The evaluation of the efficacy of automated peak frequency annotation algorithm for the identification of critical isthmus of ventricular tachycardia and deceleration zones

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Background: Substrate modification techniques have widely been adopted due to hemodynamic instability and non-inducibility of clinical ventricular tachycardia (VT). Accurate annotation of local near field EGMs is paramount to better evaluate the ventricular substrate. Furthermore, annotation of late potentials (LP) necessitates substantial manual input and isochronal late activation mapping (ILAM) involves constant sensitivity adjustments, potentially affecting the accuracy of local ventricular signal representation.

Objective: This study aims to assess the utility of novel automated peak frequency (PF), which aims to determine near field local activity in low voltage regions in the prediction of the CI of scar related reentrant VTs. Furthermore, the effectiveness of automated PF annotation of near field EGMs to identify deceleration zone (DZ) during ILAM was also evaluated.

Methods: A total of 18 patients with scar-related VT were analyzed. In all patients, VT isthmuses were identified based on activation maps and acute termination achieved during radiofrequency ablation. Automated PF annotation using Ensite X system (Abbott) was retrospectively performed in all cases specifically in areas of low voltage with fractioned signals. The accuracy of applying the PF value and automated ILAM map for detecting VT isthmus was also assessed.

Results: Among the study group, 12 (66.7%) had ischemic cardiomyopathy, while 6 (33.3%) had nonischemic cardiomyopathy [3 (16.7%) with arrhythmogenic right ventricular cardiomyopathy, 2 (11.1%) with idiopathic dilated cardiomyopathy, and 1 (5.6%) with hypertrophic cardiomyopathy]. All identified isthmuses were located in areas exhibiting bipolar voltage below 0.5 mV and a PF of 250 Hz with fractionated EGMs. Automated NF DZ annotation predicted the VT isthmus in 16/18 (88.9%) of the cases similar to the conventional ILAM with manual adjustment (88.9%).

Conclusion: Using high-density electroanatomical mapping with near field algorithm, a PF cutoff of 250 Hz accurately identified the low voltage regions to predict the CI of VT. In addition, automated annotation of EGMs during ILAM similarly identified the DZs compared with conventional last deflection algorithm with manual adjustments, which were colocalized with CI of VTs.
A. The voltage map reveals a substantial anteropical scar, exhibiting a voltage range of 0.1-1.5 millivolts; B. During sinus rhythm, the automated near-field isochronal late activation map; C. Peak frequency, with a cut-off at 250 Hz, is superimposed on the voltage map for enhanced visualization; D. The activation map during ventricular tachycardia.