JACC: CASE REPORTS VOL. 3, NO. 16, 2021

CASE REPORT

ADVANCED

CLINICAL CASE

LV Pseudoaneurysm With Concomitant Mitral Valve Defect After LV Summit Ablation

A Rare Late Complication

Angeliki Darma, MD, Livio Bertagnolli, MD, Federica Torri, MD, Ingo Paetsch, MD, Cosima Jahnke, MD, Borislav Dinov, MD, Gerhard Hindricks, MD, Arash Arya, MD

ABSTRACT

A 25-year-old male patient with highly symptomatic, monomorphic, premature ventricular contractions presented for repeat ablation after failed endocardial ablation. Three weeks after excessive endocardial and epicardial ablation on the left ventricular summit, the patient was admitted again with tamponade following a pseudoaneurysm on the ablation site. (**Level of Difficulty: Advanced.**) (J Am Coll Cardiol Case Rep 2021;3:1756–1759) © 2021 The Authors. Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

HISTORY OF PRESENTATION

A 25-year-old male patient with highly symptomatic, monomorphic premature ventricular contractions (PVCs burden: 45,000/day) (**Figure 1A**) presented to our institution (Heart Centre of Leipzig, Leipzig, Germany) for ablation.

PAST MEDICAL HISTORY

Previous medical antiarrhythmic treatment failed. The patient underwent a failed endocardial radiofrequency ablation procedure 2 years earlier.

LEARNING OBJECTIVES

- To identify the key steps of complex ablation on the LV summit.
- To understand the possible early and late complication risks of aggressive multisite ablation.

INVESTIGATIONS

Echocardiography and cardiac magnetic resonance (CMR) showed no structural heart disease.

MANAGEMENT

Left ventricular (LV) electroanatomic activation mapping of the PVC was performed using the CARTO-3 system (Biosense-Webster) endocardially after transseptal puncture (Agilis transseptal needle, St. Jude Medical) and epicardially through the coronary sinus (CS). During endocardial mapping, anticoagulation was administered using intravenous heparin (activated clotting time target >250 seconds). The endocardial mapping of the anterolateral mitral anulus through transseptal puncture and the retrograde approach in the LV outflow tract showed moderate early activation (−14 ms and −5 ms, respectively). The earliest activation was seen at the

From the Department of Cardiac Electrophysiology, Heart Centre of Leipzig, Leipzig, Germany.
The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the Author Center.

Manuscript received May 4, 2021; revised manuscript received August 5, 2021, accepted August 12, 2021.

ISSN 2666-0849 https://doi.org/10.1016/j.jaccas.2021.08.008

distal recordings in the CS (−26 ms) (Figures 1B and 1C, Supplemental Figure 1). The operators decided on a combined ablation approach: endocardial ablation with an irrigated-tip catheter and 45 to 50 W (F-type Thermocool, Biosense-Webster, maximum 42 °C) and epicardial ablation through the CS with 20 to 25 W. To perform the ablation in the CS, the impedance upper cutoff limit was disabled, and the impedance changes were monitored closely. However, the ablation at this site needed to be constantly interrupted because of an unacceptably steep impedance increase. The PVCs were terminated only for a few minutes, so the operators proceeded to subxiphoid puncture (Agilis epi, Abbott) to gain better epicardial access. In the epicardial activation map, the site of earliest activation was confirmed in the area of the LV summit (−35 ms) (Figure 1D). Coronary angiography excluded close proximity to the coronary vessels, so an extensive ablation with 40 to 45 W was performed at this site until the PVCs were eliminated. No prominent impedance drop or audible steam pop occurred during the ablation. The echocardiogram on the following day showed no signs of pericardial effusion.

FOLLOW-UP

Three weeks later, the patient was admitted again with angina, progressive dyspnea, and syncope. The electrocardiogram showed ST-segment elevation in leads II, aVF, and V_4 to V_6. The echocardiogram revealed a large pericardial effusion causing tamponade, a pseudoaneurysm of the lateral anterobasal wall of the left ventricle (20 × 18 mm), and a relevant defect of the mitral valve (Figures 2A and 2B, Video 1). The patient underwent emergency pericardiocentesis, where 500 mL hemorrhagic pericardial effusion was drained, and injury of the coronary arteries was excluded. Given these findings, perforation of the pseudoaneurysm was suspected, and the patient was referred to the surgical department for emergency operation.

