Received: 12 January 2024 | Revised: 30 April 2024 | Accepted: 6 May 2024

DOI: 10.1002/ccr3.8965

CASE REPORT

Clinical Case Reports Open Access WILEY

Successful chemical ablation for intraventricular septal ventricular tachycardia—An alternative approach to the septal branch

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Key Clinical Message

Trans-coronary ethanol ablation for ventricular tachycardia originating from the ventricular septum is effective, but there are cases with no septal perforator from left anterior descending artery. CT and angiography can reveal the optimal vessel.

KEYWORDS

coronary computed tomography angiography, previous myocardial infarction, septal perforator, trans-coronary ethanol ablation, ventricular tachycardia

1 | INTRODUCTION

Arrhythmia-substrate-based radiofrequency (RF) catheter ablation (RFCA) is an effective treatment for scar-related ventricular tachycardia (VT) in patients with a previous myocardial infarction (MI).[1] However, energy delivery to deep myocardial origins, such as the ventricular septum, is challenging.

Trans-coronary ethanol ablation (TCEA) is one of an effective treatments option for VT of deep myocardial origin, and its advantage in the treatment of VT of septal origin has been widely reported; however, its safety and efficacy have not yet been established.[2–4] This method requires the target vessel to be in an appropriate location.[5,6] Therefore, TCEA becomes difficult if a stent has been implanted previously in the culprit vessel. The following case describes a patient who developed VT from the ventricular septum with previous MI, which was treated with a stent implantation in the left anterior descending branch (LAD). The VT of this patient seemed to be difficult to treat with not only RFCA but also TCEA through the LAD. However, we could identify the septal branch from the high lateral branch (HL), then we could perform TCEA successfully through the HL.

We believe this would be the first case of the septal VT in which chemical ablation of the ventricular septum could be successfully performed even with stenting in the LAD after MI.

2 | CASE HISTORY

A 64-year-old man with a body mass index of 28 kg/m^2 and dyslipidemia experienced an acute MI in 2009 and underwent percutaneous coronary intervention (PCI) at another hospital, where a drug-eluting stent (DES) was implanted in the mid LAD. Subsequently, one DES was placed in the mid right coronary artery, and two DESs were placed in the proximal left coronary artery circumflex. DES was implanted for proximal LAD in our hospital with an overlap with the previous stent because of unstable angina pectoris in 2018 (Figure 1A).

