

Catheter ablation of ventricular tachycardia in a patient with a left endoventricular patch: a case report

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Abstract

Surgical resection of a left ventricular aneurysm in the setting of ventricular tachycardia (VT) was first described by Couch in 1959. The technique was further developed by Dor *et al.* with performance of endocardectomy and complete myocardial revascularization. Despite an attempt to remove the arrhythmogenic substrate, however, recurrences of VT remain an issue. Furthermore, the surgical technique used entails limited access to the potential area of interest with regard to a percutaneous catheter ablation procedure. We present a case report of a 65-year-old man who was referred for catheter ablation due to recurrent episodes of VT. He had undergone a coronary artery bypass surgery 8 years previously. During surgery, resection of an apical thrombus and reconstruction of an apical aneurysm with a Fontan stitch and an endoventricular patch were performed. The mapping and ablation procedure was aided by intracardiac echocardiography. During mapping, the ablation catheter was noticed to enter the apical pouch from the inferoseptal border of the endoventricular patch. During the ablation procedure, one of the VTs was successfully ablated in the inferior aspect of the apical pouch. This report confirms that the arrhythmogenic substrate underneath an endoventricular patch may be accessed in some instances and that these complex catheter ablation procedures may benefit from the use of intracardiac echocardiography.

Keywords

Ventricular tachycardia • Intracardiac echocardiogram • Endoventricular patch • Case report

Learning points

- Access to an arrhythmogenic substrate beneath an endoventricular patch may be feasible through the guidance of intracardiac echocardiogram.
- In this case, no resection of the subendocardium was performed during original surgery leaving a substrate for arrhythmia. The potential harm of this is highlighted by the fact that different VTs were ablated in the border zone of the endoventricular patch.

Introduction

Left ventricular aneurysmectomy with the aim to treat ventricular tachycardia (VT) through surgery was described more than 50 years ago.¹ Dor *et al.*² later developed a technique with non-guided subtotal endocardectomy and left ventricular (LV) reconstruction in patients with ischaemic heart disease and VT. In brief, the surgical technique included coronary revascularization, resection of the endocardial scar, cryotherapy of the border lesion, and reconstruction of the LV with an autologous or synthetic patch. Despite an attempt to remove the arrhythmogenic substrate, however, recurrences of VT remain an issue.³ Furthermore, percutaneous access to the myocardium beneath the endovascular patch might prove impossible, requiring a surgical approach.

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We present a case report of a patient with recurrent VT after surgery with an endoventricular patch, highlighting the possibility of endovascular access to the myocardium beneath the patch through guidance from intracardiac echocardiography.

Case presentation

A 65-year-old male patient was referred for catheter ablation due to recurrent episodes of VT causing repetitive ICD shocks. The patient had ischaemic heart disease and had undergone a coronary artery bypass surgery 8 years previously. Cardiac magnetic resonance examination prior to surgery confirmed an LV apical

aneurysm with non-viable myocardium and a thrombus formation. Left ventricular ejection fraction was calculated to be 25%. During surgery, resection of an apical thrombus and reconstruction of an apical aneurysm with a Fontan stitch and an endoventricular patch were performed. No resection of the subendocardium was carried out.

Pre-procedural echocardiogram revealed an LVEF of 25%. Doppler measurements and contrast-enhanced images showed a connection between the LV and the apical pouch.

The CARTO-3 system (Biosense Webster Inc., Diamond Bar, CA, USA) was used to guide the mapping and ablation procedure. High-density endocardial bipolar LV mapping was performed during sinus rhythm with a multielectrode catheter (Pentaray[®], Biosense Webster) and an open irrigated-tip catheter of size 3.5 mm with contact force sensor technology (ThermoCool SmartTouch[®], Biosense Webster). The three-dimensional electroanatomical mapping was aided by CartoSound[®] intracardiac echocardiography (Biosense Webster). Mapping revealed a relatively large dense apical scar, corresponding to the endoventricular patch, with a patchy scar in the basal portion of the LV (*Figure 1*). During mapping, the catheter tip (3.5 mm) was noticed to enter the pouch from the inferoseptal border of the patch (*Figure 2*).

At baseline and throughout the mapping procedure, five VTs with different morphologies were initiated, all but one requiring cardioversion due to haemodynamic collapse. Four of these VTs were ablated in proximity to the endoventricular patch, using pace mapping in combination with activation and entrainment mapping when feasible (haemodynamically tolerated VT). Interestingly, for one of the VTs, where pace mapping was employed to assess the exit, successful ablation was performed in the inferior aspect of the apical pouch, beneath the endoventricular patch (*Figure 3*).

