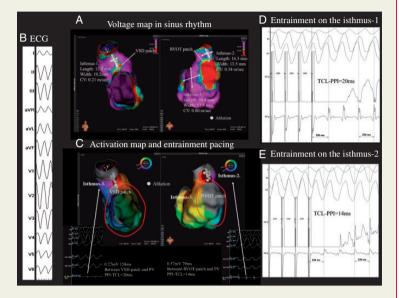
Dual-loop circuit of ventricular tachycardia in repaired tetralogy of Fallot patient

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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 OrionTM catheter and RhythmiaTM 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.

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