EP CASE REPORT

Single very high-power short-duration application for successful ablation of frequent premature ventricular contractions

Christian-H. Heeger [1,2]*, Sorin S. Popescu[1], Julia Vogler[1], Charlotte Eitel[1], Karl-Heinz Kuck[1,3], and Roland R. Tilz[1,2]

[1]Division of Electrophysiology, Medical Clinic II (Department of Cardiology, Angiology and Intensive Care Medicine), University Heart Center Lübeck, University Hospital Schleswig-Holstein, Ratzeburger Allee 160, D-23538 Lübeck, Germany; [2]German Center for Cardiovascular Research (DZHK), Partner Site, Lübeck, Germany; and [3]LANS Cardio, Stephansplatz 5, 20354 Hamburg, Germany

* Corresponding author. Tel: +49 451 500 75293; fax: +49 451 500 44585. *E-mail address*: christian.heeger@gmx.net

Very high-power short-duration (vHP-SD) catheter ablation (CA) has been recently introduced and was found to be safe, effective, and fast for pulmonary vein isolation.[1] This strategy aims to create shallower but wider lesions in a very short time by simultaneously reducing conductive heating and increasing resistive heating of tissue. Additionally, collateral damage might be reduced.[2] Although vHP-SD concepts have been evaluated for atrial procedures, ablation within the ventricles has not been reported in human up to date.

A 39-year-old male patient with frequent premature ventricular contractions (PVC, 32% PVC burden in 24 h Holter ECG) presented with dyspnoea and palpitations. There were no further diseases reported. The patients refused to take antiarrhythmic drug therapy and no previous invasive treatment of PVC has been performed. The 12-lead ECG showed a bigeminus of monomorphic PVC with an inferior axis and an RS transition in V2/V3, highly suggestive for a right ventricular outflow tract (RVOT) origin. After informed consent, the patient was scheduled for an ablation procedure.

At the beginning of the procedure, the patient presented the clinical PVC. The procedure was performed under deep sedation using fentanyl and propofol. Three right femoral vein punctures (3×8F) and one femoral artery puncture (1×6F) were