At the end of the procedure, no VT was inducible with up to three extra stimuli from the right ventricular and LV apex. The patient has remained free of VT at 12 months of follow-up.

Timeline

Time	Events
2008 (February)	Silent myocardial infarction, secondary heart failure
2008 (April)	Follow-up (F/U). New York Heart Association (NYHA) III, echocardiogram with left ventricular ejection fraction (LVEF) 25%
2008 (November)	Coronary bypass+'DOR Surgery'
2009 (April)	F/U. NYHA II. Moderately depressed LVEF. Primary prophylactic implantable cardiac defibrillator (ICD)
2014 (November)	Ventricular fibrillation, ICD shock
2015 (February)	Non-sustained VT
2015 (November)	Non-sustained VT
2015 (December)	Sustained, monomorphic VT with ICD shock
2016 (March)	Catheter ablation procedure
2017 (March)	Uneventful F/U

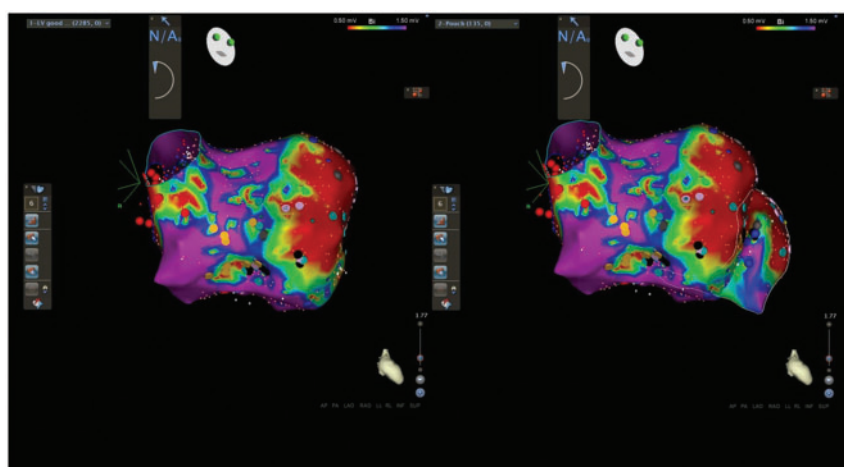


Figure 1 Electroanatomical mapping. The three-dimensional bipolar voltage of the left ventricle alone (left) and the added apical pouch (right). Image size 9×5 cm.

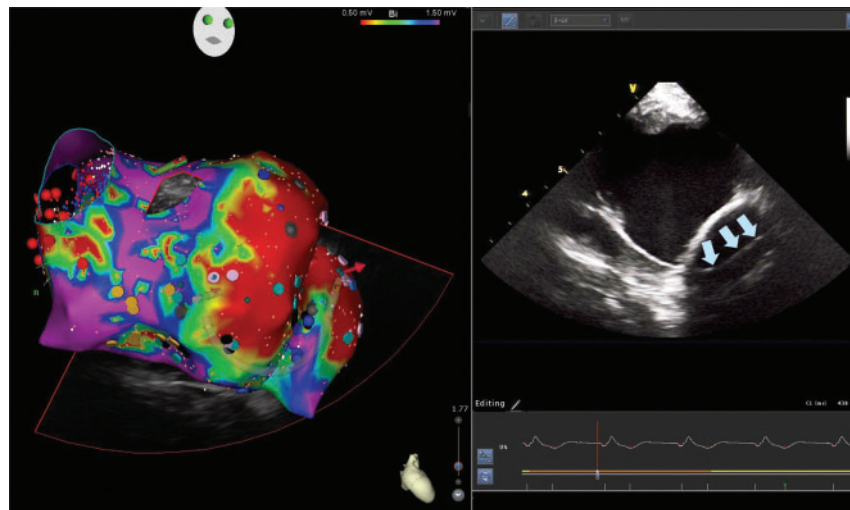


Figure 2 Anatomical reconstruction with three-dimensional mapping system and intracardiac echocardiogram. Left: the three-dimensional reconstruction of the LV and the apical aneurysmal pouch. Right: the real-time CartoSound® intracardiac echocardiographic image showing the tip of the catheter inserted into the aneurysmal pouch (ablation catheter indicated by blue arrows). Image size 14×8 cm.

