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Distribution of evoked delayed potential and delayed potential in a patient with subendocardial inferior infarction and transmural postero-lateral infarction: A case report

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<Abstract>
A 47-year-old man with transmural posterolateral myocardial infarction (MI) and subendocardial inferior MI underwent catheter ablation for monomorphic ventricular tachycardia (VT). Right ventricular extra stimulation could unmask evoked delayed potentials in the subendocardial infarction area without delayed potentials in the sinus rhythm. Extra stimulation mapping for VT is useful for hidden VT substrates, particularly in the subendocardial infarction area.

Key Words: Ventricular tachycardia; myocardial infarction; delayed potential; evoked delayed potential; case report.

<Introduction>

Although the critical isthmus of ventricular tachycardia (VT) is the traditional target of scar-related VTs [1], a previous report showed that substrate modification targeting fractionated, delayed, and abnormal signals was associated with a reduced recurrence of VT compared to ablation targeting only the isthmus of VT [2]. Ablation targeting evoked delayed potentials (EDP) is a new strategy for substrate modification in patients with post-myocardial infarction (MI) VT [3].

<Case Report>
A 47-year-old man was admitted to our hospital for frequent appropriate implantable cardioverter-defibrillator (ICD) therapy. He had had a posterolateral MI and an inferior MI 17 years and 11 years previously, respectively. Coronary artery bypass grafting (CABG) was performed 1 year prior. ICD implantation was performed 1 month after CABG for secondary prevention. Despite amiodarone therapy, appropriate ICD therapies due to monomorphic sustained VT were performed 34 times in 1 month before admission. Three different VTs were documented. The cycle lengths of clinical VT were within 320 to 400 ms and the morphologies of VT were left superior axis, right bundle branch block pattern, with different transition zones (VT1: V5, VT2: V6, and VT3: positive concordant).

Transthoracic echocardiography showed a reduced left ventricular (LV) ejection fraction of 34% with severe hypokinesis at the LV posterolateral wall. Cardiac magnetic resonance imaging demonstrated transmural distribution of late gadolinium enhancement (LGE) at the LV posterolateral wall and the subendocardial layer of the LGE at the LV inferior wall (Fig. 1). Electrophysiological studies and radiofrequency catheter ablation were performed using an electroanatomic mapping system (CARTO XP, Biosense Webster, Inc., Diamond Bar, CA, USA). Nonclinical VT was induced and activation mapping during VT could not be performed because of unstable hemodynamics. Voltage mapping during sinus rhythm (SR) showed a dense scar area (0.1–0.5 mV) at the posterolateral wall and a scar border area (0.6–1.5 mV) to almost normal voltage (>1.5 mV) at the inferior wall. Delayed potential (DP) during SR was obtained mainly in dense scar areas (Fig. 2). A single extra stimulus with a coupling interval of 50 ms above the ventricular refractory period from the right ventricular (RV) apex was performed to assess EDP in the whole area around the infarct. EDPs were observed at the inferior wall and scar border around the posterolateral wall, without DPs, in the SR (Figure 3). The distribution of EDPs were limited in scar border area at postero-lateral wall. There was no hidden substrate around scar border at postero-lateral wall. On the other hand, EDPs were observed not only in scar border area but also in normal voltage area at LV inferior wall. Entrainment pacing during non-clinically induced VT showed concealed entrainment at the point of the latest DP, where VT was terminated during radiofrequency ablation. Additionally, pace mapping in the inferior wall region showed catheter-induced VT, which approximated clinical VT. Ablation was performed with the aim of completely eliminating the DP and EDP as much as possible. No further VTs were induced at the end of the procedure. No appropriate ICD therapy was required during the 2 years after ablation.

