



EDITORIAL COMMENT

Ablation of ventricular arrhythmic substrate: When the whole is more than the sum of its parts



Ablação do substrato arritmico ventricular: quando o todo é mais do que a soma das suas partes

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Ablation of ventricular tachycardia (VT) is just one example in interventional electrophysiology in which treatment has shifted from focal ablation of the tachycardia exit point or circuit to wider ablation of the arrhythmic substrate which underlies the origin of the arrhythmia. Other examples of substrate ablation are known. I am specifically referring to the ablation of atrial fibrillation or atypical atrial flutter. Haissaguerre and colleagues began by ablating arrhythmogenic foci within the pulmonary veins, but, given the increased risk of complications associated with this strategy (such as pulmonary vein stenosis), they moved from this approach to the segmental isolation of the pulmonary veins. This subsequently gave rise to antral ablation, which eliminates an important substrate that can trigger and allow the perpetuation of atrial fibrillation.^{1–3}

In a similar fashion, ablation of the VT substrate destroys tissue that may be responsible for the appearance of potentially fatal arrhythmias in patients with significant left ventricular systolic dysfunction who do not tolerate the induction of such arrhythmias in the electrophysiology laboratory. Following studies by Arenal and colleagues on

the identification and characterization of late ventricular potentials (local abnormal ventricular activity [LAVA]) which are seen in channels that enable reentry to occur, it became possible to treat a large number of patients who would otherwise be at high risk of death.⁴ The advent of high-density three-dimensional mapping and multipolar catheters facilitated the creation of detailed maps of the scar tissue, its edges and LAVAs which constitute the arrhythmic substrate to be ablated.⁵

In this issue of the *Journal*, Mário Oliveira and colleagues⁶ provide follow-up data on 20 patients from their tertiary center with ischemic or non-ischemic dilated cardiomyopathy, left ventricular systolic dysfunction and implanted cardioverter-defibrillators (ICDs) that had been implanted for the primary prevention of sudden death. All patients underwent radiofrequency ablation due to recurrent ICD therapies refractory to antiarrhythmic drugs or arrhythmic storms. The authors described the methods used to achieve their long-term goal of freedom from ventricular arrhythmias and ICD therapies. They treated a group of patients at high risk of cardiovascular events and complications during and after the procedure, which highlights the need for careful planning to reduce procedure time and to maintain hemodynamic stability in sinus rhythm. Therefore, substrate

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ablation was the preferred technique rather than VT induction with activation mapping.

In this setting, cardiac magnetic resonance imaging (MRI) is valuable.⁷ This exam provides useful information on scar extent and location, and potentially the presence of narrow channels within scar tissue. It helps determine the most appropriate approach for each patient: endocardial ablation only, epi-endocardial or epicardial. The number of patients who underwent cardiac MRI in the present study was small, as the exam is not always easy in patients with ICDs. However, although image quality may be reduced, it is often possible to perform cardiac MRI in ICD patients and this option should be considered.⁸ In our practice we usually request cardiac MRI prior to ICD implantation, particularly in patients with non-ischemic cardiomyopathy, in the expectation that this information could be useful in the future.

The authors used the PentaRay multipolar catheter in all cases to create a detailed map of the left ventricle with careful delineation of scar tissue. They further performed extensive ablation of all areas showing fractionated, double, prolonged, delayed, pre-systolic or low-voltage potentials. This differs from the approach used by other operators who ablate areas showing post-QRS potentials only. Nevertheless, more extensive substrate ablation is also used by some operators, who start by defining scar channels and arrhythmia exit points with pacemapping and apply more localized ablation, but then move to wider ablation. This may be justified by the concern that non-ablated (bystander) circuits may trigger future arrhythmias requiring further ablation procedures.

The authors performed mapping in sinus rhythm, but other operators may choose to do this in right ventricular pacing (either with a quadripolar catheter or via the ICD), and some may even perform more than one map with pacing from multiple sites to allow for more than one wavefront. Using premature ventricular stimulation from certain areas of the map may further enable better characterization of LAVA tissue.⁹ Mapping while pacing from the ventricle may also be quicker, which is advantageous in these cases.

In this setting, programmed ventricular stimulation at the beginning of the procedure may be less useful, as it will not significantly impact on the main strategy, which is the elimination of the arrhythmic substrate.¹⁰ In fact, it will lengthen the procedure and may even lead to hemodynamic decompensation when fast VT is induced requiring electrical cardioversion. While mapping the substrate with a multipolar catheter, spontaneous induction of the clinical VT is occasionally seen, enabling activation mapping.

The good results seen in this study show that VT substrate ablation is the way forward. Although the ICD may reduce the risk of sudden death, ICD shocks have a detrimental effect on these patients, increasing their overall mortality risk.¹¹ This may sound paradoxical, but in both the SCD-HeFT and MADIT-II trials, patients receiving ICD shocks were at

higher risk of death than ICD patients with no ICD therapies, but also higher than patients in the control groups who received pharmacological treatment only. Our duty is therefore to prevent such therapies and prolong the life of these patients with ventricular arrhythmic substrate ablation, perhaps at an earlier stage.

Conflicts of interest

The author has no conflicts of interest to declare.

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