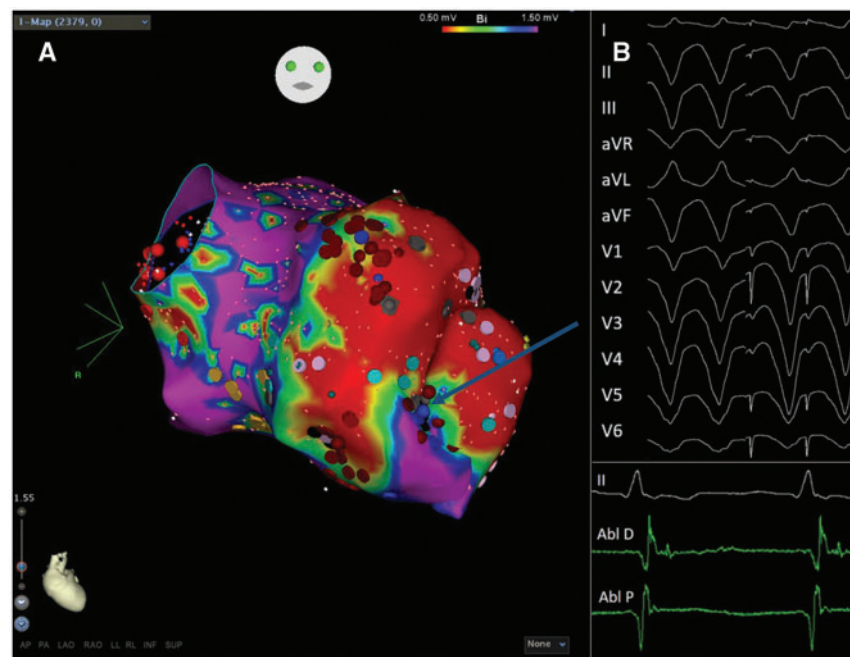


Figure 3 Electroanatomical mapping with ablation lesion set (A). (B) The 12-lead ECG showing the VT originating beneath the endoventricular patch (left) and pace map (right) from the successful ablation point (indicated by blue arrow in A) is presented. Below are the local electrograms from the ablation catheter in the successful ablation point. Image size 9×7 cm.

Discussion

Surgical resection of an LV aneurysm in the setting of VT was first described by Couch¹ in 1959. The technique was further developed by Dor *et al.*² with performance of endocardectomy with or without cryotherapy in combination with complete myocardial revascularization.

There are few reported cases of VT ablation in patients undergoing LV reconstruction. In a publication from Wijnmaalen *et al.*,³ 12 of 416 patients referred for VT ablation had a history of surgical ventricular restoration. In that report, successful ablation sites were frequently located at the border of the surgical scars and patch materials. Notably, in this case report, no endocardectomy was performed during surgical

reconstruction, thus leaving an additional substrate for VT. In most cases, no access exists to the myocardium behind the endoventricular patch, limiting the ability to reach the arrhythmogenic substrate. In these cases, the only reasonable way to perform the ablation would be through a percutaneous epicardial access, an approach that might nevertheless be limited by pericardial adhesions. In this case, there was a connection between the LV cavity and the apical pouch. Notably, in addition to the VT originating from the apical pouch, our patient had three further VTs originating from the LV in proximity to the endoventricular patch.

Conclusion

This report confirms that the arrhythmogenic substrate underneath an endoventricular patch might be accessed in some instances and that these complex catheter ablation procedures might benefit from the use of intracardiac echocardiography.

Consent: The authors confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

Author Contributions: All authors were involved in compilation of data and manuscript preparation. L.K. and I.L. were the senior consultants involved in the catheter ablation procedure.

References

1. Couch OA Jr. Cardiac aneurysm with ventricular tachycardia and subsequent excision of aneurysm; case report. *Circulation* 1959;**20**:251–253.
2. Dor V, Sabatier M, Montiglio F, Rossi P, Toso A, Di Donato M. Results of non-guided subtotal endocardectomy associated with left ventricular reconstruction in patients with ischemic ventricular arrhythmias. *J Thorac Cardiovasc Surg* 1994;**107**:1301–1307; discussion 7–8.
3. Wijnmaalen AP, Roberts-Thomson KC, Steven D, Klautz RJM, Willems S, Schalijs MJ, Stevenson WG, Zeppenfeld K. Catheter ablation of ventricular tachycardia after left ventricular reconstructive surgery for ischemic cardiomyopathy. *Heart Rhythm* 2012;**9**:10–17.