

EP CASE REPORT

A case of focal ventricular tachycardia with alternating endocardial and epicardial exits: utility of non-invasive mapping in predicting exits

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Introduction

We present a case of sustained ventricular tachycardia (VT) arising from the left ventricular (LV) summit with alternating epicardial and endocardial exits, highlighting the utility of non-invasive mapping in predicting an endocardial vs. an epicardial exit.

Case report

A 71-year-old man with non-ischaemic cardiomyopathy was admitted to our hospital in sustained VT at 130 b.p.m. (QRS width 182 ms). The arrhythmia had a right bundle branch block morphology, inferior axis, and a positive vector throughout the precordial leads. The VT would alternate to a narrower morphology (QRS width 121 ms) with an axis from rightward to leftward and the same cycle length (Figure 1). The narrower of the two VTs had been ablated at the superior septum a month prior.

The patient underwent non-invasive mapping and both VTs had similar earliest depolarization at the LV outflow tract (LVOT) (Figure 1A and B). Global activation of the wider VT showed early propagation laterally along the mitral annulus and depolarization of the left ventricle from left to right, explaining the rS complex in lead I. In contrast, the narrower VT demonstrated earlier propagation towards the LV septum and relative symmetrical depolarization between the ventricles (Figure 1A and B).

In the EP Laboratory, both VTs occurred spontaneously. The coupling intervals were the same. Activation and pacemapping was performed at the right ventricular outflow, sinuses of valsalva, great cardiac vein (GCV), and LV endocardium. The wider VT had earliest activation inside the distal GCV (−41 ms). The narrower VT was mapped earlier on the endocardial site of the LV septum (−39 ms) (Figure 1C and D). Pacemapping from the earliest sites of each VT gave a 95% and 94% morphology match for wide and narrow VT, respectively. Ablation from both endocardial and epicardial sites rendered the VTs non-inducible. The patient remains arrhythmia free a year post-ablation, off antiarrhythmics.

Discussion

Due to the complex regional anatomy of the LV summit, ablation of VAs arising from this area is challenging. Although direct epicardial approach to this site is difficult, successful ablation of these arrhythmias is possible via adjacent anatomical structures.¹

The alternating VT morphologies in our patient suggested differential exits of the same focus. The similar activation times of the earliest sites suggested a mid-myocardial location of the site of origin. In addition to demonstrating evidence of differential exits of a single VT focus by invasive mapping, we also provide non-invasive electro-anatomical maps of the two exits. These show distinct propagation patterns between endocardial and epicardial exits despite the similar arrhythmia 'break out' at the LVOT. In the case of wide VT, we propose that the late engagement of the septum and lateral initial propagation along the mitral annulus suggests epicardial origin. This was subsequently confirmed with invasive mapping. For the narrower VT, the early engagement of the septum with symmetrical right and left activation suggests endocardial exit, also confirmed by invasive mapping.

Conclusion

Non-invasive electro-anatomical mapping could compliment electrocardiogram morphology by demonstrating differential patterns of global propagation for VT that could be characteristic depending on the arrhythmia origin.

Conflict of interest: none declared.