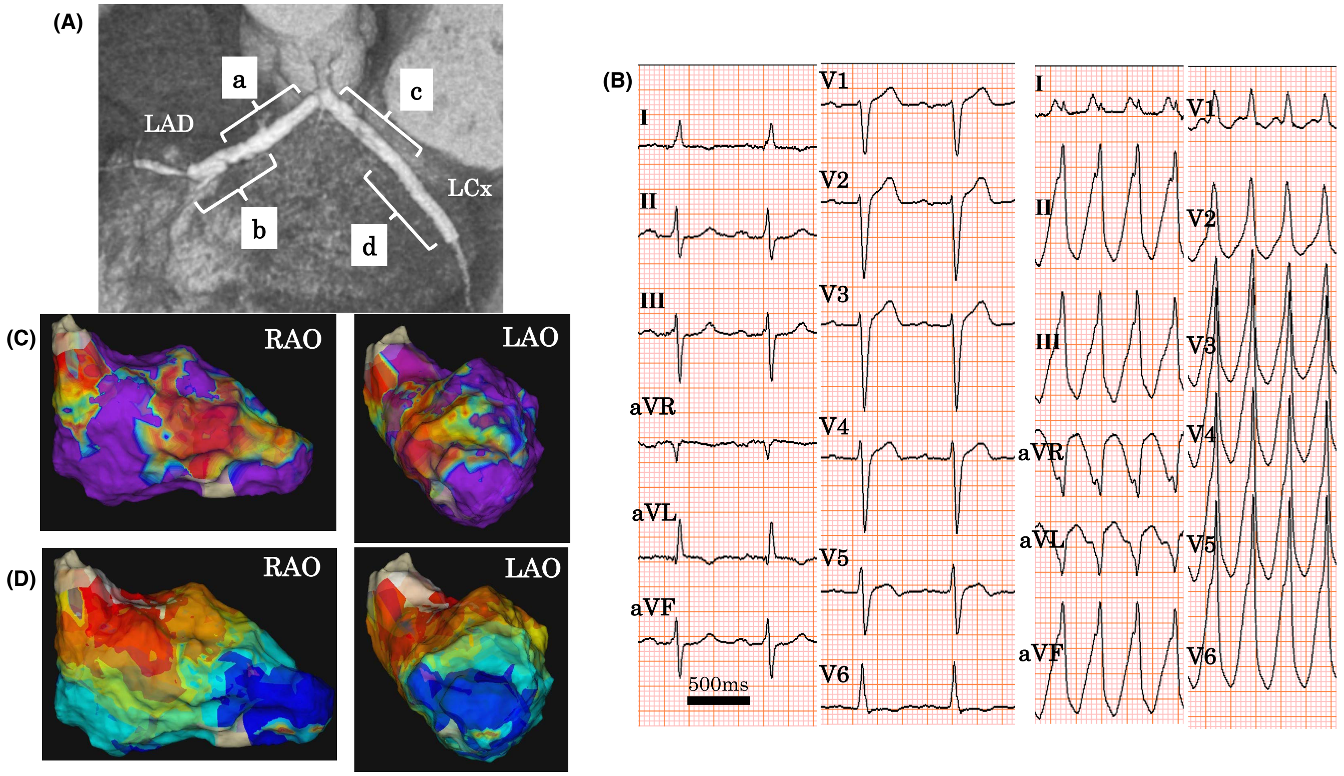

FIGURE 1 (A) Coronary computed tomography (CT; volume rendering) showing stents implanted in the left coronary artery. Two stents were implanted in the left anterior descending branch (LAD) in 2009 (a) and 2018 (b). Two stents were also implanted in the left coronary artery circumflex (c, d). (B) Left: 12-lead ECG during sinus rhythm (SR). Right: 12-lead ECG during ventricular tachycardia (VT). The patient had sustained monomorphic VT with a right bundle branch block and wide QRS on the inferior axis. (C) During SR, the HD grid showed a low voltage area at the middle of the left ventricular (LV) septal endocardium. (D) Observation of the LV endocardium with HD grid during VT showed the earliest potentials at the base of the LV septum.

In 2019, the patient visited our institution because he suddenly developed chest pain during cycling. A 12-lead ECG showed sinus rhythm (SR) and ventricular premature contraction (VPC) with a right-bundle-branch-block (RBBB) waveform on the inferior axis. No de novo lesions were observed on multidetector computed tomography and coronary angiography (CAG), however, VT occurred occasionally in the ward with symptoms similar to the chest pain as he felt before admission. During VT, his vital signs were stable at 132/91 mmHg, and a 12-lead ECG showed 187 bpm with RBBB in the inferior axis (Figure 1B).

3 | METHODS

RFCA was performed after informed consent was obtained for all procedures, including TCEA that was approved by the review board of this institute.

The patient was heparinized at the start of the procedure, and activated coagulation time was maintained for over 300 s. The three-dimensional mapping system used was EnSite Precision (Abbott, St Paul, MN, USA). Left ventricular (LV) potentials during SR were examined with the Advisor HD grid mapping catheter (Abbott, St. Paul, MN, USA), and no local abnormal ventricular activity (LAVA) was observed, however, a low voltage area in the septum was observed (Figure 1C). Programed stimulation elicited a VT almost identical to clinical VT with earlier excitation of the ventricular septal base (Figure 2B). However, VT was not sustained and entrainment pacing was not possible. The local ventricular potentials during VT from both ventricles preceded 28 ms earlier than the body surface ECG (Figure 2B). RF energy was applied from the LV side (Figure 2D), which was ineffective. The vessels feeding the earliest VT site were examined using computed tomography (CT) and CAG to find out the possibility of an origin from the intramural ventricular septum. Although there was no septal perforator from the LAD to the target region of the VT, a branch was observed from the HL branch (Figure 3A, B).

