Mini-Electrodes Help Identify Hidden Slow Conduction during Ventricular Tachycardia Substrate Ablation

A CASE REPORT

Short title: Usefulness of mini-electrode catheter during VT substrate ablation

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Introduction

Hidden slow conduction (HSC) assessment and ablation provides further substrate identification during ventricular tachycardia (VT) ablation procedures.[1] Novel catheters with embedded mini-electrodes (ME) on the tip of the catheter permit to identify local electrograms (EGM) more accurately, by means of reducing far-field EGM components respect the conventional bipolar dipole (CBD).[2]

This case report shows how ME-obtained electrograms permit to accurately localize substrate having HSC, thus identifying target ablation sites and allowing the elimination of this VT substrate.

Case report

A 69-year-old male with dilated cardiomyopathy, severe left ventricular (LV) dysfunction, carrier of an implanted cardioverter-defibrillator (ICD), and with a history of sustained monomorphic VT (SMVT) episodes underwent a VT ablation attempt of in March 2016. The ablation could not be performed due to the proximity of the conduction system to the earliest activation site. The patient consulted in the emergency department in January 2017 due to appropriate ICD therapy caused by another episode of SMVT.

A decision was taken to submit the patient to a second VT ablation attempt, which was carried out under general anesthesia. A reference catheter for Rhythmia™ Mapping System (Boston Scientific, Cambridge, MA, USA) was placed in superior vena cava and a quadripolar catheter was advanced to the right ventricular apex (RVA). Single transseptal puncture was performed to access the LV. A mapping catheter (IntellaMap™ Orion, Boston Scientific, Cambridge, MA,

USA), was progressed to the LV through a deflectable sheath. A SMVT showing LBBB-like morphology was induced with programmed stimulation (Panel A). An electroanatomical activation map during VT showed an anteroseptal basal origin, close to the conduction system (Panel B1, anteroseptal view; Panel B2, anterolateral view; Orange tags: His electrogram). During mapping, VT stopped due to a mechanically induced premature ventricular contraction.

An ablation catheter (IntellaTip™ MiFi OI, Boston Scientific, Cambridge, MA, USA) with ME was advanced to the LV. The use of ME in this case was preferred in order to elucidate the mechanism of the VT. The presence of EGMs with delayed components during sinus rhythm (therefore showing slow conduction) or the demonstration of HSC would support a reentry mechanism. This in turn would allow to target the VT substrate without the need for VT re-induction. It would also permit to apply RF under stable sinus rhythm, a critical issue when ablating close to the conduction system. The previously described[1] multiple extrastimuli technique was used to unveil HSC (two extrastimuli were applied from RVA, coupled 450 and 350 ms, respectively). If the local potential was delayed, it was considered a HSC-EGM (positive response). A minimum delay of 10 ms from the off-set of the far-field signal was required to designate it as HSC-EGM. The availability of mini-electrodes on the tip of the catheter allowed recognizing false positive HSC-EGM (see Panel C and blue dot in Panel B) misdetected by the conventional bipolar dipoles, as well as to locate true, positive HSC EGM (see Panel D and white dots in Panel B) that were used as target ablation sites (red tags in Panel B). After RF ablation was performed in the two identified target ablation sites, a programmed stimulation protocol was performed, without induction of the SMVT. During 1 year follow-up, the patient has had no appropriated ICD therapies.

Conclusions

ME embedded on the tip of the ablation catheter provide an accurate identification of local EGM. In the present case, the ME permitted to identify the sites showing HSC and false positive electrograms in the CBD, thus allowing RF delivery during sinus rhythm to safely ablate the VT substrate.