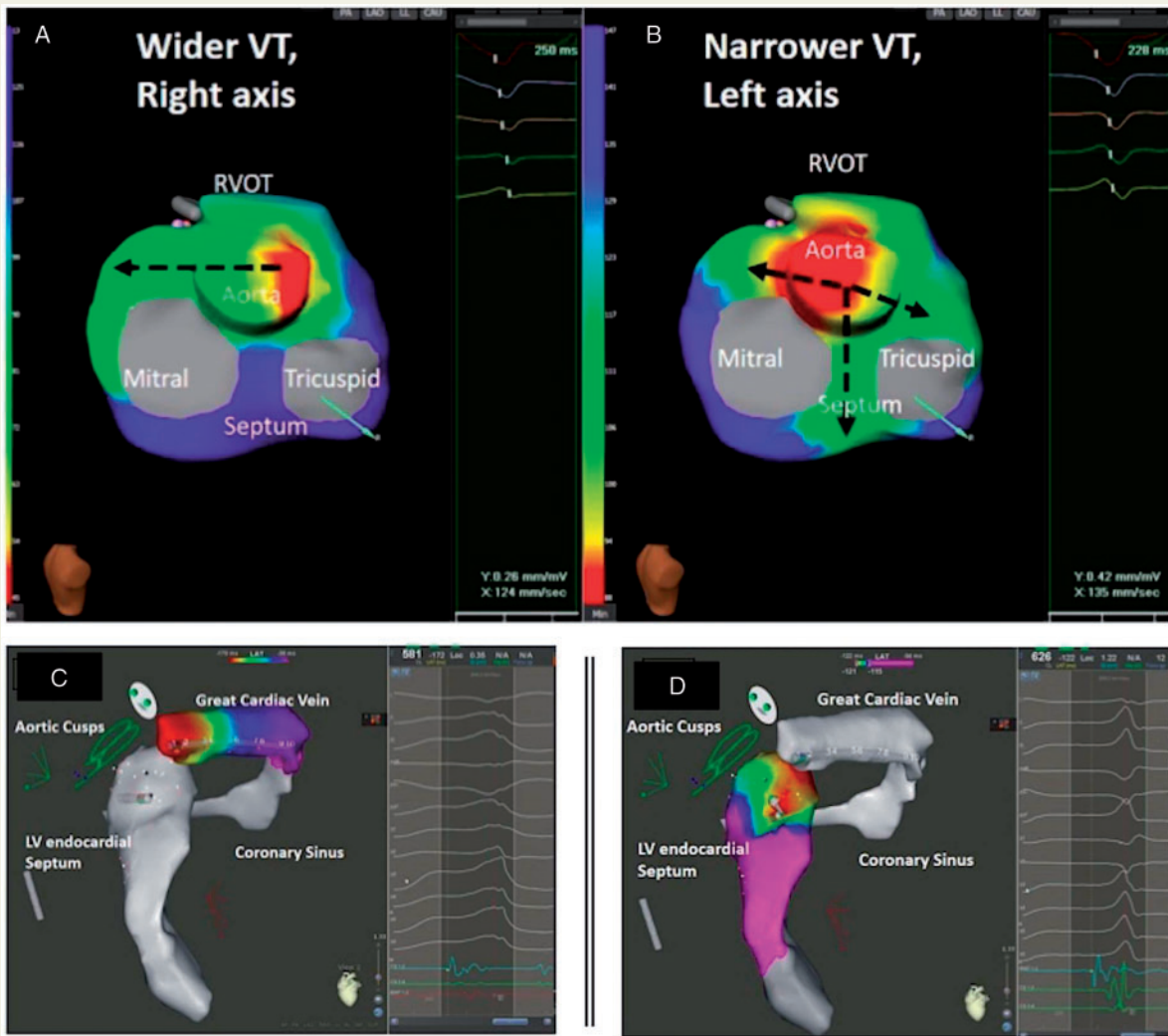


Figure 1 Activation mapping of two VTs. (A) Non-invasive mapping: the wider VT would propagate laterally along the mitral annulus before depolarizing the LV from left to right (rS complex in lead I). Notice the late engagement of the LV septum despite the fact the earliest site (red) appears to be on its superior aspect. Above observations suggest epicardial origin. (B) Non-invasive mapping: the narrower VT would show similar earliest activation at the LVOT and engaged the LV septum early with symmetrical activation of the anterior RV and LV suggesting endocardial origin. (C) Invasive mapping: wider VT had earliest activation in the distal GCV suggesting an epicardial exit. (D) Invasive mapping: during the narrower VT, the earliest activation would switch from the epicardium to the opposite endocardial site. GCV, great cardiac vein; LV, left ventricular; LVOT, LV outflow tract; RV, right ventricular; RVOT, RV outflow tract; VT, ventricular tachycardia.

Reference

1. Mountantonakis SE, Frankel DS, Tschabrunn CM, Hutchinson MD, Riley MP, Lin D *et al.* Ventricular arrhythmias from the coronary venous system: prevalence, mapping, and ablation. *Heart Rhythm* 2015;**12**:1145–53.