An angiographic catheter (6F SPB 3.75, ASAHI Intec, Tokyo, Japan) was cannulated into the left coronary artery from the radial artery, and a guidewire (0.014-inch Sionblue

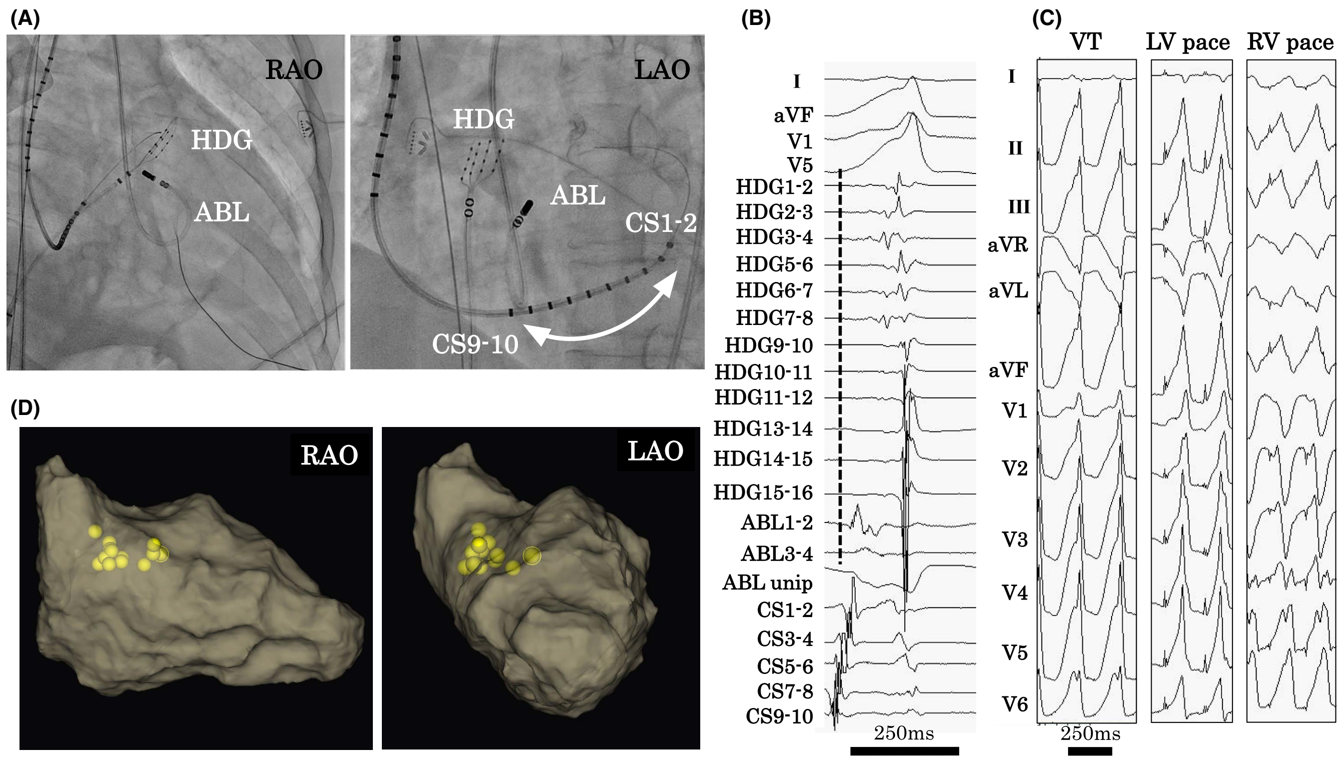

FIGURE 2 (A) Irrigation catheter placed in the left ventricle, and HD grid placed in the right ventricle during ventricular tachycardia (VT). (B) The earliest VT potentials were almost the same during the use of the irrigation catheter and HD grid. (C) Pacing stimulation was performed at the earliest VT site from the left and right ventricles, and the morphology was more similar to VT in the left ventricle. (D) The RF energy was delivered in the left ventricular septal endocardium during VT.

