

Thoracoscopic hybrid ablation in a patient with drug refractory arrhythmogenic right ventricular cardiomyopathy combined with non-invasive electrocardiographic imaging: a multidisciplinary approach

Cinzia Monaco¹, Luigi Pannone ¹, Antonio Bisignani ¹, Gian Battista Chierchia¹, Mark La Meir², and Carlo de Asmundis ^{1*}

¹Heart Rhythm Management Centre, Postgraduate Program in Cardiac Electrophysiology and Pacing, European Reference Networks Guard-Heart, Vrije Universiteit Brussel, Universitair Ziekenhuis, Belgium; and ²Department of Cardiac Surgery, Vrije Universiteit Brussel, Universitair Ziekenhuis, Brussel, Belgium

*Corresponding author. Tel: +32 2 4776009; fax +32 2 4776851. E-mail address: carlo.deasmundis@uzbrussel.be; carlodeasmundis@me.com

Case report

A 50-year-old man with no cardiovascular antecedents was admitted to our emergency department for malaise and palpitations during cycling. A 12-lead electrocardiogram (ECG) showed evidence of a sustained ventricular tachycardia (VT) with left bundle branch block (LBBB) morphology and superior axis, tachycardia cycle-length (TCL) 280 ms and no haemodynamic compromise. A magnetic resonance imaging scan of the heart revealed dilated right ventricle (end-diastolic volume 102 mL/m²) with mildly reduced right ventricle ejection fraction (45%). Synchronized cardioversion restored sinus rhythm. The ECG during sinus rhythm showed low QRS voltage in V1 and negative T wave from V1 to V3. A post-excitation wave (epsilon wave) was visible in V1 (see [Supplementary material online, Figure S1](#)).

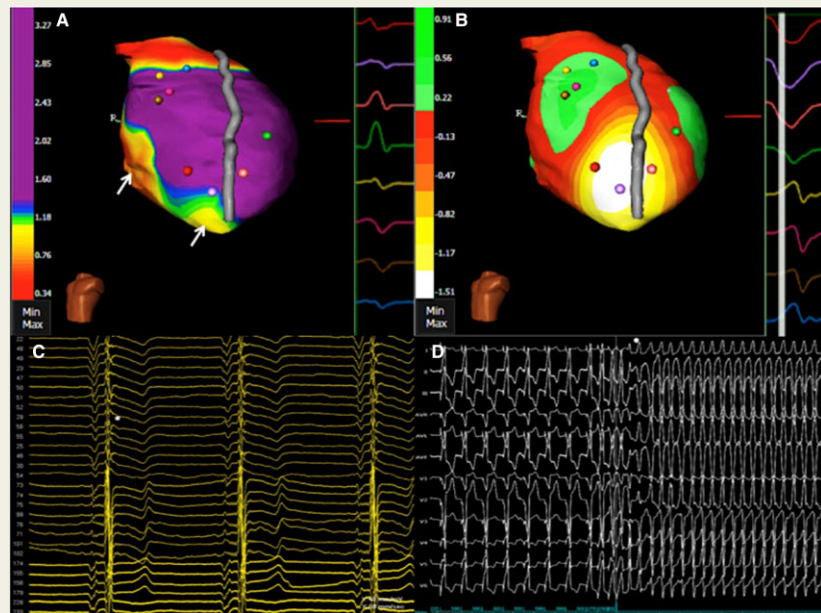
Echocardiography, coronarography and chest X-ray were unremarkable. Given the presence of three major criteria,¹ diagnosis of arrhythmogenic right ventricular cardiomyopathy (ARVC) was made. Anti-arrhythmic drugs (AADs) were not well tolerated by the patient because of symptomatic sinus bradycardia. Considering the risk of sudden cardiac death (SCD) and the intolerance for AADs, the patient was scheduled for implantable cardioverter defibrillator (ICD) implantation and a hybrid-approach ablation of the arrhythmogenic substrate, consisting in a concomitant endocardial and video-thoracoscopic epicardial mapping/ablation.

On the day of the procedure, the 252 electrodes CardiInsight Vest (Medtronic Inc., MN, U.S.A.) was applied to the chest of the patient. Computer tomography scan of the chest and segmentation identified sensor locations and created a detailed 3D shell of the heart (for our purpose, bi-ventricular). The protocol of the study had been previously approved by local Ethic Committee.

After deep sedation, a right femoral vein access was obtained for the electrophysiology study. A ventricular programmed stimulation protocol induced a sustained VT, showed the same morphology and similar TCL of the clinical arrhythmia, with likely origin in the RV apex. CardiInsight-derived potential and activation map showed earliest activation in the region of the apex. Voltage map obtained with electrocardiographic imaging (ECGi) during sinus beats identified areas of low voltage in the RV, mainly involving the apex and the anterolateral wall, close to the tricuspid valve. Epsilon wave was evident on high density ECGi (*Panels A to D*).

Epicardial and endocardial contact mapping were then performed with the HD-grid multielectrode catheter (St. Jude Medical, MN, U.S.A.) to identify the areas of aEGMs (the target of ablation)³ identified in the epicardial RV apex and anterolateral RV wall, with good spatial correspondence with the areas of low voltage detected with ECGi.

Ablation of the identified areas was then performed with the 10 cm aluminium CryoICE Cryoablation Probe (AtriCure Inc., OH, U.S.A.) with six applications of 3 min each (mean temperature -60°C); three applications were carried out at the apex, three at the anterolateral



RV. Re-mapping after ablation documented disappearance of fragmented potentials. The same induction protocol was repeated, but VT was no longer inducible.

After ablation, an ICD was implanted epicardially. The patient was discharged 4 days later without complications, on medications to prevent the post-pericardiotomy syndrome. After 1 year of follow-up, the patient had no symptoms and no episodes of ventricular tachy-arrhythmias recorded by device monitoring.

Conclusion

We performed an ECGi study during a hybrid-approach ARVC ablation; added to endo-epicardial map it can help to correctly identify the pathological substrate. In this perspective, ECGi could be also a valuable adjunct to the imaging and 12-leads ECG in the planning of the procedure.

Supplementary material

[Supplementary material](#) is available at *Europace* online.

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Conflict of interest: none declared.

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