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LETTER TO THE EDITORS

Transapical access for catheter ablation of left ventricular tachycardia in a patient with mechanical aortic and mitral valve prosthesis

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Sirs:

A 48-year-old man had received mechanical aortic and mitral valve replacement due to infective endocarditis in 1994. During a redo surgery, accidental occlusion of the left circumflex coronary artery with a large postero-lateral myocardial infarction occurred and he received an ICD in 2008. An additional epicardial left ventricular lead was implanted in 2011 during a third sternotomy for closure of a paravalvular mitral leak.

Since November 2012, the patient had received multiple ICD shocks for recurrent VT (Fig. 1a) and electrical storm despite treatment with amiodarone 400 mg/day (QTc 430 ms) and high-dose betablockers (bisoprolol 10 mg/day). A retrograde aortic and a transseptal route with transmitral access was contraindicated after mechanical aortic and mitral valve replacement. Epicardial access seemed impossible after three cardiac surgeries with presumed pericardial adhesions and epicardial LV lead placement. We therefore decided to access the left ventricle through a transapical approach.

Oral anticoagulation was stopped 2 days before the procedure and unfractionated heparin was used for periprocedural bridging as soon as the INR was less than 2.5. Heparin was stopped 2 h before the procedure and preprocedural INR was 1.4.

The procedure was performed in the electrophysiologic (EP) catheter laboratory under general anesthesia. Access to the LV apex was achieved through a left anterolateral minithoracotomy along the fifth intercostal space. Two pledgeted purse-string sutures were placed within the muscular tissue in the left ventricular apex region. After ventricular puncture and placement of a short guide wire, a short 8 F-sheath was placed in the left ventricle and a mapping and ablation catheter [4 mm Navistar® surround flow (SF) irrigated tip, Biosense-Webster, Diamond Bar, CA, USA] was introduced (Fig. 1b). Unfractionated heparin was then administered once as a bolus (7,000 U, 80 U/kg). Hemostasis was guaranteed by tightening the purse sutures around the catheter shaft. Three-dimensional (3D) electroanatomic voltage mapping set to standard values was performed (CARTO 3®, Biosense-Webster) to define the low voltage area and its borders as ablation targets [1, 2]. Voltage mapping revealed a large postero-lateral myocardial infarction involving the inferior region (Fig. 1c). Despite easily inducible and spontaneous occurrence of the clinical VT during the procedure an activation map defining the complete circuit could not be performed due to spontaneous acceleration with consecutive hemodynamic instability. Therefore, the whole border of the low voltage area, sites with 12/12 pacemap and Stimulus-QRS interval >40 ms, sites showing late potentials and fractionated electrograms inside the scar and the corridor between the mitral valve and the scar were targeted for ablation (power controlled modus, maximum power 50 W, irrigation rate 15 ml/min). In summary, an extensive ablation concept was used including pacemapping, encircling of the scar border zone, linear lesions and abolishment of late potentials to

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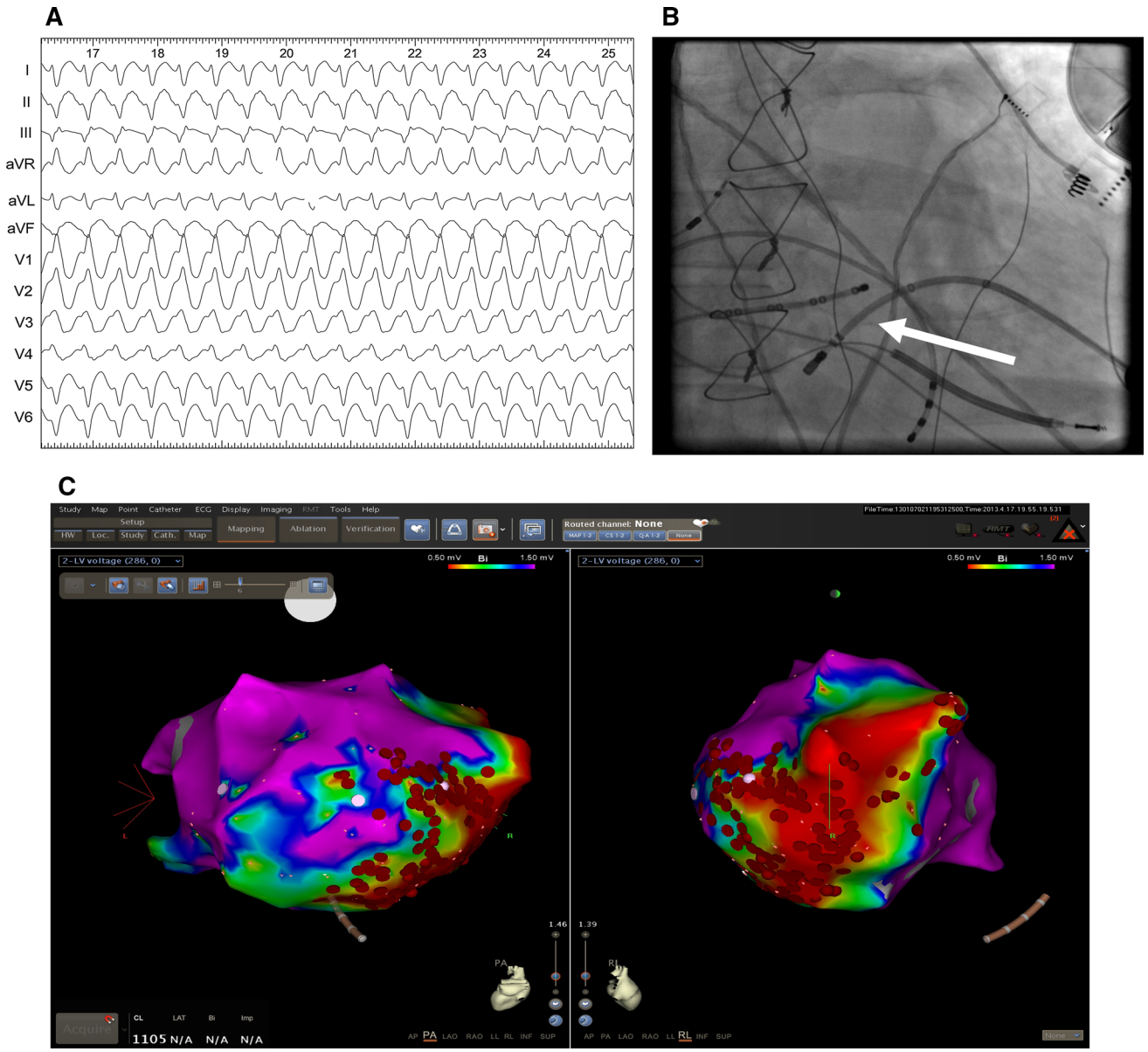