<Discussion>

In the ablation of VT, it is rarely possible to create an activation map because many patients have hemodynamic failures [4]. Therefore, a pace map was used to locatethe isthmus of the VTs. Furthermore, substrate modification was used to eliminate the potential isthmus of the VTs. Although targeting dense scar areas and scar border zones, considered as diseased myocardium, is a reasonable approach, attention should be paid to the pitfall of substrate modification based on bipolar amplitude. A previous report demonstrated that the LGE-based scar areas were as large as CARTO-based low-voltage areas in patients with transmural myocardial infarction. However, in patients with subendocardial MI, the LGE-based scar areas were much larger than the CARTO-based low-voltage areas [5]. Subendocardial near-field low-voltage signals can be hidden by subepicardial far-field high-voltage signals in these patients [3]. Therefore, voltage-amplitude-guided substrate modification may underestimate the substrate extent. Ablation-targeting EDPs are a new strategy for substrate modification in patients with post-MI VT [3]. Near-field low-voltage signals can be delayed by RV single extra stimulation and separated from far-field high-voltage signals. However, if mapped under RV burst pacing, DP could have possibly been taken more extensively. Consequently, a method of continuous single extra pacing has also been recently reported [6]. In this case with two different MI characteristics, intracardiac electrograms, including bipolar voltage amplitudes, and the presence of DP and EDP were significantly different between transmural and subendocardial infarct areas. Targeting the hidden substrate unmasked by RV extra stimulation may be beneficial, particularly in the area of subendocardial MI.

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<References>

[1] Stevenson WG, Friedman PL, Sager PT, Saxon LA, Kocovic D, Harada T, et al. Exploring postinfarction reentrant ventricular tachycardia with entrainment mapping. J Am Coll Cardiol 1997;29:1180–9. https://doi.org/10.1016/s0735-1097(97)00065-x.

[2] Di Biase L, Burkhardt JD, Lakkireddy D, Carbucicchio C, Mohanty S, Mohanty P, et al. Ablation of stable VTs versus substrate ablation in ischemic cardiomyopathy: the VISTA randomized multicenter trial. J Am Coll Cardiol 2015;66:2872–82. https://doi.org/10.1016/j.jacc.2015.10.026.
[3] de Riva M, Naruse Y, Ebert M, Androulakis AFA, Tao Q, Watanabe M, et al. Targeting the hidden substrate unmasked by right ventricular extrastimulation improves ventricular tachycardia ablation outcome after myocardial infarction. JACC Clin Electrophysiol 2018;4:316–27. https://doi.org/10.1016/j.jacep.2018.01.013.
[4] Soejima K, Suzuki M, Maisel WH, Brunckhorst CB, Delacretaz E, Blier L, et al. Catheter ablation in patients with multiple and unstable ventricular tachycardias after myocardial infarction: short ablation lines guided by reentry circuit isthmuses and sinus rhythm mapping. Circulation 2001;104:664–9. https://doi.org/10.1161/hc3101.093764.
[5] Wijnmaalen AP, van der Geest RJ, van Huls van Taxis CF, Siebelink HM, Kroft LJ, Bax JJ, et al. Head-to-head comparison of contrast-enhanced magnetic resonance imaging and electroanatomical voltage mapping to assess post-infarct scar characteristics in patients with ventricular tachycardias: real-time image integration and reversed registration. Eur Heart J 2011;32:104–14. https://doi.org/10.1093/eurheartj/ehq345.
[6] Srinivasan NT, Garcia J, Schilling RJ, Ahsan S, Babu GG, Ang R, et al. Multicenter study of dynamic high-density functional substrate mapping improves identification of substrate targets for ischemic ventricular tachycardia ablation. JACC Clin Electrophysiol 2020;6:1783–93. https://doi.org/10.1016/j.jacep.2020.06.037.

<Figure Legends>

Figure 1. Cardiac magnetic resonance imaging demonstrates two different transmuralities of myocardial infarction characteristics. Transmural late gadolinium enhancement is observed at the left ventricular postero-lateral wall (dashed line) and subendocardial late gadolinium enhancement is observed at the left ventricular inferior wall (arrows).

Figure 2. Voltage mapping during sinus rhythm shows dense scar area (0.1–0.5 mV) at postero-lateral wall and low voltage area (0.6–1.5 mV) at inferior wall. Delayed potential (orange tag) during sinus rhythm is obtained mainly in dense scar area and evoked delayed potentials (blue tag) are observed at inferior wall and scar border around postero-lateral wall without delayed potentials in sinus rhythm.