for coronary angioplasty, ASAHI Intec) was used to inflate the balloon catheter (15-mm length Emerge over-the-wire with a 1.25-mm nominal diameter for angioplasty, Boston, MA, USA) at the target branch (Figure 3C, D). Immediately after injection of the contrast medium through over-the-wire lumen, the VPC disappeared, and VT was no longer observed (Figure 3E). We ensured that the injection of ice-cold saline would not affect AV conduction after confirming the absence of shunting and then injected 3 mL of dehydrated ethanol (98%) twice at 1 mL per minute. The procedure was completed after it was determined that neither VPCs nor VTs were induced. The patient was discharged after implanted defibrillator, which revealed that there was no VT recurrence for the next 2 years.

4 | CONCLUSION

TCEA might be effective in patients with VT originating from deep septal lesions associated with a previous MI with a stent implantation in the LAD if there are other septal feeding arteries to the VT origin other than the LAD. Detailed evaluation of the coronary arteries using CT and CAG would be crucial for such patients requiring therapy for VT with a deep septal origin.

5 | DISCUSSION

Despite showing the RBBB morphology in this case, the earliest activation sites were located at both of the RV base and the LV base, suggesting that the VT might be originated from the ventricular septal base. When RFCA fails, TCEA can serve as an alternative approach for ventricular arrhythmias with a deep septal origin, which are difficult to treat with endocardial or epicardial RFCA,[7,8] most of which has been performed in the septal branch diverging from the LAD. However, in our case, two stents were placed in the LAD after PCI, and there might not be an appropriate septal perforator for TCEA, but it branched from the HL. But frequency of septal branching from other than the LAD. Millar et al. reported a VT case associated with nonischemic cardiomyopathy treated with ethanol injection into septal branches from vessels other than the LAD,[10] and the frequency is reported as 10.0–14.7%.[9] TCEA may be feasible even in cases of ventricular arrhythmias with deep septal origins in the presence of stents in the LAD after PCI if the culprit area is fed by other vessels, as we experienced in this case. We had better search for an optimal vessel using CT or CAG to achieve successful TCEA even in case implanted stent to the culprit site.[11]

