Impella-assisted ventricular tachycardia ablation in patient with dilated cardiomyopathy and electrical storm

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A 49-year-old male with non-ischemic dilated cardiomyopathy was referred to the cardiology department on account of 10 high energy discharges for hemodynamically unstable ventricular tachycardia (VT) within the preceding 24 hours, which met the criteria of an electrical storm. Medical history included left bundle branch block, implantation of cardiac resynchronization therapy i.e., defibrillator for primary prevention of sudden cardiac death, and amiodarone-induced thyrotoxicosis. Transthoracic echocardiography on admission showed severely depressed left ventricular ejection fraction of 23%, apical akinesia, and severe left ventricular dilation (end-diastolic volume of 290 ml). Given the non-ischemic etiology and unsuccessful intravenous antiarrhythmic treatment with lidocaine, potential ablation was only feasible in the event of arrhythmia induction, but hemodynamic instability of the arrhythmia precluded prolonged electrophysiology study. Thus, following general sedation, a microaxial flow pump (Impella CP®, Abiomed, Germany) was inserted into the left ventricle (LV) using a 14F sheath *via* the left common femoral artery allowing for mechanical circulatory support of 3.1–3.4 l/min (Figure 1A). A Thermocool SmartTouch SF® catheter and a DecaNav® mapping electrode were introduced into the LV *via* a transseptal approach (Figure 1A). LV electroanatomical mapping with the CARTO 3® system visualized low voltage zone in the postero-lateral segments of LV (Figure 1B). Stimulation from the mapping electrode led to the induction of self-terminating VT with 290 ms cycle, consistent with previously recorded arrhythmia, while programmed ventricular stimulation led to further induction of different, incessant VT characterized by 260 ms cycle (Figure 1C–D). During the prolonged period of VT (c. 60 minutes), cardiac output was completely dependent on the Impella CP® pump, leading to disappearance of pulsatile flow and equalization of systolic and diastolic pressures (Figure 1E). Multiple radiofrequency energy applications (40 W, irrigation flow 15 ml/min, 45°) in this area led to termination of arrhythmia, which did not reappear until the end of the procedure, despite standard and aggressive programmed electrical stimulation. The arterial femoral access was sealed using a dual Perclose Proglide® device. As the arrhythmia further recurred, the patient was subsequently successfully treated with oral mexiletine. The patient was enrolled onto the heart transplant list in the transplantation center. Along with a dynamic implementation of a microaxial flow pump for the treatment of cardiogenic shock and high-risk percutaneous coronary interventions [1–2], the present case depicts the emerging technique of using a percutaneous LV assist device for cardiac output maintenance during electrophysiology procedures [3]. If not for the microaxial flow pump, VT ablation would not be possible on account of hemodynamic instability and the need for immediate electrical cardioversion.