Fig. 1 **a** 12-lead ECG of the clinical VT: right bundle branch block, superior axis and rS QRS-morphology in lead I and a VL. **b** Fluoroscopic image in AP projection. The ablation catheter (*white arrow*) has been introduced via the transapical access. **c** Three-dimensional voltage-map in PA (*left*) and right lateral (*right side*). *Purple* indicates normal bipolar electrogram amplitude (>1.5 mV), *red* represents low voltage area with bipolar electrogram amplitude (<0.5 mV). *Dark red dots* represent ablation lesions

prevent the need for a redo procedure in this difficult setting.

After a procedure duration of 200 min, fluoroscopy time of 9 min and radiofrequency time of 35 min VT was non-inducible during right and left ventricular programmed stimulation. Programmed stimulation was performed with two different baseline cycle lengths (600 and 400 ms and up to three extrastimuli) from the right ventricular apex, right ventricular outflow tract and the apical region of the left ventricle. After withdrawal of the ablation catheter, closure of the transapical cannulation site was performed by the surgeon without complications by tightening the purse-string sutures. Intravenous unfractionated heparin was restarted 4 h after the procedure. Oral anticoagulation was started 2 days after the ablation procedure.

The patient had an uneventful post- interventional course and was discharged home after 5 days without any episode of ventricular tachycardia. During a 6-months follow-up, no further VT occurred as documented by the ICD, set to a monitor zone starting as low as 550 ms.

The transapical approach to the left ventricle has been used previously to quantify gradients across stenotic valves

and valve prostheses. Major complications occurred in 8 % of cases including hemopericardium, hemothorax, ventricular arrhythmias, pneumothorax, accidental puncture of the lung, bronchus, right ventricle and injury of coronary arteries [3].

More recently, the transapical access is used for transcatheter aortic valve replacement and for the repair of paravalvular leaking [4–7]. Especially in the setting of transcatheter aortic valve replacement, severe apical bleeding occurs in 7 % of patients and an apical pseudoaneurysm was seen in 2 % of patients. A new apical hypo- or akinesia was seen in 37 % of patients after transapical puncture [8]. However, delivery sheaths of 26 French are placed via the transapical puncture in these patients. Probably due to the smaller introducer size in our case compared to the transapical valve replacement access, we observed no bleeding complication and no wall motion abnormalities after the procedure. Hsieh et al. [9] describe two cases in which direct percutaneous LV puncture was used to treat scar related ventricular tachycardia. Hemorrhage into the left pleural space occurred in the first case requiring 20 min of CPR and urgent surgery. In this case, direct percutaneous puncture of the LV apex through the intercostal space was performed. In the second case, bleeding was prevented by using a minithoracotomy and purse-string ties to control bleeding from the LV puncture site as reported in our case. Brown et al. [4] report a series of cases in which transapical access was used for repair of paravalvular mitral valve leaks and in one patient for catheter ablation. Complications (hemothorax and injury of a coronary artery) occurred only in patients where a direct percutaneous puncture instead of a minithoracothomy was used. These cases demonstrate the necessity of close cooperation with cardiac surgeons and the use of a minithoracothomy and purse-string ties in this setting to avoid severe complications.

In our case, the ablation target at the posterior wall was easily accessible by the transapical approach. However, in patients with an apical substrate it might be difficult to reach all parts of the left ventricular apex. Recently Vaseghi et al. described a direct transventricular approach to the left ventricle [10]. Access to the left ventricle was gained by transseptal puncture of the interventricular septum via the internal jugular vein. Coronary angiography, angiography of the right ventricle with levophase for angiography of the left ventricle was required to delineate the muscular septal anatomy in relationship to the prosthetic valves and to identify areas without interference from a septal perforator artery. This technique is expected to have the advantage of a lower bleeding risk. However, unfavorable anatomical conditions might be a limitation of this approach.

This case shows that a transapical access is feasible and useful to reach ablation targets in the left ventricle when conventional access is not possible. The close cooperation between cardiac surgeons and electrophysiologists is the key to success in patients with complex preconditions and contraindicated percutaneous access.

Conflict of interest None.

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