EP CASE REPORT

Steam pop visualized in live intracardiac echocardiography during ablation of the anterolateral papillary muscle

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A 52-year-old male without structural heart disease was admitted due to frequent premature ventricular contractions (PVC) and incessant runs of non-sustained monomorphic ventricular tachycardia. The morphology of the PVC suggested an origin in the anterolateral papillary muscle (*Figure 1A*). Treadmill stress test, echocardiography, cardiac magnetic resonance imaging, and coronary angiography were normal. Premature ventricular contractions burden was 35%. Prior to admission, patient underwent unsuccessful catheter ablation on the anterolateral papillary muscle area, both retroaortic and transseptal approaches, without success.

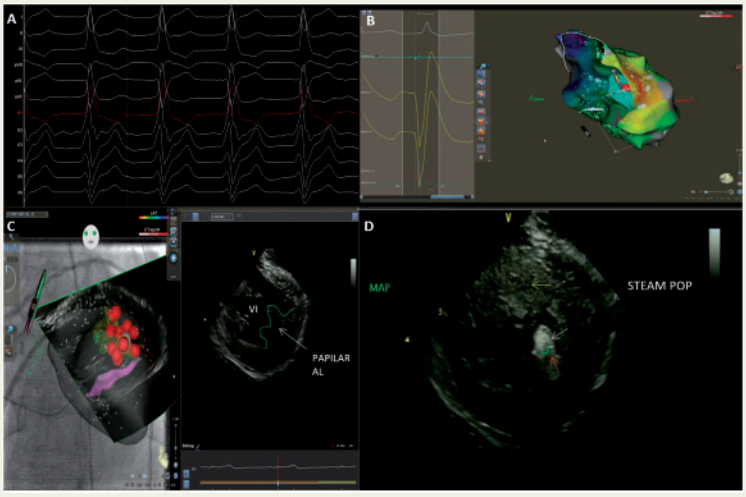

Figure 1 (*A*) Basal rhythm with suggestive morphology of origin in the anterolateral papillary muscle. (*B*) Electroanatomic map with 3D integration of the papillary muscle where the area of greatest precocity and QS unipolar morphology is observed. (*C*) Intracardiac ultrasound anatomy of the muscle and its integration in the map. Circumferential ablation applications are shown. (*D*) Steam pop during one of the applications in the muscle. The white arrow indicates the appearance of the lesion in the muscle. The yellow arrow shows the increase in bubbles formation due to the explosion. The red arrow points to the tip of the ablation catheter at that time.

A new study guided by CARTO-SOUND® was carried out, reconstructing the three-dimensional anatomy of the left ventricle and the papillary muscles and integrating them into the electroanatomic map of the navigator. A transseptal approach was done without complications and then, a multipolar catheter (Pentaray®) was used in order to create an activation map of the left ventricle (*Figure 1B*). The area of greatest precocity was located in the most basal area just between the two muscle heads. No Purkinje potentials were found in that zone. The application of radiofrequency (40–50 W) in that area suppressed just slightly the density of the PVC. Due to the low success of previous interventions, it was decided to perform a circumferential ablation of the papillary muscle[1] (*Figure 1C*). During the applications given, the appearance of a non-audible steam pop was observed (Supplementary material online, *Video*), clearly visualized in intracardiac echocardiography (ICE) (*Figure 1D*). Radiofrequency application was stopped immediately. Live monitoring by ICE ruled out pericardial effusion or other complications during a waiting period. After the appearance of the steam pop, PVC disappeared completely without appearing again and even after administering isoprenaline. The 3-month follow-up demonstrated a baseline PVC density of 0.7% without complications related to ablation.

Ablation of PVC/VT originating from the papillary muscles is a challenging procedure because they are intracavitary structures with anatomical variations and high mobility, which leads to difficulty in catheter stability.[2] Although several radiofrequency applications were done, it was not until the appearance of the steam pop, that definitive success was achieved, perhaps due in part to the unpredictable effect of the injury generated by the steam explosion. In addition, as our case demonstrates, due to the need to apply high power, the use of ICE allows continuous (online) monitoring at all times the occurrence of complications related to ablation.[3]

Supplementary material is available at *Europace* online.

Conflict of interest: none declared.

References

1. Wo HT, Liao FC, Chang PC, Chou CC, Wen MS, Wang CC *et al*. Circumferential ablation at the base of the left ventricular papillary muscles: a highly effective approach for ventricular arrhythmias originating from the papillary muscles. *Int J Cardiol* 2016;**220**:876–82.
2. Peichl P, Baran J, Wichterle D, Čihák R, Skála T, Aldhoon B *et al*. The tip of the muscle is a dominant location of ventricular ectopy originating from papillary muscles in the left ventricle. *J Cardiovasc Electrophysiol* 2018;**29**:64–70.
3. Sato A, Yagihara N, Hasegawa Y, Otuki S, Iijima K, Izumi D *et al*. A steam pop detected by intracardiac echocardiography during catheter ablation of the left ventricular papillary muscle. *Int Heart J* 2019;**60**:199–203.