

Figure 1. Illustrative example of rEGMs and associated voltage loops shown with fluorescence signals.  
 A: rEGM at baseline (left) and after pinacidil infusion (right).  
 B: Optical signals measured at same locations.  
 C: Vector loops obtained from orthogonal bipoles. Large component traced in black represents the QRS while the color coded segment illustrates the repolarization loop. Color depicts time of repolarization.

### CE-520-03

#### USE OF RIPPLE MAPPING TO ENHANCE LOCALIZATION AND ABLATION OF OUTFLOW TRACT PREMATURE VENTRICULAR CONTRACTIONS

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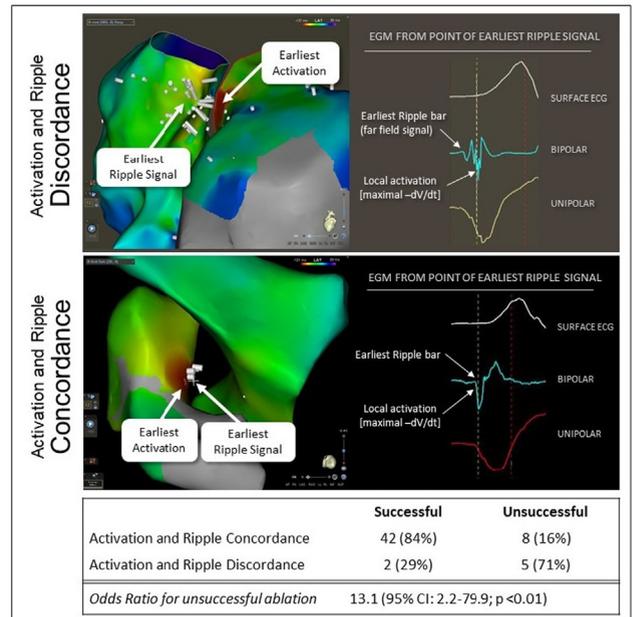
**Background:** Mapping outflow tract (OT) premature ventricular contractions (PVCs) can be difficult given a frequent mid-myocardial origin. Compared to local activation time mapping, Carto® Ripple Mapping provides visualization of both far field and near field signals independent of local annotation that may enhance PVC localization.

**Objective:** To evaluate the utility of Ripple mapping to localize OT PVCs.

**Methods:** Electroanatomic maps for consecutive OT PVC catheter ablation cases (July 2018-December 2020) were analyzed. For each PVC, we identified the earliest local activation point (EA), defined by the point of maximal  $-dV/dt$  in the unipolar electrogram (EGM) within each corresponding bipolar EGM, and the earliest Ripple signal (ERS), defined as the earliest point at which 3 grouped simultaneous Ripple bars appeared. Procedural success was defined as full suppression of the targeted PVC.

**Results:** 57 PVC maps were included. When ERS was in the same chamber (right ventricle, left ventricle, or coronary sinus) as EA, procedural success was 84%, versus 29% when discordant ( $p < 0.01$ ) (Figure). Site discordance had an odds ratio for needing multisite ablation of 7.9 (95% confidence interval 1.4-4.6;  $p = 0.02$ ) and for unsuccessful procedure of 13.1 (2.2-79.9;  $p < 0.01$ ). Median EA-ERS distance in successful and unsuccessful cases was 4.6 mm (interquartile range 2.9, 8.5) vs 12.5 mm (7.8, 18.5); ( $p < 0.01$ ). Positive predictive value for successful ablation with EA-ERS distance  $< 10$ mm was 90% (79-95%,  $p < 0.01$ ).

**Conclusion:** Greater concordance between EA and ERS is associated with higher odds of successful OT PVC ablation. Visualization of far-field signals via Ripple mapping may offer localization information complementary to activation mapping for PVCs of mid-myocardial origin.



### CE-520-04

#### FORWARD-SOLUTION COMPUTATIONAL ARRHYTHMIA SOURCE MAPPING: THE VMAP STUDY

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**Background:** The accuracy of arrhythmia source localization using a forward solution computational mapping system has not yet been evaluated in blinded, multicenter analysis.