REFERENCES

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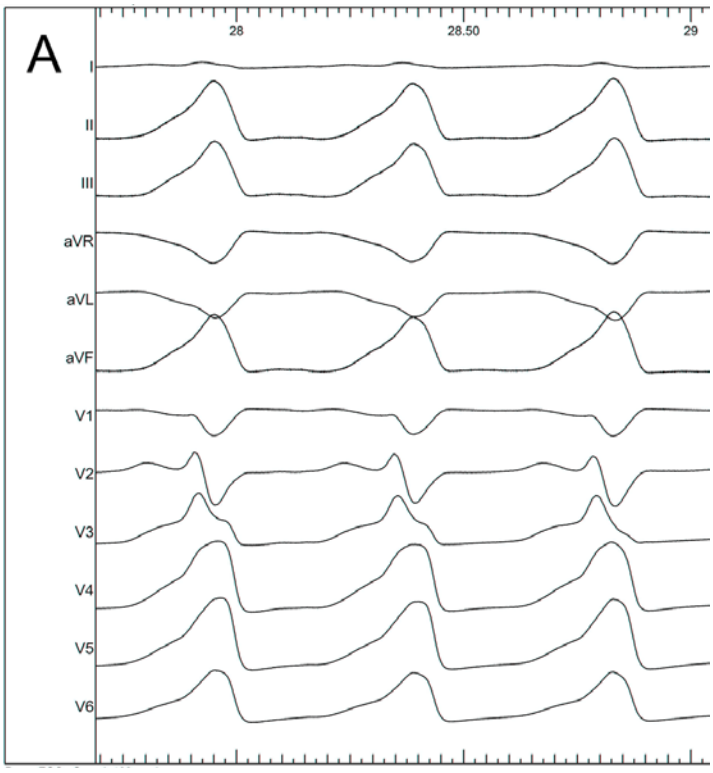
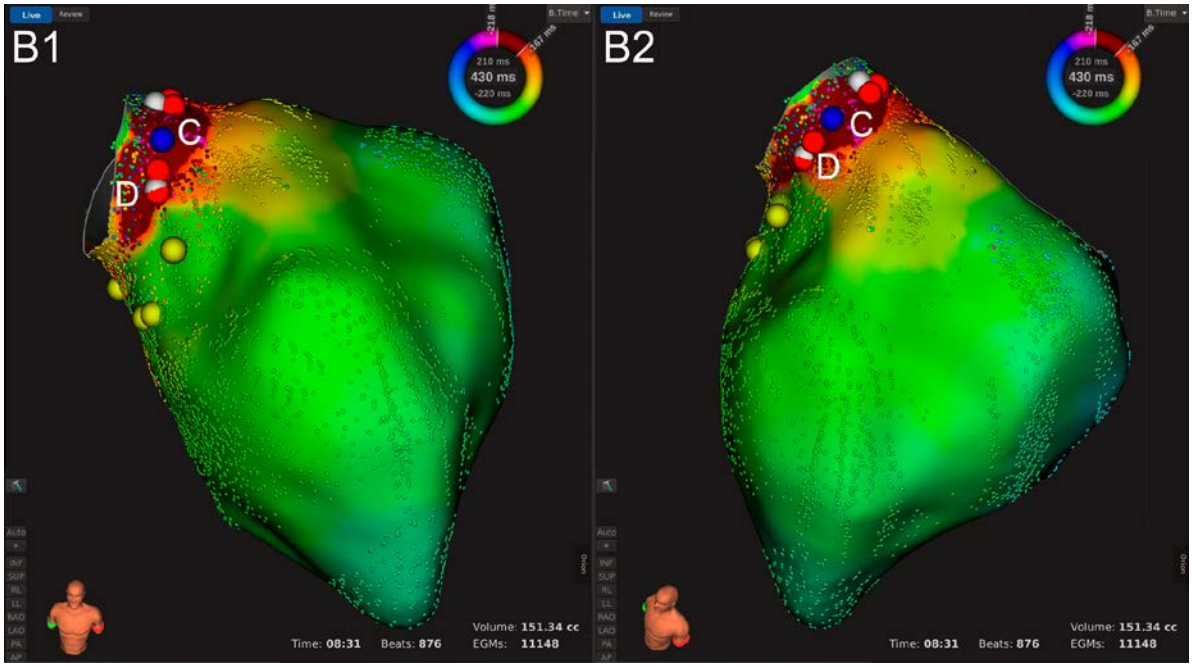
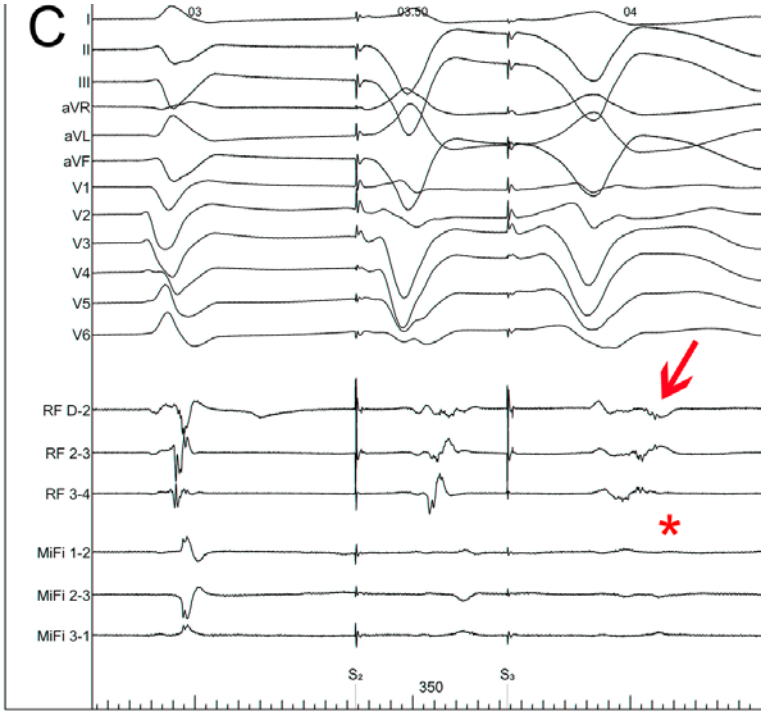
Figure



