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## Image integration guided ablation of left outflow tract ventricular tachycardia: Is coronary angiography still necessary?



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### 1. Case

A 62-year-old man was referred to our center for re-do of catheter ablation for idiopathic premature ventricular contractions (PVCs) after a failed attempt in the septal region of right ventricular outflow tract (RVOT). PVCs morphology was at left bundle branch type (QS in V1, transition in V3, rs in I, monophasic R in II,III,aVF) (Fig. 1).

A 2D-echocardiogram documented mild dilation of the left ventricle [LVEDD (end diastolic diameter): 60mm] with moderate systolic dysfunction [Ejection Fraction (EF): 40%], while right ventricle size and function were preserved. These data were confirmed by cardiac magnetic resonance (MR) which also excluded presence of scars and/or areas with late gadolinium enhancement. Furthermore, coronary angiography ruled out atherosclerotic disease of the epicardial vessels.

When planning the re-do procedure, computed tomography (CT) scans of the left ventricular outflow tract (LVOT) including left ventricle, aortic root and coronary arteries were acquired.

The patient underwent electrophysiological study using CARTO 3<sup>®</sup> (Johnson & Johnson, Biosense Webster) navigation system for mapping and ablation.

Catheter location was confirmed by accurately merging the anatomical shell delineated with intracardiac echo (ICE) to the geometry of the cusps region (included the coronaries ostia) segmented from the pre-acquired angio-CT scans as well as monitoring « live » the catheter position by intracardiac echo. The point of earlier activation was easily achieved with a retrograde approach (Fig. 2A) and, through CARTO 3 PaSo<sup>®</sup> module 12-lead EKG analysis, pace mapping was performed showing a 92% correlation (Fig. 2B).

Radiofrequency ablation using 4-mm irrigated contact force catheter (Thermocool<sup>®</sup> SmartTouch, Johnson & Johnson, Biosense Webster) titrated to 25 W completely abolished PVCs in the region of the right sinus of Valsalva 18 mm below the right coronary artery ostium (Fig. 2C). The mean force applied during the radiofrequency application was 15 g. Thanks to continuous monitoring of catheter position into the complete merged anatomical map, navigation and ablation could be performed safely, without the use of coronary angiography during the procedure.

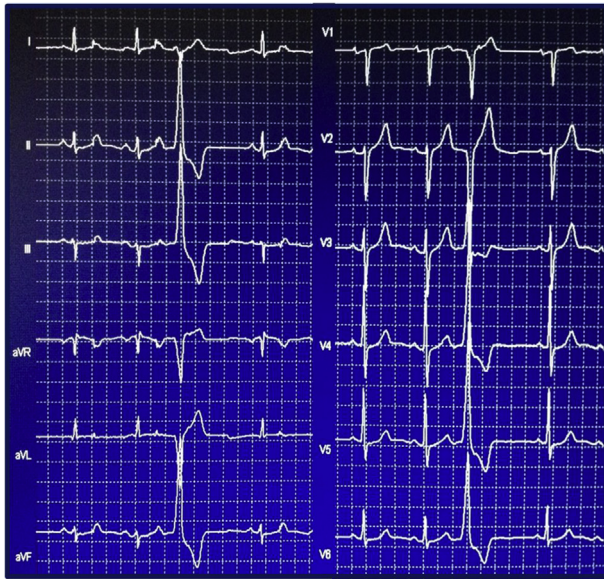
Ventricular arrhythmias in patients without structural heart disease mainly arise from the right and left ventricular outflow tracts (RVOT/LVOT). Compared with VAs originating from the RVOT, ablation of LVOT-VAs is more complex due to the subtle anatomical setting [1,2]. To avoid complications when targeting the area above the aortic valve, angiography of the aorta and coronary arteries should be performed prior to RFCA. Furthermore the left main coronary artery should be cannulated for the protection with an angiographic catheter. During ablation continuous fluoroscopic monitoring of catheter position is strongly suggested in the case of using 2D mapping [3].

A 3D ICE shells of the LVOT can be used to guide catheter manipulation in order to create a 3D echo-anatomic map focused on the area of interest. This approach is useful to achieve a fluorless direct visualization of the ablation catheter, its tissue contact

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**Fig. 1.** 12-leads EKG showing premature ventricular contractions with left bundle branch block morphology and QRS transition in V3. Inferior leads display tall and narrow monophasic R waves.

and stability as well as an early identification of complications such as pericardial effusion or tamponade [4]. Indeed it is strongly suggested to make clearer and easier the complex outflow tracts relationship which greatly varies between patients [5].