During on-pump cardiac surgery by median sternotomy, a defect underneath the aortic valve between the left coronary cusp and the A1 segment of the mitral valve was detected and closed using a xenologic pericardial patch (Figures 3A and 3B). Additionally, the mitral valve was reconstructed using a pericardial patch. One day after surgery, the

ABBREVIATIONS AND ACRONYMS

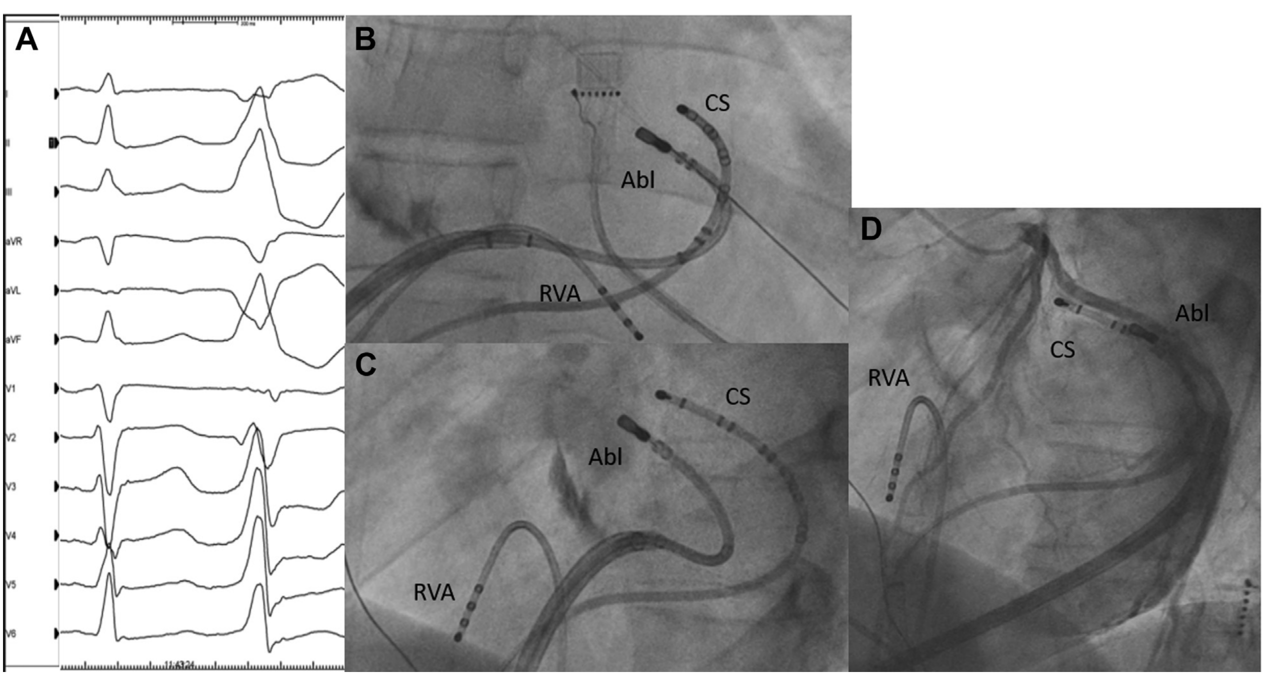
CMR = cardiovascular magnetic resonance

CS = coronary sinus

LV = left ventricular

PVC = premature ventricular contraction

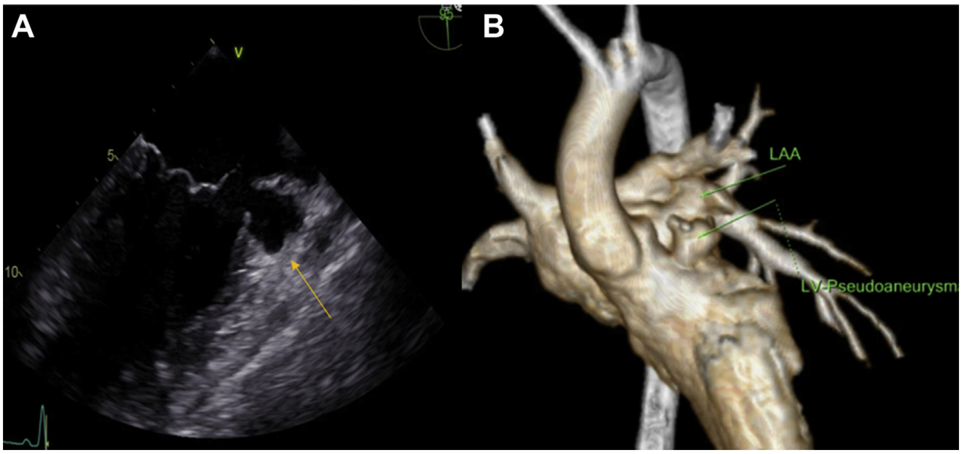
FIGURE 1 Premature Ventricular Contractions and Ablation Sites



(A) Body surface 12-lead electrocardiogram of clinical premature ventricular contraction. **(B and C)** Right and left anterior oblique projections of the endocardial ablation site and through the coronary sinus (CS). **(D)** Left anterior oblique projection of the successful epicardial ablation site. Abl = tip of the ablation catheter; RVA = catheter in the right ventricular apex.

JACC: CASE REPORTS, VOL. 3, NO. 16, 2021
NOVEMBER 17, 2021:1756-1759

FIGURE 2 Imaging of the Pseudoaneurysm on the Mitral Annulus



(A) Transesophageal echocardiographic long-axis view of mitral valve and the pseudoaneurysm on the lateral mitral annulus **(arrow). (B)** Cardiac magnetic resonance reconstruction of the left atrium, left ventricle (LV), and aorta that reveals the site and size of the pseudoaneurysm (20 × 18 mm). LAA = left atrial appendage.

