Non-invasive 3D mapping and remote-controlled PVC ablation: a first experience

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Background

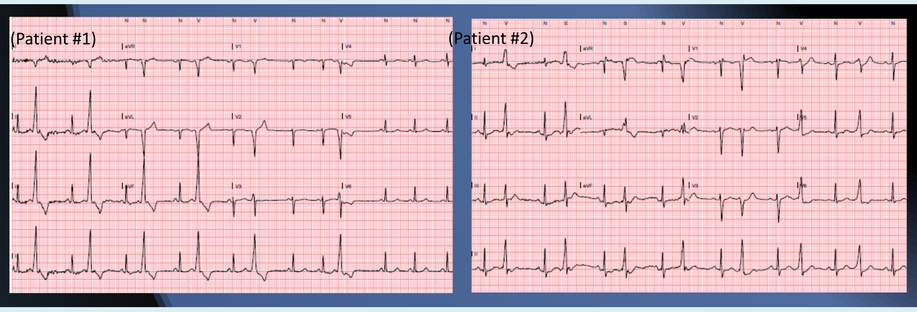
VIVO™ (Catheter Precision Inc) is a novel 3D non-invasive mapping system which allows to precisely localize ventricular arrhythmias using 3D DICOM data (from CT or CMR) in combination with 12 lead digital ECG files recorded on a 12-lead Holter. Catheter ablation was subsequently performed using remote magnetic navigation (RMN) to reduce both radiation exposure and risk of adverse events.

Objective

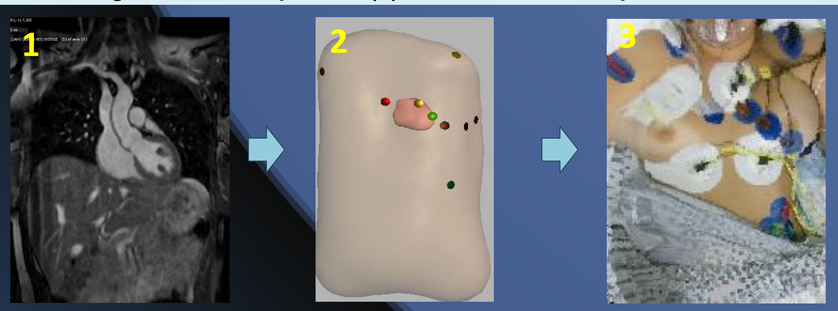
We report on the first worldwide PVC ablations using RMN combined with non-invasive 3D mapping.

Results

Two female patients (30yrs and 70yrs), with structurally normal hearts and 2 previous PVC ablations, presented with very symptomatic monomorphic PVCs. On the ward, both had a pre-procedural 12-lead Holter to document the clinical PVC.



A 3D model of heart and torso (2) was reconstructed from pre-acquired CMR (1) scans and merged with a 3D picture (3) of the ECG leads' position on the torso.



Finally, a digital ECG from the Holter recording was imported.
In the first case, the software localized the PVC at the LV basal aspect, whereas the other located at the medial aspect of the RVOT.

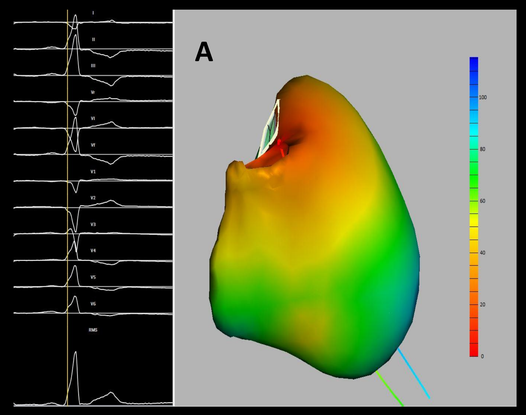


Figure A. Patient#1. Clinical PVC localized at the medial aspect of the RVOT (*colours show activation pattern, red to blue*)

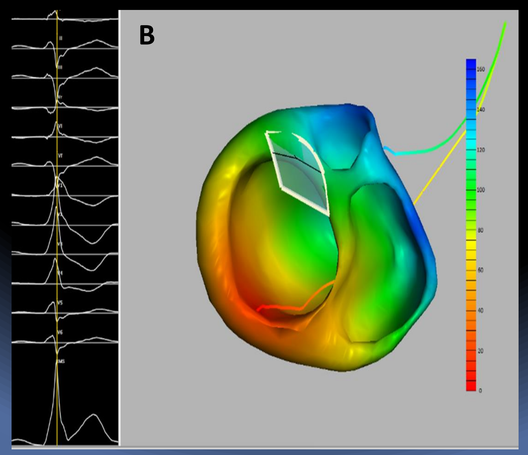
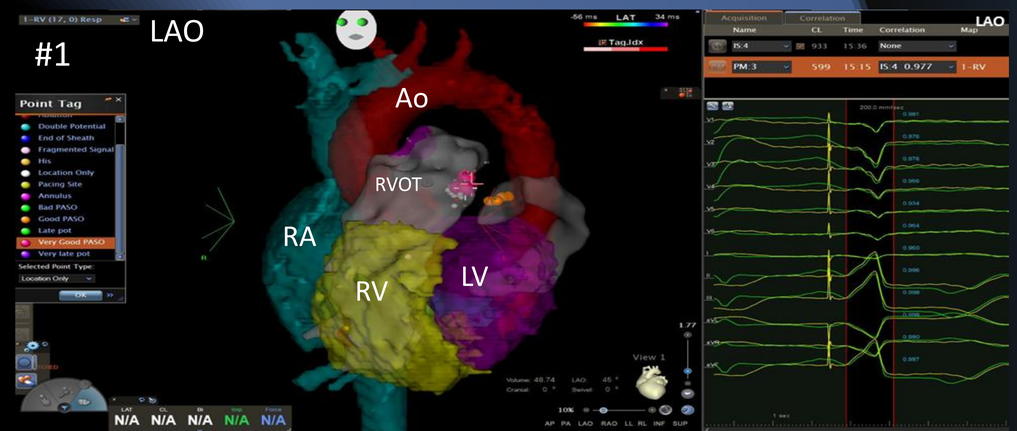


Figure B. Patient#2. Clinical PVC localized at the medial aspect of the left ventricular basal aspect.

Both underwent either a trans-aortic retrograde or trans-venous ablation procedure using RMN integrated with CARTO. Best pace-map was observed at the predicted sites, and ablation resulted in typical warming-up, followed by complete elimination of any PVC.



Above, patient #1. On the left, 3D reconstruction of patient's heart merged with FAM of the RVOT and coronary sinus (CS). *Orange dots*, RF deliveries attempts from distal CS which didn't suppress the clinical PVC. *Purple dots*, RF deliveries at the medial aspect of the RVOT (98% PASO match) with stable suppression of the clinical PVC (shown on the right).

Below, patient #2. On the left, FAM of the aorta during retrograde trans-aortic approach in remote magnetic navigation, followed by quick FAM of the LV at the basal aspect and RF deliveries at the site indicated by VIVO™ analysis. On the right, warming-up during RF deliveries at this site, followed by suppression of the clinical PVC.

Fluoroscopy time was 5 and 22 sec, procedure time amounted to 139 and 98 min

Conclusions

These are the first cases demonstrating the combination of non-invasive 3D localization of PVC origin and subsequent successful remote-controlled catheter ablation. It resulted in eliminating PVCs in patients who failed previous conventional EAM ablations. Besides ultra-low radiation exposure, most of the mapping procedure was performed outside the EP lab.

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