known that VTs complicated with inferior myocardial infarctions often arise from the epicardial crux of the heart, which is formed by the junction of the atrioventricular and posterior interventricular grooves and corresponds roughly to the junction of the middle cardiac vein and coronary sinus, near the origin of the posterior descending coronary artery [6].

In this case, the pericardial adhesions in the inferior wall of the LV were not dense, and percutaneous epicardial catheter ablation successfully treated the crux VT. When an ischemic VT arises from an epicardial substrate in a patient with a history of CABG,

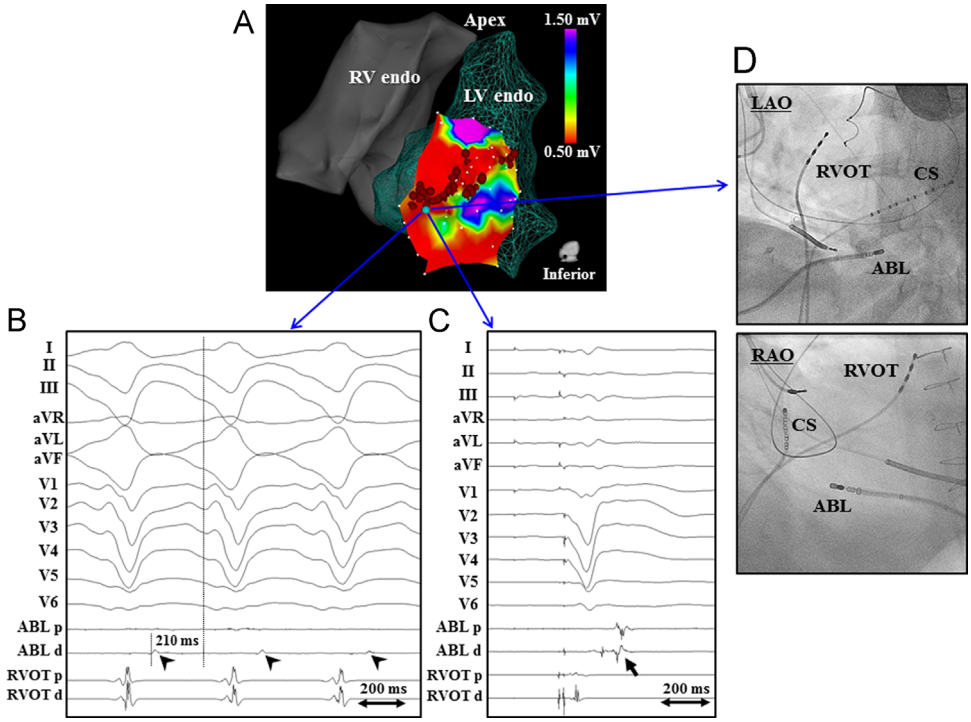

Fig. 2. (A) Voltage map (inferior view) of the epicardial surface exhibiting a large scar in the infero-posterior wall of the left ventricle (LV). The blue tag indicates the successful ablation site of the ventricular tachycardia (VT). LV (RV) endo=left (right) ventricular endocardial shell. (B) Cardiac tracings exhibiting an early-diastolic potential recorded at the successful ablation site during the VT (*arrowheads*). ABL d(p)=the distal (proximal) electrode pair of the ablation catheter; RVOT d(p)=the distal (proximal) electrode pair of the mapping catheter positioned in the RV outflow tract (RVOT). (C) Cardiac tracings exhibiting a distinct and split isolated diastolic potential recorded at the successful ablation site during a biventricular paced rhythm (*arrow*). (D) Fluoroscopic images exhibiting the successful ablation site. ABL=the ablation catheter. The other abbreviations are as in Fig. 1.

catheter ablation of the VT should be challenging, and a hybrid procedure involving a surgical access may often be required [2–4]. However, a subxiphoidal pericardial access may be attempted first, especially when a VT is suggested to arise from the LV inferior wall. In this type of procedure, it is important to understand the anatomy of the bypass grafts and native coronary artery before the pericardial access and epicardial catheter ablation in order to avoid complications. It should further be emphasized that this type of procedure is currently carried out by very experienced hands at high-volume centers for carefully selected patients only.

4. Conclusion

This case report suggested that epicardial ischemic VT arising from the crux of the heart could be successfully treated by catheter ablation via the subxiphoidal pericardial approach despite a history of CABG.

Conflict of interest

All authors declare no conflict of interest related to this study.

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