Figure 3. A single extra-stimulus with a coupling interval of 50 ms above the ventricular refractory period from right ventricular apex to assess evoked delayed potential in the area around the infarct area.

Figure 1

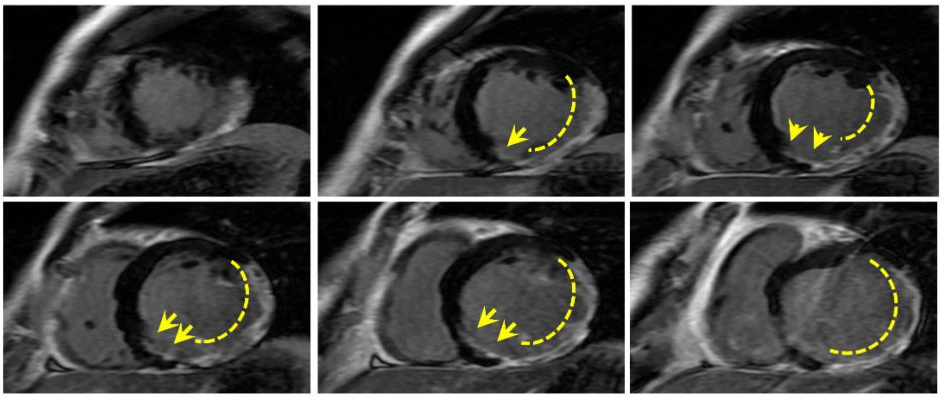


Figure 2

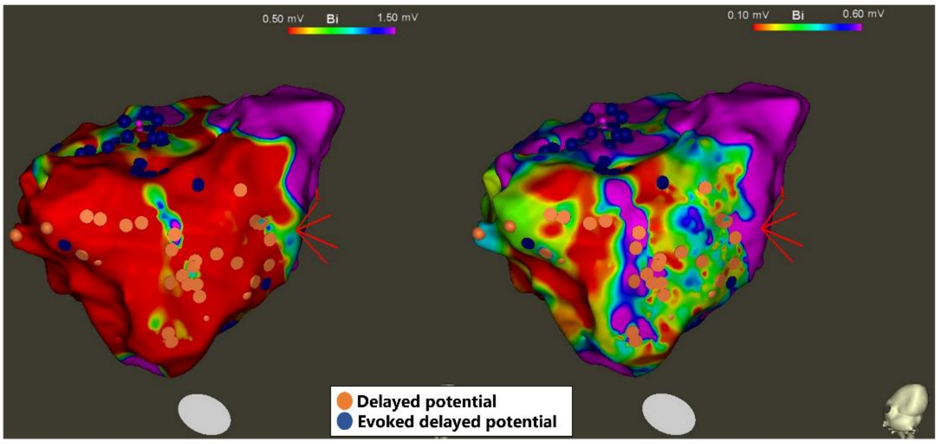
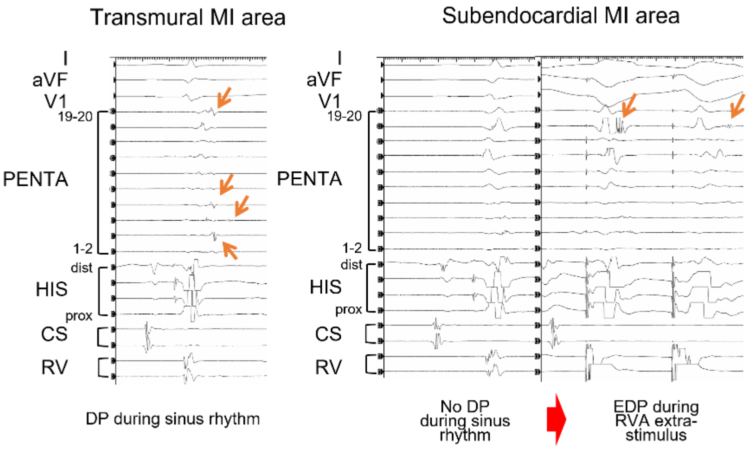


Figure 3



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