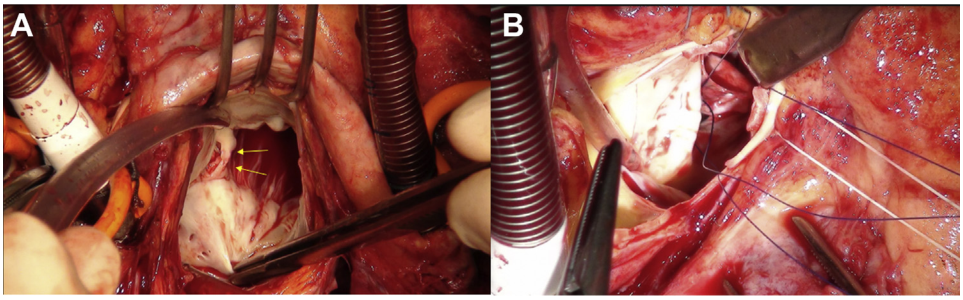
patient could be transferred from the intensive care unit to the ward. The postoperative CMR scan revealed a small perfusion jet in the pseudoaneurysm. Because of the very small size of the jet, the operators decided to perform a control examination in 3 months.

The control CMR scan revealed a persistent shunt to the pseudoaneurysm with a concomitant grade I to II aortic valve insufficiency grade, so reoperation was indicated. The pseudoaneurysm was again closed using a pericardial patch, and an aortic reconstruction with tightening was performed. The patient's further hospital stay was uneventful, and the patient was discharged on the ninth postoperative day.

DISCUSSION

The risk of cardiac perforation during ablation in the ventricle is relatively small compared with the risk in atrial procedures, ranging from 0.4% to 1.0% (1,2). Ventricular pseudoaneurysms after VT ablation are very rare, especially when no structural heart disease is present (3). The most probable mechanism for this complication was an inaudible steam pop during the ablation. Although steam pops occur during ablation in 1.5% of the lesions, just 2% of these steam pops cause perforation of the ventricle (4). However, surgical repair in these cases is often necessary.

FIGURE 3 Mitral Valve Defect and Repair



(A) After anterior left ventriculotomy, a defect on the A1 segment of the mitral valve is revealed **(arrows). (B)** The defect is covered by an epicardial patch.

CONCLUSIONS

Effective ablation on the LV summit remains challenging because multisite ablation has been associated with worse long-term outcome (5). Alternative ablation techniques, such as simultaneous bipolar ablation from endocardial and epicardial or alcohol ablation, can overcome the limitations and risks of high-power and prolonged classic radiofrequency applications and could improve the outcome in such demanding cases (6).

FUNDING SUPPORT AND AUTHOR DISCLOSURES

The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

ADDRESS FOR CORRESPONDENCE: Dr Angeliki Darma, Department of Electrophysiology, Heart Center University Leipzig, Struempellstrasse 39, 04289 Leipzig, Germany. E-mail: angeliki_darma@hotmail.com OR angeliki.darma@helios-gesundheit.de.

REFERENCES

1. Tokuda M, Kojodjojo P, Epstein LM, et al. Outcomes of cardiac perforation complicating catheter ablation of ventricular arrhythmias. *Circ Arrhythm Electrophysiol*. 2011;4:660–666.

2. Stevenson WG, Wilber DJ, Natale A, et al. Multicenter Thermocool VT Ablation Trial Investigators. Irrigated radiofrequency catheter ablation guided by electroanatomic mapping for recurrent ventricular tachycardia after myocardial infarction: the Multicenter Thermocool Ventricular Tachycardia Ablation trial. *Circulation*. 2008;118:2773–2782.

3. Koch KE, Raiszadeh F, Godelman A, Palma E, Forman R. Giant left ventricular pseudoaneurysm and myocardial dissection as a complication of multiple ventricular tachycardia ablations in a patient with cardiac sarcoidosis. *Clin Med Insights Cardiol*. 2015;9:105–107.

4. Seiler J, Roberts-Thomson KC, Raymond JM, et al. Steam pops during irrigated radiofrequency ablation: feasibility of impedance monitoring for prevention. *Heart Rhythm*. 2008;5:1411–1416.

5. Chung FP, Lin CY, Shirai Y, et al. Outcomes of catheter ablation of ventricular arrhythmia originating from the left ventricular summit: a multicenter study. *Heart Rhythm*. 2020;17(7):1077–1083.

6. Futyma P, Sander J, Ciąpała K, et al. Bipolar radiofrequency ablation delivered from coronary veins and adjacent endocardium for treatment of refractory left ventricular summit arrhythmias. *J Interv Card Electrophysiol*. 2020;58(3):307–313.

KEY WORDS ablation, complication, ventricular tachycardia

APPENDIX For a supplemental video and a figure, please see the online version of this paper.