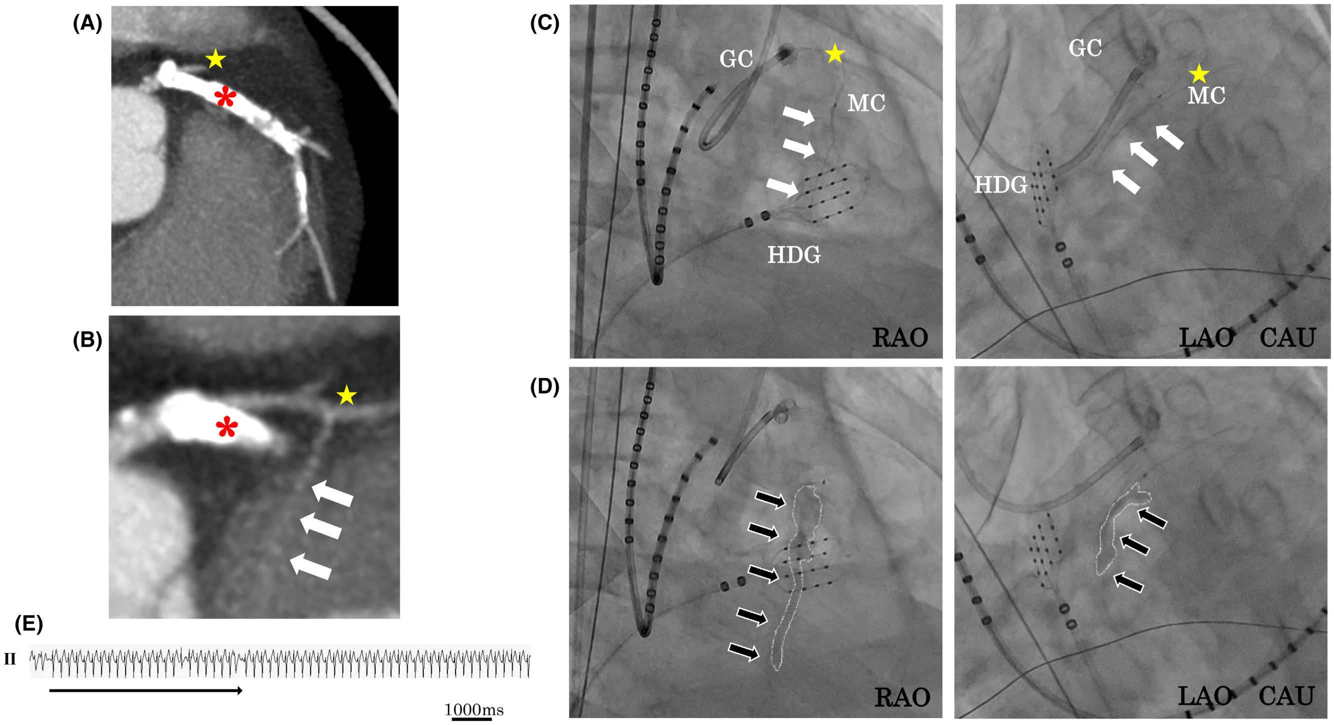

FIGURE 3 (A) No vessels return to the base of the ventricular septum from LAD (red asterisk). (B) Coronary CT shows the HL branch (yellow star) and LAD. The septal perforator (white arrow) is seen at the base of the ventricular septum. (C) Ethanol injection into the septal perforator. A guiding catheter was introduced into the left coronary artery, and selective contrast injection was administered via a microcatheter into the septal perforator (white arrow) branching from the HL branch (yellow star). (D) The contrasts did not shunt (black arrow). (E) Ventricular premature contractions were observed before ethanol administration but were suppressed after ethanol administration.

However, this report has the following limitations. First, LV and RV potentials were evaluated only in SR, and all of LAVAs in the LV and RV were recorded in SR. Other arrhythmogenic insight may have obtained if the ventricular activation sequence map would be obtained under right or left ventricular pacing. Second, the contrast injection alone could abolish the VPC, suggesting that the perfusion area might be culprit. We chose the coated guidewire for its better lubricity and cross ability, which unfortunately spoiled detecting the local information. If we would use uncoated wire so as to record local potentials, we could obtain further evidence for the culprit site. Bipolar and needle ablation procedures could have been successful; however, both are not covered by insurance in this country, rendering them unavailable.

Further large multicenter trials are needed to assess the success rates and safety of chemical ablation in post-stenting VT cases.

AUTHOR CONTRIBUTIONS

Shin Hasegawa: Conceptualization; data curation; formal analysis; investigation; methodology; project administration; validation; visualization; writing – original draft; writing – review and editing. **Akimitsu Tanaka:** Data curation; formal analysis; validation. **Yukihiro Uehara:** Data curation. **Hiroki Yabuta:** Data curation. **Kazuo Kato:** Data curation; formal analysis; validation.

ACKNOWLEDGMENTS

None.

FUNDING INFORMATION

This research did not receive any specific grants from funding agencies in the public, commercial, or not-for-profit sectors.

CONFLICT OF INTEREST STATEMENT

None.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

CONSENT

Written informed consent was obtained from the patient to publish this report in accordance with the journal's patient consent policy.

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How to cite this article: Hasegawa S, Tanaka A, Uehara Y, Yabuta H, Kato K. Successful chemical ablation for intraventricular septal ventricular tachycardia—An alternative approach to the septal branch. *Clin Case Rep*. 2024;12:e8965. doi:10.1002/ccr3.8965