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Substrate-based strategies for paroxysmal refractory VT catheter ablation: Coming of age?

Técnicas basadas en el sustrato para la ablación con catéter de la TV paroxística refractaria: ¿están lo suficientemente maduras?

Dear Editor,

Patients with ischemic and nonischemic cardiomyopathy are at increased risk of sudden death due to ventricular arrhythmias. Implantable cardioverter-defibrillators (ICD) have lowered this mortality rate; however, ICD shocks impact quality of life.¹ Medical treatment with the combination of betablockers with amiodarone reduces ventricular tachycardia (VT) inducibility² and ICD shocks,³ but long-term side effects are unfortunately relatively frequent. In patients with sustained paroxysmal refractory VT, catheter ablation has been proven to reduce VT recurrence by directly addressing the arrhythmogenic substrate, albeit at a procedure-dependent risk; nevertheless, ablation has no effect on mortality.⁴

Catheter mapping of recurrent VT relies on arrhythmia induction and identification of ablation targets (isthmuses and exit sites) by entrainment and activation criteria during ongoing VT. Ideally, it provides an endpoint to the procedure in the case of non-inducibility of VT. However, this approach is somewhat difficult due to some potential limitations: non-inducibility of VT, VT pleomorphism due to complex substrates, hemodynamic compromise. Therefore, these limitations have driven the development of substrate-based mapping and new ablation strategies.

In patients with structural heart disease, ventricular scar represents the anatomical (and electrophysiological) basis for VT initiation and its maintenance. Abnormal local electrograms in sinus rhythm (SR) have been identified in border zones surrounding the scar. Surgical resection of subendocardial and/or epicardial reentry circuits was first attempted as an ablative method.

In the February 2013 issue of this Journal, Vergara et al. published a review of current substrate-based strategies for VT catheter ablation.⁵ They comprehensively describe several approaches to substrate ablation. The first two

methods reported, conceptually derived from surgical ablation, employ linear ablation lines to cross, encircle or link the scar and anatomical barriers. Arenal et al.⁶ elegantly identified channels of delayed conduction through the scar zone through a step-wise reduction in voltage thresholds, targeting these areas with relatively few applications. However, the absence of a clear end point can limit its efficacy. The same technique was used by Berrueto et al.⁷ in a series of arrhythmogenic right ventricular dysplasia patients. Alternatively, Vergara et al.⁸ focused on complete mapping and ablation of late potentials (LPs), combined with pace-mapping in SR and, when possible, entrainment maneuvers. LPs ablation was associated with low VT recurrence rates and was a good predictor of arrhythmia-free survival. Thus, the authors postulated that "complete" LPs elimination is superior to non-inducibility of VT, given its ability to simultaneously address multiple circuits.

In spite of their promising results, several limitations remain. The population of these studies is heterogeneous as to VT induction and hemodynamic stability, thereby providing a possible bias. While the procedural endpoint has mostly been substrate-based, Soejima et al.⁹ found that non-identification of an isthmus was associated with recurrence. Also, different bipolar voltage cut-offs were used. Lastly, the ablation strategies have not been directly compared.

Despite these limitations, the current review by Vergara et al. suggests that substrate mapping and ablation strategies could be a valuable addition to the field of chronic recurrent VT catheter ablation, hopefully translating into a better clinical benefit for our patients.

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