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EDITORIAL COMMENT

Catheter Ablation of Ventricular Tachycardia in Nonischemic Cardiomyopathy

The Relevance of Pathology Subtype and Experience of Centers: The More the Better?*

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Catheter ablation of ventricular tachycardia (VT) has beneficial effects on arrhythmia recurrences, electrical storm, and rehospitalization in an ischemic cardiomyopathy (ICM) population, but data on ablation of nonischemic cardiomyopathy (NICM) etiology of structural VT is sparse. Reports are limited to a small group of highly experienced centers. Recent studies document a lower efficacy of VT ablation in NICM patients compared with in ICM patients, and recurrences are significantly more often in NICM patients (1–4). One of the reasons is that whereas the mechanism of VT in ICM appears well understood, the substrate and therefore also the mechanism of VT is more complex in NICM. So far, no study comparing outcome of NICM-VT ablation to other treatment modalities is available, and therefore ablation of VT in the general population of NICM is recommended in the guidelines as "may be considered" after failure of antiarrhythmic medication (usually amiodarone). In specialized centers, the NICM population approaches one-half of the patients undergoing ablation for structural VT, but ablation approaches, treatment strategies, and endpoints of interventional therapy remain widely heterogeneous. In addition, the group of NICM encompasses a heterogeneous group of cardiac pathologies, and further subdivision may be necessary for optimized treatment, but subdividing an already small group of patients may lead to inadequate power of subgroup analysis (2,3).

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In this issue of *JACC: Clinical Electrophysiology*, Vaseghi et al. (5) increase evidence on the efficacy of catheter ablation in different subsets of NICM pathologies gathered in a combined effort of the IVTCC (International Ventricular Tachycardia Ablation Center Collaborative) experience. It is the seventh publication by the IVTCC group and focuses on VT ablation in NICM. The overall group of 780 patients consisted of 6 different subsets of NICM pathologies including dilated cardiomyopathy (DICM) as the largest group in 518 patients, right ventricular cardiomyopathy (ARVC) in 100 patients, valvular CM and myocarditis in 50 patients each, hypertrophic CM in 35 patients, and sarcoidosis in 27 patients. Of note, although 12 of the most renowned and largest VT ablation expert centers have combined their experience on the largest so far published group of NICM-VT ablations, only a mean of 5.4 NICM-VT ablations per year per center were included, indicating the sparsity of experience. Twelve-month freedom from any ventricular arrhythmia during follow-up was 69% in the overall group being lower than the experience published by the IVTCC group on ICM (72%) (1).

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The study is in line with previous publications on NICM-VT ablation experience and overall results are comparable (freedom from VT recurrence achieved in 77% in a comparable mix of NICM patient subgroups) although it remains unclear how many previously published patients from different groups are included in the current IVTCC report (2,3). Outcome of VT ablation was worst in hypertrophic, valvular, and sarcoid subtypes. In addition to NICM- subtype, lower left ventricular ejection fraction, higher New York Heart Association functional class, and number of induced VT were predictors of VT recurrence. All these parameters indicate lower efficacy in a more severe left ventricular pathology. Three main aspects are covered that merit further discussion.

TECHNICAL AND PROCEDURAL ASPECTS OF VT ABLATION IN NICM

Efficacy of catheter ablation is related to the understanding of the underlying substrate and the potential to target scar tissue relevant to the VT mechanism. Therefore, differences in outcome depend on the strategy of mapping and ablating the underlying scar pathology. Different subtypes of NICM therefore need different approaches for effective VT treatment.

Details about the procedures are not documented in the report by Vaseghi et al. (5) but may include the need for high-density multi-microelectrode catheter mapping and a need for epicardial ablation as well as definition of endpoints such as effective late potential abolition and noninducibility testing. Whereas programmed ventricular stimulation to induce VT is limited by many aspects such as prior noninducibility, deferral of testing after ablation and variable reproducibility of programmed ventricular stimulation noninducibility of any VT has been shown to predict superior freedom from ventricular arrhythmia recurrences and mortality (6). Post-procedural noninvasive programmed ventricular stimulation as test for inducibility of VT days after ablation is also predictive of future recurrences (7) in ICM and NICM. Implementing noninvasive programmed stimulation into the strategy of NICM-VT ablation may help to identify patients in need of early redo procedures, to appropriately program implantable cardioverter-defibrillators, and to risk-stratify patients potentially for future need of implantable cardioverter-defibrillators.

Approximately 40% of the procedures included epicardial instrumentation without differences among the 6 different NICM subtypes. Epicardial ablation is performed to increase efficacy of VT ablation and combined endocardial and epicardial approaches have been linked to higher long-term efficacy specifically in ARVC patients and in nonseptal DICM scar substrates. In the study by Vaseghi et al. (5) epicardial ablation was not related to higher efficacy or better outcome. It remains unclear whether any of the subtypes may benefit from primary endocardial-epicardial approaches.

Differentiation of NICM subsets by location and topography of scar tissue (e.g., septal vs. nonseptal topology) may be a helpful additional discriminator to predict outcome and help to understand some of the reasons for lower ablation efficacy in subsets of NICM. In addition, definition of NICM subsets is not exclusive and overlaps and misdiagnosis may occur. Pre-ablation imaging (mostly cardiac magnetic resonance tomography) has been helpful in documenting scar areas and target sites for VT ablation and is specifically relevant in NICM as a helpful tool for pre-ablation procedural planning including need for epicardial access and focusing on specific target areas. Performing cardiac magnetic resonance tomography should be considered in all patients with NICM before undergoing implantable cardioverter-defibrillator implantation.

High-density micro-multielectrode mapping has helped to identify low voltage and electrogram abnormalities to a much higher extent than limited ablation catheter maps can. Especially for mapping less-well known scar VT and characterizing the underlying scar pathology, high-density mapping of the underlying electrophysiological substrate is of particular value. Whereas these catheters have been implemented in clinical practice, the effect on outcome of VT ablation remains unclear.

Optimum mapping strategies, need for epicardial access, ablation settings, and strategy, as well as endpoints and evaluation have to be defined to individualize mapping and ablation strategies within an overall standardized approach for subgroups of patients. Vaseghi et al. (5) clarify that understanding the underlying pathology is key to effective VT ablation and specifically valvular, hypertrophic, and sarcoid CM are at increased risk for failure to long-term VT suppression.

An interesting point of the study by Vaseghi et al. (5) is that despite the complexity of the procedures, NICM-VT complications are low (7%) and not higher than in ICM-VT ablations. Ablation of NICM-VT should be performed primarily by high expertise operators at dedicated, specialized centers, creating high efficacy and superior safety profiles. To further increase efficacy and understanding of the underlying pathology NICM-VT, ablation procedures may be focused in some highly experienced VT ablation centers.