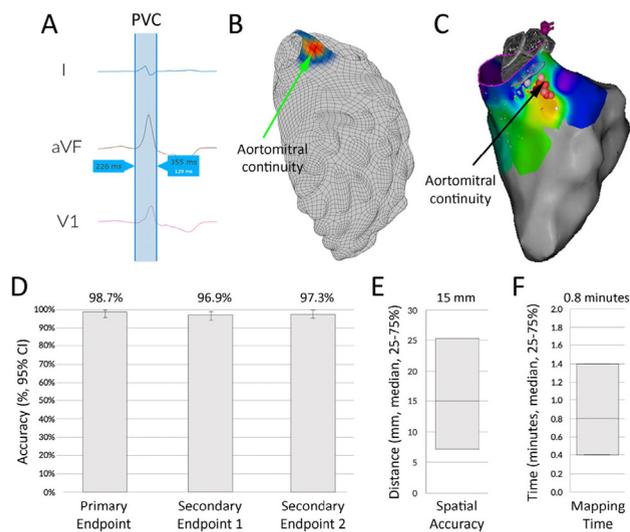
**Objective:** The study tested the hypothesis that a computational mapping system using a comprehensive arrhythmia simulation library would provide accurate localization of the site of origin for atrial and ventricular arrhythmias and pacing using the 12-lead ECG compared with the gold standard of invasive electrophysiology study and ablation.

**Methods:** The VMAP study was a blinded, multicenter evaluation with final data analysis performed by an independent core laboratory. Eligible episodes included atrial and ventricular: tachycardia (VT), fibrillation, pacing, premature complexes (PACs and PVCs; figure panel A); and orthodromic atrioventricular reentrant tachycardia. Forward solution mapping system results (panel B) were compared with the gold standard site of successful ablation or pacing during invasive electrophysiology study and ablation (panel C). Mapping time performance was assessed from timestamped analysis logs. Pre-specified performance goals were used for statistical comparisons.

**Results:** A total of 255 episodes from 225 patients were enrolled from 4 study centers. Regional accuracy for VT and PVCs in patients without significant structural heart disease ( $n = 75$ ,

primary endpoint) was 98.7% (95% CI: 96.0-100%,  $p < 0.001$  to reject study null hypothesis, panel D). Regional accuracy for all episodes (secondary endpoint 1) was 96.9% (95% CI: 94.7-99.0%,  $p < 0.001$ ). Accuracy for the exact or neighboring segment for all episodes (secondary endpoint 2) was 97.3% (95% CI: 95.2-99.3%,  $p < 0.001$ ). Median center-to-center spatial accuracy was 15 mm ( $n = 255$ , IQR: 7 - 25 mm, panel E). The mapping process was completed in a median of 0.8 minutes (IQR: 0.4 - 1.4 minutes, panel F).

**Conclusion:** Computational ECG mapping using a forward simulation approach exceeded prespecified accuracy goals for arrhythmia source and pacing site localization. Spatial accuracy analysis revealed clinically actionable results. This rapid, non-invasive mapping technology may facilitate catheter-based and noninvasive arrhythmia therapies.



## ABSTRACT CI-523: Clinical Trials in CIEDs

Friday, April 29, 2022

9:15 AM - 10:15 AM

### CI-523-01

#### CONDUCTION SYSTEM PACING VERSUS CONVENTIONAL PACING IN PATIENTS UNDERGOING AV NODE ABLATION: NON-RANDOMIZED, ON-TREATMENT COMPARISON

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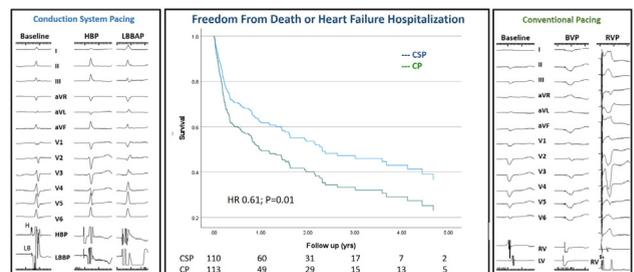
**Background:** AV Node Ablation (AVNA) with right ventricular or biventricular pacing (Conventional Pacing-CP) is an effective therapy for patients with refractory atrial fibrillation. Conduction System Pacing (CSP) using His bundle pacing or left bundle branch area pacing preserves ventricular synchrony and may be associated with better clinical outcomes.