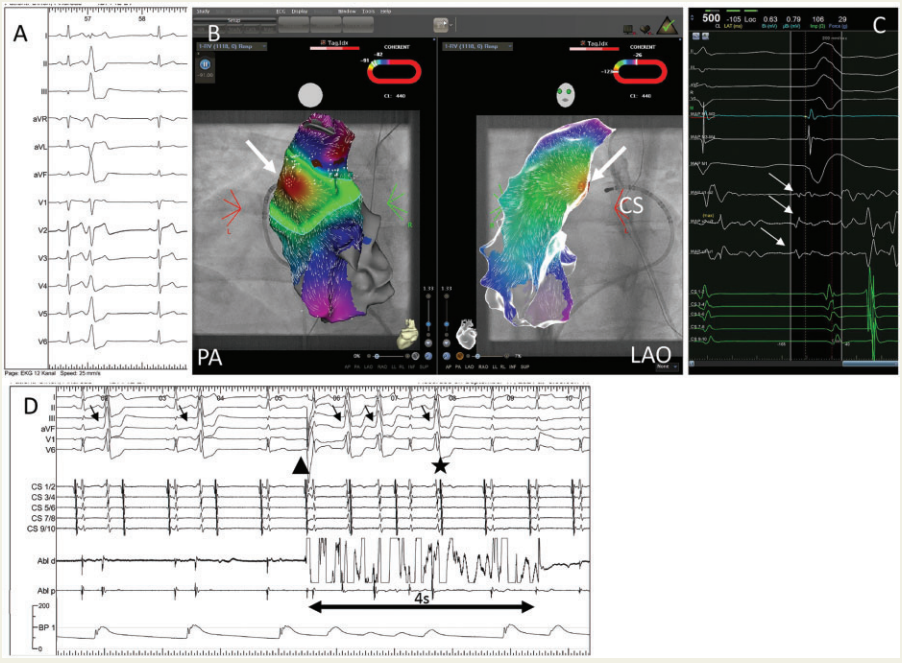

Figure 1 (*A*) Baseline ECG showing premature ventricular complex (2nd beat) with inferior axis and R/S transition in V3. Speed 25 mm/s. (*B*) Electroanatomic map of the right ventricle utilizing CARTO 3, V7 (Biosense Webster). Left-side PA view, right-side LAO view. CS, coronary sinus catheter placed distal in the coronary sinus; PA, postero-anterior view; LAO, left anterior oblique view. White arrows = Location of earliest activation with very high-power short-duration application (red-white dot). (*C*) Surface and intracardiac electrocardiograms with the ablation catheter at the location of earliest activation of the PVC within RVOT. Please note the early potentials on the micro-electrodes (pointed out by white arrows) preceding the signal on the distal and proximal electrodes. MAP M1–M2 = distal electrodes on the map catheter. MAP M3–M4 = proximal electrodes on the map catheter. MAP u1–u2, MAP u2–u3, MAP u1–u3 = micro-electrodes. Speed 200 mm/s. (*D*) Surface and intracardiac electrocardiograms with the ablation catheter at the location of termination PVC within RVOT. The total radiofrequency ablation time was 4 s. CS, coronary sinus catheter placed distal in the coronary sinus; Spiral, Spiral mapping catheter placed inside the left atrial appendage; Abl d, distal electrodes on the map catheter; Abl p, proximal electrodes on the map catheter; A, atrium; V, ventricle. Black triangle = start ablation. Black star = stop application. Arrowhead-line = radiofrequency delivery. Black arrows = PVC. Speed 100 mm/s.

performed guided by ultrasound. Three-dimensional electroanatomic reconstruction (CARTO 3 V7; Biosense Webster, Diamond Bar, USA) of the right ventricle (RV) was performed via multielectrode fast anatomical mapping with a linear decapolar mapping catheter (DECANAV; Biosense Webster). Pattern matching of PVC and sinus rhythm beats were simultaneously performed utilizing local activation time (LAT) hybrid (CONFIDENSE module, Biosense Webster). A total of 1119 mapping points were acquired utilizing a LAT map with a window of interest of −165 ms/+40 ms and lead V1–V6 (centre of energy) as reference. The COHERENT module (Biosense Webster) was utilized for LAT calculation. The earliest activation was detected in the antero-lateral part of the RVOT. For more precise mapping and ablation, the novel QDOT Micro ablation catheter (Biosense Webster) was utilized. This catheter provides three microelectrodes and six thermocouples at its tip. It allows for vHP-SD ablation (QMODE+, 90 W/4 s) with the opportunity to switch to conventional temperature-controlled QMODE ablation.[1] In QMODE+ power is adapted to adjust the target temperature (60°C) measured by the thermocouples.[2] Within the antero-lateral RVOT the micro-electrodes detected early fragmented potentials which were not detectable on the standard bipolar electrodes. At the earliest activation point (−40 ms to onset QRS) a single vHP-SD application of 4 s was applied resulting in an immediate loss of PVC (Figure 1). After a waiting period of 30 min and awakening of the patient, no PVC occurred. The total procedure time (skin to skin), including the waiting time of 30 min, was 68 min. The fluoroscopy time was 2.2 min. No periprocedural complications occurred. Antiarrhythmic drug therapy was stopped. On short-term follow-up (30 days), no recurrence of PVC occurred.

Here, we presented the first-in-man vHP-SD ablation within the RV and treatment of frequent PVC originating from RVOT by ablation with a single vHP-SD QMODE+ application.

Despite the fact that vHP-SD ablation has been associated with the smallest lesion size when compared to standard ablation, this strategy was successful in this case of PVC originating from the thin-walled RVOT.[3] The combination of micro-electrodes and vHP-SD ablation seems to offer ideal options for PVC ablation procedures.

Conflict of interest: C.H.H. received travel grants and research grants by Boston Scientific, Biosense Webster and Cardiofocus and Speaker's Honoraria from Boston Scientific, Biosense Webster and Cardiofocus. R.R.T. is a consultant of Boston Scientific, Biotronik and Biosense Webster and received Speaker's Honoraria from Biosense Webster, Medtronic, Boston Scientific and Abbot Medical. K.H.K. reports grants and personal fees from Abbott Vascular, Medtronic, Biosense Webster outside submitted work. All other authors have no relevant disclosures.

References

1. Tilz RR, Sano M, Vogler J, Fink T, Saraei R, Sciacca V et alet al Very high-power short-duration temperature-controlled ablation versus conventional power-controlled ablation for pulmonary vein isolation: the fast and furious - AF study. *IJC Hear Vasc* 2021;**35**:100847.
2. Reddy VY, Grimaldi M, Potter TD, Vijgen JM, Bulava A, Duytschaever MF et alet al Pulmonary vein isolation with very high power, short duration, temperature-controlled lesions the QDOT-FAST trial. *JACC Clin Electrophysiol* 2019;**5**:778–786.
3. Nakagawa H, Ikeda A, Sharma T, Govari A, Ashton J, Maffre J et alet al Comparison of in vivo tissue temperature profile and lesion geometry for radiofrequency ablation with high power-short duration and moderate power-moderate duration: effects of thermal latency and contact force on lesion formation. *Circulation Arrhythmia Electrophysiol* 2021;**14**:e009899.