CT-imaging vs. high-density mapping in ischemic cardiomyopathy VT ablation: in whom do we trust?

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Ablation of ventricular tachycardia (VT) has emerged an effective therapy in patients with ischemic heart disease. Electroanatomical mapping is currently considered the gold standard in terms of VT ablation (1). Bipolar voltage mapping is the standard tool to characterize substrate with commonly used cut-off values of 0.5 to 1.5 mV to discriminate between dense scar and intermediate border zones (1,2,3). Nevertheless, several limitations arise when bipolar voltage mapping is utilized. Cut-off values for electroanatomical mapping were derived from studies with small patient populations and based on experiences with single-tip catheters with limited resolution (2,3). Mapping is mainly performed at endocardial ventricular sites without implementation of information from epicardial or intramural myocardium. Additionally, automatic annotation algorithms are limited in discrimination between ventricular far-field and near-field signals especially in case of local signals with low amplitudes. Preprocedural radiologic imaging may add valuable information to electroanatomical mapping. Current society guidelines recommend the use of preprocedural cardiac magnetic resonance imaging (MRI) for planning and intraprocedural guidance of VT ablation (1). Recently, cardiac computed tomography (CT) has been investigated as a novel imaging modality using a commercially available software (InHEART, Pessac, France). The software may enable preprocedural assessment of myocardial fibrosis as well as derivation of information on myocardial wall thickness. These data can be used to guide catheter ablation and to detect specific VT mechanisms. Wall thinning has been demonstrated to be a powerful predictor of localizations of abnormal electrical substrate in patients with ischemic cardiomyopathy (4). Additionally,

ablation sites derived from conventional electrophysiological criteria such as pace mapping or entrainment mapping were commonly found adjacent to areas of wall thinning (5).

In this issue, Ene et al. report 40 patients with previous myocardial infarction who underwent preprocedural CT imaging and consecutive image integration into 3D-electroanatomical mapping using a commercially available software (6). The study sought to analyze currently used voltage cut-off values in its relation to myocardial thinning estimated by CT imaging. The authors found that current cut-off values of 0.5 mV may overestimate the myocardial substrate if merely electroanatomical mapping is used. In detail, thin myocardial layers were detected more precisely when a lower cut-off value of 0.2 mV was used. Ene et al. analyzed patients undergoing 3D-electroanatomic mapping with multielectrode catheters enabling high-density mapping. Differences between bipolar mapping using single-tip catheters and multipolar catheters can be assumed. Multipolar catheters are widely available today and should be seen as gold standard for complex atrial and ventricular procedures. Again, this study confirms to individualize patient treatment- also in VT ablation. Each patient is different, each scar is different and imaging certainly can help to identify areas of interest and plan lesion deployment preprocedurally.

The main findings of the study are in line with previous studies which found arrhythmogenic substrate even in thin myocardial layers with low voltage, which would have been denoted as dense scar when usual cut-off values would have been applied (7). Interestingly, VT channels were exclusively found in regions of myocardial thinning of 1-4 mm (7).

The authors elegantly demonstrate the value of a comprehensive setup consisting of preprocedural CT imaging and high-density mapping to enable optimal characterization of the substrate. Based on the present results, ablation targets may be found in regions of 0.2 to 1.0 mV of bipolar voltage. The findings may be especially relevant in patients in whom VT is not inducible or hemodynamically unstable and detailed activation mapping to guide substrate-based ablation is not possible. Using the above-mentioned criteria derived from 3D-electroanatomical mapping and CT imaging, regions of interest may be identified even at sites with marked low voltage in which validity of electroanatomic mapping is generally limited. Furthermore, CT imaging has several distinct advantages over MRI in patients undergoing VT ablation. CT offers a higher spatial resolution compared to MRI and is widely available. Additionally, presence of implantable cardiac devices can be a contraindication for MRI imaging in distinct patients and may impair MRI quality. The current study by Ene et al. focused on the potentially most suitable patient cohort: post myocardial infarct patients. The impact of CT information in non-ischemic cardiomypathies is still limited- although some groups try to perform late-enhancement imaging using CT as an imaging modality as well. In this cohort, MRI will probably remain the method of choice to identify the arrhythmogenic substrate. Further studies need to evaluate the currently used cut-off values in other heart diseases such as non-ischemic cardiomyopathy or arrhythmogenic cardiomyopathy. However, contrast-enhanced computed tomography in ventricular tachycardia ablation is a promising tool for preprocedural substrate analysis.

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