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VT ablation in the real-world: Inducibility matters

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Ablation of ventricular tachycardia (VT) has evolved around the concept of ischemic scar, providing the substrate for ventricular macro-reentry. These early concepts enabled the development of classical mapping techniques and ablation strategies, as exemplified by the seminal work of the late Marc Josephson [1]. Today, electrophysiologists are confronted with more heterogeneous etiologies, resulting in more challenging substrates.

Improvements in interventional treatment and clinical management of structural heart disease (SHD) have led to significantly reduced mortality in this cohort, with an increasing number of patients living to experience ventricular arrhythmias (VA). While implantable defibrillators (ICDs) offer effective protection in patients at high risk or with prior manifestation of VA, shock delivery constitutes a relevant emotional burden and is associated with increased hospitalization and mortality. Catheter ablation has been shown to reduce VT recurrence in those patients, even in severely progressed heart failure [2].

Consequently, the clinical need for interventional treatment of VA in patients with SHD is increasing, inspiring the development of new mapping and ablation strategies. Owing to the heterogeneity of ventricular substrate in SHD, classical activation or entrainment mapping of VTs is often impeded by complex circuits, with inhomogeneous distribution of substrate involving the intramural and epicardial space [3]. Another obstacle is hemodynamic intolerance of VA, due to short reentry cycles and poor ventricular function, with some authors advocating the use of mechanical circulatory support in those cases, this introduces additional procedural complexity and possible complications and should be only utilized in carefully selected cases. Therefore, the systematical mapping of ventricular substrate with identification of scar areas and abnormal local signals during sinus rhythm has become a procedural key element [4].

This development is fostered by the advent of multipolar catheters with high sensitivity – low noise electrode designs (e.g. HD Grid, Abbott; Orion, Boston Scientific; Pentaray, Biosense Webster). Those catheters, in combination with corresponding proprietary mapping software (AutoMap, Abbott; Rhythmia, Boston Scientific; Confidense, Biosense Webster), enable the expeditious creation of high-density maps, capturing even minute local signals [5]. This allows for an improved differentiation of scar areas, as well as abnormal local signals and identification of possibly relevant routes of conduction in ventricular macro- or localized reentries [6].

Addressing those targets by catheter ablation is the logical procedural consequence and might follow different concepts (e.g. dechanneling, scar homogenization, late potential ablation), with the endpoint being the elimination of all pre-specified targets. This can be time-consuming and often results in the extensive application of ablation energy. While the achievement of this endpoint is associated with reduced recurrence of VT, it is sometimes hard to judge. Owing to the sometimes complex, three-dimensional structure of the substrate, this also might necessitate epicardial mapping and ablation or, in case of intramural substrate, alternative approaches like bipolar ablation or coronary ethanol injection [7]. Therefore, programmed ventricular stimulation (PVS) testing for inducibility of VT after ablation is another way of assessing procedural success, which can be applied more reliably [8].

In their manuscript published in this issue of the *International Journal of Cardiology* Breitenstein et al. present a multi-center VT ablation registry of remarkable size, encompassing 566 patients with SHD from 5 English tertiary electrophysiology centers, with a follow-up period of 5 years. Patients undergoing VT ablation were included on an all comers base, when there was LVEF <45%, established diagnosis of any cardiomyopathy or presence of ventricular late gadolinium enhancement. There was a high prevalence of patients with non-ischemic etiology of SHD (44%, n = 193), setting this study apart from many other VT registries which mostly were restricted to patients with ischemic heart disease. Mean LVEF was 35 ± 15% and 78% (n = 444) of the patients already had an ICT or CRT-D implanted. Also, 55% (n = 312) patients received anti-arrhythmic medication (mostly amiodarone, 43%, n = 244) prior to ablation, further underscoring the severity of disease in this collective. This is reflected by the high number of patients requiring unscheduled or emergency ablation (59%, n = 333), due to acute manifestation of VT.

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While was no pre-specified modus of mapping and ablation in this study, the procedural specifics reported by the authors suggest a high interventional standard: The most utilized route of ventricular access was antegrade via transseptal puncture 67% (n = 379), additional or stand-alone retrograde access was chosen in 48% (n = 273) of cases. Epicardial access was obtained at a low threshold in 9% (n = 52) ablation procedures. Use of contact force catheters was reported in 33% (n = 189) cases. Programmed ventricular stimulation to test for VT inducibility after ablation was not mandatory, but was undertaken in 70% (n = 398) of the procedures. In the majority of cases substrate mapping and ablation, with or without additional activation mapping and ablation of isthmus or exit regions, was performed (74%, n = 420), while the remaining procedures were limited to the latter.

Acute procedural complications occurred infrequently and were mainly driven by access site hematoma (1.8%, n = 10) and pericardial tamponade (3.5%, n = 20), other major adverse events (e.g. stroke, death < 24 h) had an incidence of well below 1%. The authors observed an increase in mortality during the first 30 days following ablation (2.7%, n = 15), which was entirely driven by patients undergoing unscheduled ablation for acute VT. This emphasizes the need for meticulous post interventional care in this critical group of patients. Also, it supports the concept of early and aggressive interventional treatment of VT in SHD, as has been proposed by other recent publications [9].

The primary endpoint of freedom from death or VA was met in 61% of patients at one year and 44% at the end of follow up, all-cause mortality during follow up was 22% (n = 127). This is in line with other recently published observations [10]. In their multivariate analysis the authors identified age, dilated cardiomyopathy, use of contact force catheters, center at which the ablation was performed and inducibility of VT after ablation, as predictors of long-term survival. Interestingly, while the mode of mapping and ablation (substrate, activation, combination) apparently had no relevant impact on the outcome, non-inducibility after ablation was a strong indicator of survival (82 vs. 71% at 5 y, p = 0.002).

In their analysis, the authors demonstrate a success rate which is in line with previously published trials and confirm the importance of non-inducibility as procedural endpoint. Also, they did not observe a relevant prognostic impact concerning the use of different mapping strategies (substrate vs. activation). Yet, how this might be affected by the advent of more sensitive and sophisticated high-density mapping techniques, has to be corroborated in further clinical studies. Considering the high morbidity of this collective and high number of emergency procedures, the authors report favorably low complication rates in a representative clinical setting, encouraging the early referral of SHD patients with VA for ablation treatment in specialized centers.

Conflict of interest

The authors report no relationships that could be construed as a conflict of interest.

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