Optimisation of Decrementing Evoked Potential mapping for functional substrate identification in Ischaemic Ventricular Tachycardia Ablation

Background: Decrement evoked potential (DeEP) mapping has been shown to identify the functional substrate critical to the Ventricular Tachycardia (VT) circuit with a higher specificity than late potential mapping.[(1)] However, there is limited data on methodological optimisation of this technique which could identify more relevant regions of conduction delay and functional block that occurs during clinical VT by activating the substrate at coupling intervals closer to the VT cycle length (CL).

Purpose: The goal of this study was to investigate a range of short coupled extra-stimuli and decrement thresholds to improve DeEP mapping target identification in patients with ischaemic cardiomyopathy.

Methods: Thirteen patients (70±12 years) underwent VT ablation. Mapping was performed with the Advisor HD Grid multipolar catheter. Maps were generated using omnipolar electrograms (EGMs). DeEP mapping was performed using 3 different extra-stimuli (S2) sequentially in each case: (1) 400 ms (DeEP-400); (2) VT cycle length (VTCL); (3) ventricular effective refractory period (VERP) + 20 ms. For each of the DeEP-400, DeEP-VTCL and DeEP-VERP maps, the definition of a DeEP was altered from the standard 10 ms decrement to multiple thresholds of 10 ms to 50 ms in 10 ms increments (figure 1). DeEP maps were compared to the VT exit site identified with VT activation maps. All patients underwent DeEP-400 focused ablation.

Results: Mean left ventricular ejection fraction (LVEF) was 30 ± 12 % and all patients had 1 inducible clinical VT (VTCL of 353 ± 48 ms) with a mean VERP + 20 ms of 300 ± 20 ms. Based on sensitivity and specificity analyses the optimal threshold for defining a DeEP for the DeEP-400 (sens. 85%, spec. 83%), DeEP-VTCL (sens. 85%, spec. 76%) and DeEP-

VERP (sens. 77%, spec. 72%) maps was with an EGM prolongation of > 20 ms (ROC AUCs of 0.88, 0.83 & 0.77, respectively). Proportionally to total mapped area, the DeEP-400 map area was significantly smaller than DeEP-VERP map area (17.0 ± 7.0 % vs 27.7 ± 12.7%; p=0.016). 92% patients were free of any VT after DeEP-400 guided ablation at 6 months median follow-up.

Conclusion: In this prospective, mechanistic study utilising omnipolar technology to explore a range of S2 extra-stimuli and decrement thresholds, DeEPs were optimally defined by a conduction delay of ≥ 20 ms with an S2 extra-stimulus coupling interval of 400 ms or VTCL to more accurately localise the VT exit site. This optimised DeEP mapping protocol further refines identification of the critical myocardial sites involved in the initiation and maintenance of VT.

References

1. Porta-Sánchez A, Jackson N, Lukac P, Kristiansen SB, Nielsen JM, Gizurarson S, et al. Multicenter Study of Ischemic Ventricular Tachycardia Ablation With Decrement-Evoked Potential (DEEP) Mapping With Extra Stimulus. JACC Clin Electrophysiol. 2018;4(3):307-15.