However, real time imaging during ablation catheter movement

is not always achievable due to the ICE probe dislocation and/or poor visualization of the smaller structures. Furthermore the delineation of coronary arteries trajectory is not always feasible. To overcome these problems the reliable model based on image integration between 3D echo chamber reconstruction and pre-acquired CT scans is able to predict the anatomy allowing the operator to manipulate more safely the catheter.

In conclusion catheter ablation of left outflow tract ventricular tachycardia remains challenging, especially for operators who have rather poor familiarity with performing coronary angiography. Image integration between pre-acquired CT scans and intra-cardiac echo reconstruction is feasible and provides an accurate real time localization of ablation catheter. In our case it definitely improved the efficacy and safety of the procedure.

**Conflicts of interest**

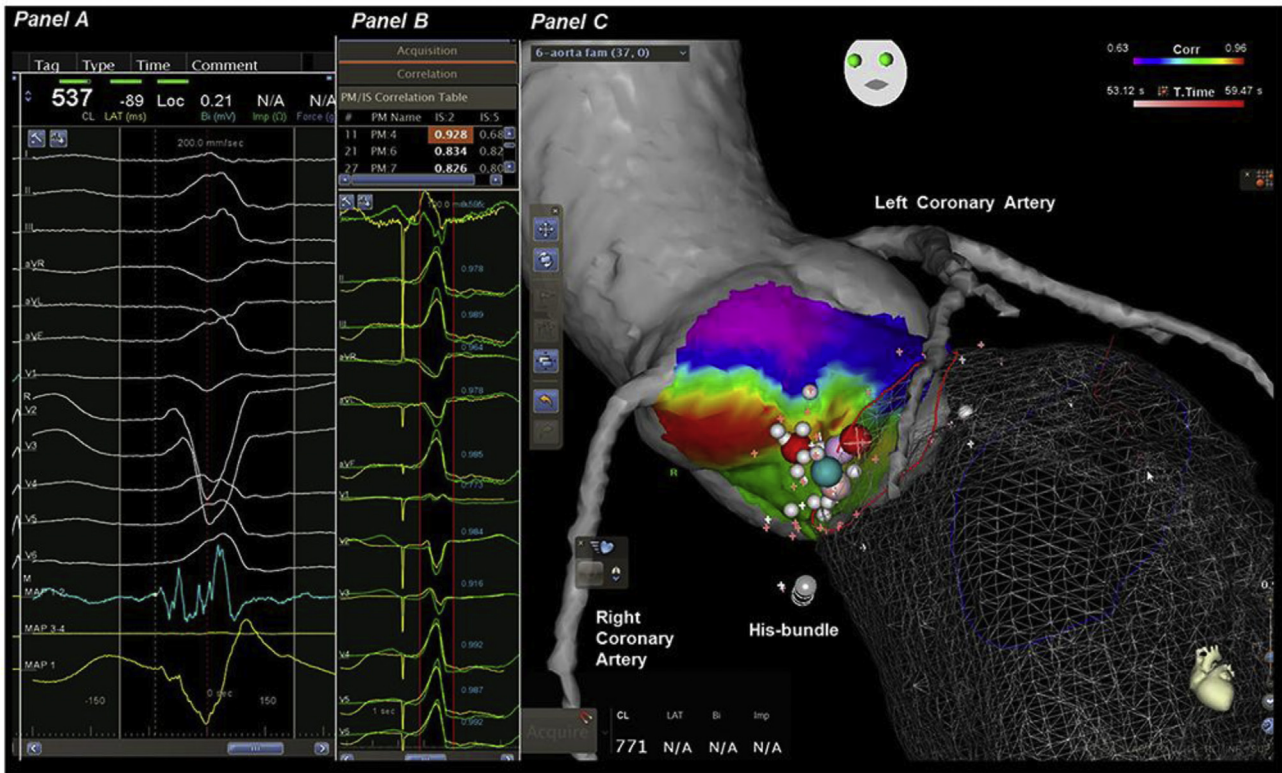
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**Appendix A. Supplementary data**

Supplementary data related to this article can be found at <https://doi.org/10.1016/j.ipej.2017.10.009>.



**Fig. 2.** **Panel A.** 12-lead EKG, EGM from bipolar (MAP 1,2 blue trace) and unipolar (MAP 1 yellow trace) ablation catheter positioned on the earlier activation point. **Panel B.** CARTO 3 PaSo® module 12-lead EKG analysis during pace mapping in the region of right sinus of Valsalva showing 92% correlation. **Panel C.** Final Image integration obtained merging pre-acquired CT scans and intracardiac echo reconstruction (blue dot: earlier activation point, white dots: best pace mapping points; pink and red dots: points of successful ablation).

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