

Dual-loop circuit of ventricular tachycardia in repaired tetralogy of Fallot patient

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A 22-year-old man who had had a surgical repair of tetralogy of Fallot (TOF) with a patch closure of the ventricular septal defect (VSD) and reconstruction of the right ventricular outflow tract (RVOT) with a patch at the age of 3 was referred for ventricular tachycardia (VT) risk assessment prior to pulmonary valve (PV) replacement.

Voltage mapping during sinus rhythm with the Orion™ catheter and Rhythmia™ system (Boston Scientific, Marlborough, MA, USA) showed three potential isthmuses as shown in Figure 1A; isthmus-1, between PV and the VSD patch [length: 12.4 mm, width: 19.2 mm, and conduction velocity (CV): 0.21 m/s], isthmus-2, between the PV and RVOT patch (length: 16.3 mm, width: 13.5 mm, and CV: 0.34 m/s), and isthmus-3 between the RVOT patch and the tricuspid annulus (length: 39.4 mm, width: 51.4 mm, and CV: 0.80 m/s). Ventricular tachycardia [cycle length (CL) = 230 ms] was easily induced by programmed pacing (Figure 1B). The activation map in VT with 18 519 points (Figure 1C) suggested that isthmuses 1 and 2 were used simultaneously for a dual-loop VT, which was confirmed by entrainment mapping (Figure 1D and E). Ablation at isthmus-1 resulted in a 10-ms increase of the CL without a remarkable alteration in surface ECG morphology. Then, we could not continue to ablate the isthmus-2 due to hemodynamically compromise. The patient was cardioverted and complete block of the isthmuses 1 and 2 was created in sinus rhythm. Afterwards, no VT was inducible.

Zeppenfeld *et al.*¹ reported that after surgical repair of TOF, the four types of potential isthmus between (i) the tricuspid annulus and scar/patch in the right anterior ventricular outflow, (ii) the pulmonary annulus and right ventricular free wall scar/patch, (iii) the pulmonary annulus and septal scar/patch, and (iv) the septal scar/patch and tricuspid annulus. In the present case, two isthmuses ([2] and [3]) were simultaneously included in the circuit of the VT. The right ventricle between tricuspid annulus and RVOT patch, which was also described as a potential isthmus ([1]) in the report, was commonly included in the both circuits. However, it was too long to be the practical isthmus in this case. Kapel *et al.*² examined 74 repaired TOF patients and succeeded in mapping 37 VTs in 24 patients. Although four patients among them had two VT-related anatomical isthmuses, each isthmus supported a different VT re-entry. They described that CV <0.5 m/s was associated with induced VTs. In the present study, the isthmuses 1 and 2 met this criterion. However, anatomical isthmus dimensions and conduction velocity may not be directly comparable to that in the previous study, as we performed an ultra-high density mapping with a multipolar catheter with smaller bipolar spacing and used a dense scar threshold of 0.2 mV, based on our previous experience with this mapping system in the right ventricle.

Here, high-resolution mapping and entrainment demonstrated that two isthmuses were simultaneously used as a VT circuit. This is the first report that demonstrates a dual-loop VT circuit in repaired TOF.

Supplementary material is available at *Europace* online.

Conflict of interest: M.T. is a temporary consultant of the Rhythmia system for Boston scientific Japan. S.C. is an employee of Boston Scientific.

References

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