**Objective:** The aim of our study is to compare the clinical outcomes between CP and CSP in pts undergoing AVNA.

**Methods:** Patients undergoing AVNA at a large health system between Jan 2015 and Oct 2020 were included in this retrospective observational study. CP or CSP were performed at the operators' discretion. Procedural, pacing parameters and

echocardiographic data were assessed. Primary outcome was the combined endpoint of time to death or heart failure hospitalization (HFH) and analyzed using Cox proportional hazards. Secondary outcomes were individual outcomes of death and HFH.

**Results:** AVNA was performed in 223 patients (CSP 110; CP 113). Age  $75 \pm 10$  years, men 52%, hypertension 67%, diabetes 25%, coronary disease 40%, LVEF  $43 \pm 15$  % and baseline QRS duration  $111 \pm 30$ ms. QRS duration increased from  $103 \pm 30$ ms to  $124 \pm 20$ ms ( $p < 0.01$ ) in CSP and  $119 \pm 32$ ms to  $162 \pm 24$ ms in CP. During a mean follow up of  $27 \pm 19$  months, LVEF significantly increased from  $46.5 \pm 14.2$ % to  $51.9 \pm 11.2$ % ( $p = 0.02$ ) in CSP and  $36.4 \pm 16.1$ % to  $39.5 \pm 16$ % ( $p = 0.6$ ) in CP. The primary outcome of death or HFH was significantly reduced in CSP compared to CP (48% vs 62%; HR 0.61, 95% CI 0.42-0.89,  $p < 0.01$ ). There was no significant reduction in the secondary outcomes of HFH and death in the CSP group compared to CP. **Conclusion:** CSP is a safe and effective option for pacing in patients with atrial fibrillation undergoing AVNA and may be associated with reduction in HFH or death compared to CP.



### CI-523-02

#### A MULTICENTER RANDOMIZED COMPARISON BETWEEN ULTRASOUNDS AND FLUOROSCOPIC GUIDANCE FOR AXILLARY VEIN PUNCTURE FOR CARDIAC DEVICES IMPLANTATION

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**Background:** Axillary vein (AV) puncture, an emerging route for cardiac implantable electronic devices (CIED), can be performed under ultrasounds (US) or fluoroscopic (Fluo) guidance.

**Objective:** To compare US to fluoroscopic-guided AV puncture in a multicenter randomized controlled trial.

**Methods:** Consecutive patients admitted for CIED (first implant or upgrade, including resynchronization therapy) intervention were prospectively randomized between US or Fluo guidance for AV puncture in the three participating centers. Access performances, radiation exposure and complications were compared in both groups.

**Results:** 102 patients were included ( $n = 51$  patients per group). The two groups had similar characteristics concerning age ( $79.4 \pm 10$  years), and LVEF ( $47 \pm 17$ %). 92 leads were implanted in both groups. AV catheterization was successful in 50/51 (98 %) in the US group versus 49/51 in the Fluo group (96 %,  $p = 0.56$ ). AV access time and procedure time were not different between the two groups, respectively ( $156 \pm 274$  in the US group versus  $137 \pm 151$  sec,  $p = 0.66$ ;  $54 \pm 24$  versus  $61 \pm 26$  min;  $p = 0.13$ ). Total fluoroscopy time (FT) and dose-area product were respectively lower in the US group, but without reaching significance:  $197 \pm 231$  versus  $247 \pm 293$  sec,  $p = 0.32$ ;  $0.39 \pm 0.95$  versus  $0.75 \pm 1.58$  mGy.m<sup>2</sup>,  $p = 0.14$ . FT for AV access was significantly higher in the Fluo group ( $51 \pm 55$  sec versus 0,  $p < 0.0001$ ). There were two complications in each group during the  $9 \pm 6$  months follow-up.