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Editorial

# Very high-power short-duration ablation for treatment of premature ventricular contractions: Truth or Dare?

The implementation of high-power short-duration (HPSD) for radiofrequency pulmonary vein isolation has increasingly become the new standard catheter ablation technique to treat patients with symptomatic atrial fibrillation [1]. In vitro and in vivo models have shown that HPSD creates transmural lesions that are often broader and shallower, and with proper settings, result in fewer steam pops which make such an approach effective and safe [2,3]. The QDOT MICRO® (Biosense Webster) catheter provides a new modality of very HPSD (vHPSD) by allowing temperature-controlled ablation with 90 W using specialized temperature monitoring and modified open irrigation cooling port. This catheter has been proven to be safe and effective in the setting of radiofrequency pulmonary vein isolation [4,5]. However, even in the thin-walled left atrium, the power and duration sometimes needs to be modified to reach deeper lesions at the thicker anatomical positions around the pulmonary veins such as the anterior ridge of the left upper pulmonary vein or the carina between the pulmonary veins [4]. Until now, the use of vHPSD has been primarily used for pulmonary vein isolation in the treatment of atrial fibrillation.

In the current issue of this Journal, Heeger et al. describe their experience in using vHPSD applied by the temperature-controlled and irrigated QDOT MICRO® (Biosense Webster) catheter to treat patient with idiopathic premature ventricular contractions (PVCs) [6]. PVCs arising from the outflow tract are the most common subtype of idiopathic ventricular arrhythmia and more than 70–80% of those originate from the right ventricular outflow tract (RVOT) and are often located in the distal septal and anterior surface of the RVOT, while a free wall focus has only been reported in 20–30% of patients undergoing radiofrequency ablation [7,8]. Although PVCs from the RVOT show a benign course, catheter ablation for symptom control is a safe treatment option with a high acute success and a low risk of complications. In a previous review article, Calco et al. showed that the acute success rate for ablation of RVOT PVCs ranges from 75 to 100% with a low recurrence rate of 5%, with the lowest rate in PVCs having an intramural or epicardial origin [9]. Precise localization for ablation is ideally guided by activation mapping of the earliest activation using irrigated or non-irrigated tip ablation catheters and if an irrigated tip catheter is used, power should be carefully titrated (up to 35 W) with a maximum temperature of 45 °C. During mapping a local ventricular activation by the distal electrode of a 3.5 mm mapping catheter, a unipolar QS pattern preceding the onset of the surface QRS complex by 10–60 ms is considered to be an optimal ablation site. However, Man et al. showed that the absence of a Q-wave alone in local unipolar electrogram may also be recorded at up to 11 mm from the earliest activation and site of origin [10]. van Huls et al. initiated a novel approach of activation mapping for RVOT PVCs that combines local bipolar activation time with the recording of reversed polarity from the bipolar electrograms recorded from the distal and mid electrode pairs of the mapping [11]. They showed that the presence of reversed polarity has a high predictive value for successful ablation sites [11]. In "The Fast-and-furious PVC study", Heeger et al. are the first to use the signals of the microelectrodes of the QDOT MICRO® catheter next to high density electroanatomic activation mapping to define the ablation target area. Each microelectrode of the QDOT MICRO® (Biosense Webster) has a surface area of 0.167 $mm^2$ embedded at the distal circumference of this 3.5-mm open-irrigated catheter. Interestingly, enough within the area of earliest activation, electrograms recorded with microelectrodes showed significantly earlier activation. These findings are in line with the study of Leshem et al., where they used the QDOT MICRO® (Biosense Webster) for a high-resolution map of the ventricular scar of pigs and they showed that the identification of surviving subendocardium by the microelectrodes was consistent with cardiac magnetic resonance and histology while the microelectrodes also improved distinction between near-field and far-field electrograms [12]. However, as already mentioned above, the success rate of radio frequency ablation of idiopathic PVCs is already high with conventional techniques, and the additional benefit of adding high-resolution mapping by microelectrodes remains uncertain and requires further investigation. Nevertheless, the QDOT MICRO® (Biosense Webster) combines the advantage of a high-resolution mapping and radiofrequency ablation with an open-irrigated, tissue contact–sensing technology and its ability to perform temperature-controlled ablation with very high very power (90 W), which may be beneficial not just for pulmonary vein isolation, but also for the treatment of RVOT PVCs. Transmural lesions that are broader and shallower can be effective and safer for the thin free wall of the RVOT. Cardiac tamponade due to steam pop seems to be less during vHPSD. The steam pop risks increase with power and time but delivering higher energy for a shorter time at one spot overcomes the challenges of catheter stability and tissue oedema, which makes the zone of reversible injury smaller and allows lesion formation within a shorter time [13]. Additionally, complications due to damage of structures in close anatomical proximity to the site of ablation in the RVOT can be limited by using vHPSD. The distance from the leftward posterior aspect of the RVOT to the left main coronary artery is $4.1 \pm 1.9$ mm, therefore vHPSD ablation along the posterior RVOT may be a safer approach not to damage the left main coronary artery. Despite all the theoretical advantage of vHPSD, this new modality should be still used with caution when structures like the His bundle are in a close proximity to the ablation site as broader lesions could resulted in irreversible consecutive heart block. Of note, as also suggested correctly by

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Heeger et al., the use of vHPSD may be effective in treating PVCs originating from the thinner walled RVOT, while more conventional power should be used to target PVCs originating from the thicker walled left ventricular outflow tract and the septal areas of the RVOT. Finally, although vHPSD ablation of RVOT PVCs by using the QDOT MICRO® (Biosense Webster) catheter reduced the required ablation points and shortened the radiofrequency delivery time, the total procedure time was not impacted suggesting, that in contrast to pulmonary vein isolation, the duration of ablation time is not leading for the procedure time of RVOT PVC ablation procedures. Nevertheless, the identification of the precise ablation site with the use of high-resolution mapping of this novel catheter can be very beneficial.

In summary, the existing data shows the feasibility, safety, and efficacy of the novel QDOT MICRO® (Biosense Webster) catheter, which combines high-resolution mapping and temperature-controlled vHPSD radiofrequency ablation for the treatment of RVOT PVCs. Although the high-resolution mapping and vHPSD resulted in a shorter radiofrequency ablation time and may minimize the risk of complications while maintaining maximal procedural efficacy, further studies are required to test for long term outcomes.

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