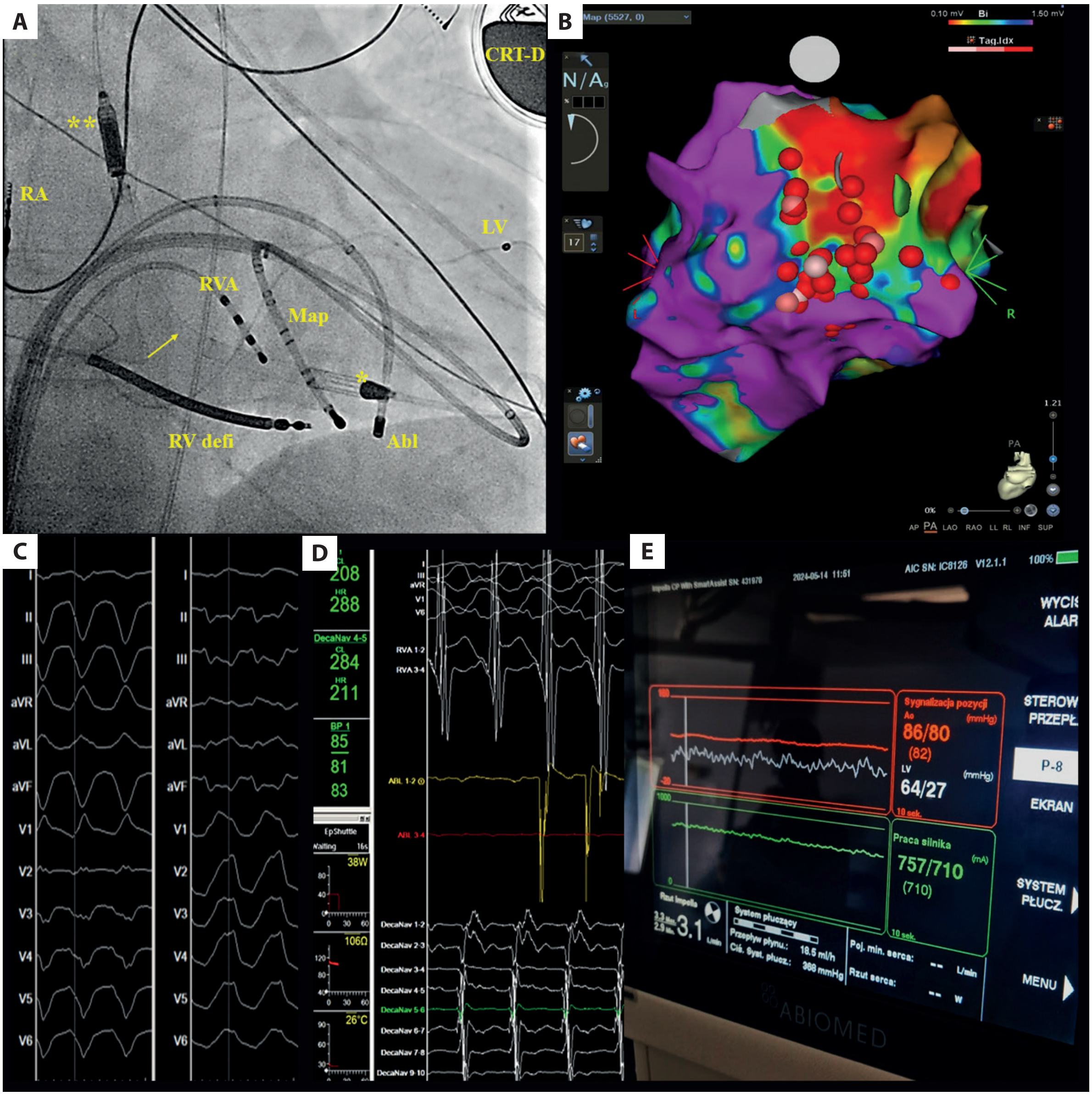

Figure 1. Impella-assisted ablation of structural substrate of ventricular tachycardia. **A.** Angiography image in AP view showing Impella 3.5 CP® device (arrow) with inflow in left ventricle (*) and outflow in ascending aorta (**) and DecaNav® mapping electrode (Map) and Thermocool SmartTouch SF® electrode (Abl) introduced to left ventricle *via* transseptal puncture. **B.** CARTO 3® electroanatomical map showing low voltage zone in postero-lateral segments of left ventricle, PA view. **C.** Surface 12-lead electrocardiogram showing two different morphologies of ventricular tachycardia. **D.** Provoked incessant ventricular tachycardia at rate of 211 bpm reflected by readings from intracardiac electrodes. **E.** Abiomed Impella CP® panel showing nearly equalized systolic and diastolic pressures (red line) reflecting cardiac output dependent on microaxial flow pump during prolonged tachycardia ablation, green line — Impella motor speed, cardiac output 3.1 l/min in bottom left corner

Abbreviations: CRT-D, cardiac resynchronization therapy – defibrillator; LV, left ventricular; RA, right atrial CRT electrode; RVA, right ventricular pacing electrode in right ventricle; RV defi, right ventricular CRT defibrillating electrode

Article information

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