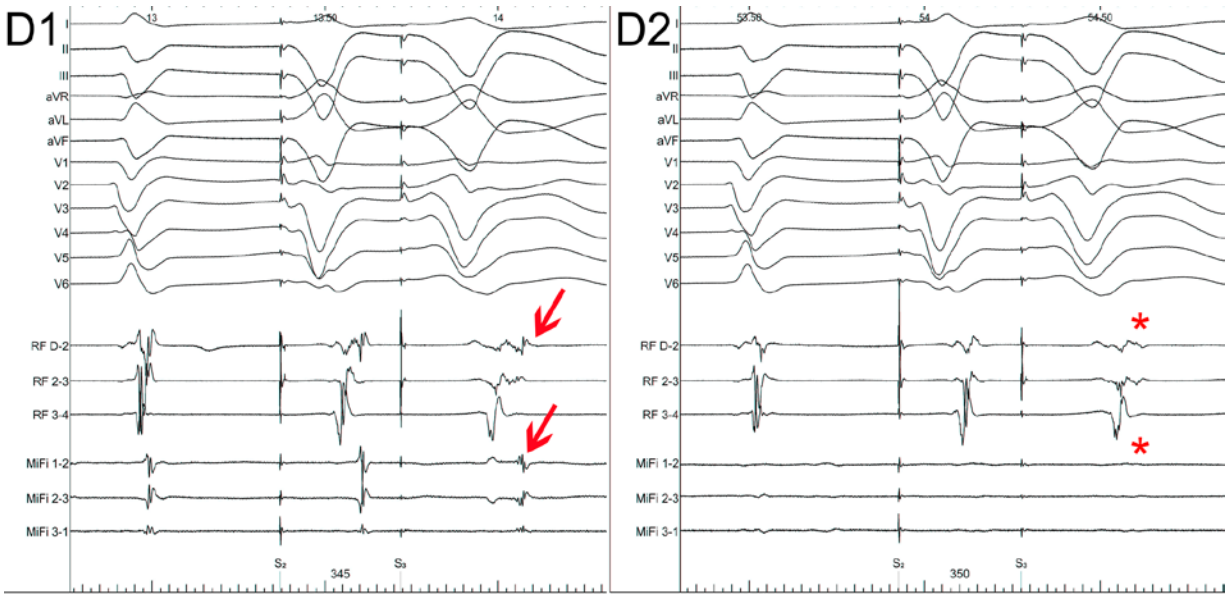
Panel A: Morphology of the induced ventricular tachycardia (VT).



Panel B: Electroanatomical activation map during the VT (**Panel B1**: anteroseptal view; **Panel B2**: anterolateral view). An anteroseptal origin close to the His-Purkinje system can be observed. The blue dot designates a false positive hidden slow conduction-EGM (see Panel C). White dots correspond to true positive hidden slow conduction-EGM, where RF was delivered (red tags).



Panels C and D: Two extrastimuli coupled 450 and 350 ms were delivered from the right ventricular apex showed up the presence of hidden slow conduction during sinus rhythm. **Panel C**: False positive HSC, marked as a blue dot in panel B. The (CBD, labeled as RF D-2, RF 2-3, and RF 3-4) show a probable HSC EGM (arrow). However, the mini-electrode dipoles (ME, labeled as MiFi 1-2, MiFi 2-3, and MiFi 3-1) located at the tip of the catheter did not show any delayed local EGM (asterisk).



Panel D1: True positive HSC in the evoked response. The CBD show probable HSC-EGM (arrow). ME show a clear, delayed local EGM (arrow). This site was marked as a target ablation point in the EAM (white point in panel B). **Panel D2**: EGM after RF ablation in the same point shown in panel D1. CBD show again a similar HSC-EGM (without the high frequency final component, asterisk). In the ME, the local EGM (asterisk) has disappeared after the ablation.

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