

IMAGES IN ELECTROPHYSIOLOGY

Multielectrode Mapping and Pattern Matching Recognition for Left Premature Ventricular Contraction Ablation



Pedro A. Sousa, MD,^a Luís Elvas, MD,^a Sérgio Barra, MD,^{b,c,d} Natália António, MD, PhD,^{a,e} Lino Gonçalves, MD, PhD^{a,e}

Catheter ablation is an established treatment for premature ventricular contraction (PVC). Nevertheless, when the PVC arises from the left ventricular outflow tract, success rates are invariably lower (1,2).

We present a new approach for left PVC ablation using a new module entitled “Pattern Matching Filter” (PMF) (CARTO 3V6, Biosense Webster, Irvine, California) combined with the PentaRay—a multi-electrode mapping catheter. To illustrate the advantages of this approach, 4 activation maps were obtained from the same patient: 1) a map obtained with PMF and the PentaRay catheter (Figure 1A); 2) a map performed with PMF and a SmartTouch (ST; Biosense Webster) ablation catheter (Figure 1B); 3) a conventional activation map with a PentaRay catheter (Figure 1C); and 4) a conventional mapping with a ST-segment ablation catheter (Figure 1D). Each map was acquired in up to 12 min.

The PMF allows a correlation between the pre-defined morphology and every real-time beat. Essentially, we defined the PVC as the template morphology to be mapped and a minimum threshold correlation $\geq 98\%$. As visualized in Figure 1, combining PMF with the PentaRay catheter allowed

the following: 1) a much more detailed activation map due to a higher number of local activation time points (547 points in total), which is particularly important when patients present with few PVC; 2) an accurate activation map, with less signal averaging and higher bipolar voltage, due to the 1-mm electrode size and closer interelectrode spacing of the PentaRay; and 3) a reliable map, because only PVC with at $\geq 98\%$ correlation with the template morphology are collected, avoiding the acquisition of activation points from mechanical PVC or PVC arising from close locations. One radiofrequency shot allowed complete elimination of the PVC.

To our knowledge, this is the first report of the combined use of PMF software with the PentaRay catheter. It is reasonable to expect lower radiofrequency applications and shorter procedure times with this approach. Further studies may help clarify whether this approach associates with higher success rates.

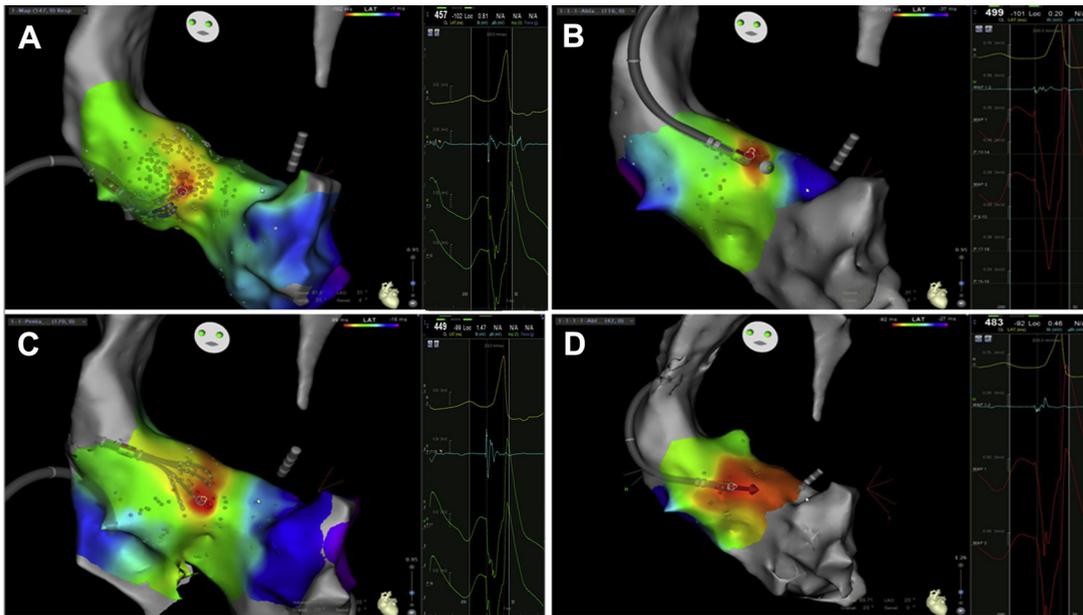
ADDRESS FOR CORRESPONDENCE: Dr. Pedro A. Sousa, Pacing and Electrophysiology Department, Centro Hospitalar e Universitário de Coimbra, Morada: Praceta Prof Mota Pinto, 3000-075 Coimbra, Portugal. E-mail: peter@chuc.min-saude.pt.

From the ^aPacing and Electrophysiology Department, Centro Hospitalar e Universitário de Coimbra, Coimbra, Portugal; ^bCardiology Department, Hospital da Luz Arrábida, Vila Nova de Gaia, Portugal; ^cCardiology Department, Centro Hospitalar Vila Nova de Gaia, Vila Nova de Gaia, Portugal; ^dRoyal Papworth Hospital National Health Service Foundation Trust, Cambridge, United Kingdom; and the ^eFaculdade de Medicina da Universidade de Coimbra, Coimbra, Portugal. The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

All authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the *JACC: Clinical Electrophysiology* [author instructions page](#).

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FIGURE 1 PVC Activation Map With the Earliest Activation Point in the Left Coronary Cusp



To facilitate the comparative analysis, all activations maps were performed in 12 min and figures are projected in left anterior oblique view with the bipolar and unipolar voltage amplitudes set similarly. **(A)** Activation map performed with the Pattern Matching Filter and the PentaRay mapping catheter. This high-density activation mapping included 547 points, resulting in a very detailed and accurate map. Also, bipolar endocardial electrograms had a higher voltage amplitude signal with shorter electrogram duration as compared with the bipolar electrograms acquired with the SmartTouch ablation catheter. **(B)** Activation map performed with the Pattern Matching Filter and SmartTouch ablation catheter. A total of 116 local activation time (LAT) points were collected, resulting in a less detailed map. Also, the bipolar electrogram is flat, longer, and fractionated and therefore potentially less accurate. **(C, D)** These maps were acquired without the new software. Points were acquired automatically with the Confidence software (Biosense Webster) and local activation annotation was based on the analysis of the bipolar signals and corresponding unipolar signals (WaveFront, Biosense Webster). However, because each point needs manual confirmation before validation and incorporation in the activation map, fewer points are acquired during the same amount of time: 170 points with the PentaRay catheter and 42 with the ST ablation catheter. PVC = premature ventricular contraction.

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