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CLINICAL VIGNETTE

Diagnosis of persistent left superior vena cava during zero-fluoroscopy catheter ablation of three substrates of supraventricular arrhythmia

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We present a case of a 35-year-old Caucasian woman with a 12-year history of recurrent episodes of symptomatic narrow QRS tachycardia requiring intravenous drugs, following the use of several failed antiarrhythmic drugs and Valsalva manoeuvres. No other chronic disease was noted; however, resting electrocardiography showed an undefined axis. Despite normal transthoracic echocardiography, the patient reported chronic daily chest discomfort at rest, which she usually considered as anxiety. The patient was referred for zero-fluoroscopy (ZF) catheter ablation (CA). We used a minimally invasive ZF approach with two catheters (a 4-mm Gold tip non-irrigated catheter, Alcath, and a decapolar non-steerable diagnostic catheter, Viacath, Biotronik, Berlin, Germany) and a three-dimensional electroanatomical system (3D-EAM, Ensite Velocity, NavX, St. Jude Medical, St. Paul, MN, USA) [1–3] (Fig. 1A). The electrophysiological study (EPS) demonstrated typical dual atrioventricular (AV) node physiology with reproducible inducibility of three types of narrow complex tachycardias: typical slow-fast AV nodal re-entry tachycardia (AVNRT), atypical slow-slow AVNRT, and right-sided atrial tachycardia located in the inferior crista terminalis (Fig. 1B). The three substrates of supraventricular arrhythmia were sequentially ablated with a vasovagal response from the coronary sinus (CS) ostium. Postprocedural EPS with an isoproterenol infusion showed complete ablation of the slow pathway and non-inducibility of the supraventricular arrhythmias. The total procedure time was 70 min, with exclusion of fluoroscopy. None of the medical staff used lead aprons. The decapolar sinus could be easily moved into the distal CS, and further introduction of the catheter led to a suspicion of an atypical connection between the CS and left subclavian region. Persistent left superior vena cava (PLSVC) was suspected, and the diagnosis was confirmed by cardiovascular magnetic resonance (CMR) [4] (**Suppl. Fig. 1 — see journal website**). Postprocedural course was uneventful for over three months. The patient reported complete resolution of chest discomfort and dyspnoea not related to tachyarrhythmias. To our knowledge, this is the first case of a successful right-sided ZF CA of three types of supraventricular tachycardia in a patient with PLSVC. Moreover, for the first time the ZF approach enabled a diagnosis of a rare congenital structural heart disease that was confirmed by CMR imaging. Recent large case series and reviews have not yet reported such a case. Extensive application of the catheters in the CS ostium enabled the ablation of the AVNRT and neuromodification of cardiothoracic reflexes, leading to persistent, long-lasting resolution of chest discomfort and dyspnoea not related to palpitation. We suspect that neuromodulation of the neural network of the CS ostium was responsible for decreasing the symptoms that were not directly associated with palpitation. Several advanced modalities can prove that this anomaly has a substantial impact on CA or pacemaker implantation. However, use of the ZF approach for cardiac electrophysiology and 3D-EAM enables operators to diagnose heart diseases related to inter-chamber septal defects or atypical arterial or venous connections such as PLSVC. Even patients with rare and difficult anatomy can be treated effectively. Therefore, the ZF approach could be used by skilled operators as a standard approach, but irregular anatomy detected by 3D-EAM mapping should be confirmed with other imaging modalities. ***References — available on-line (see journal website)***

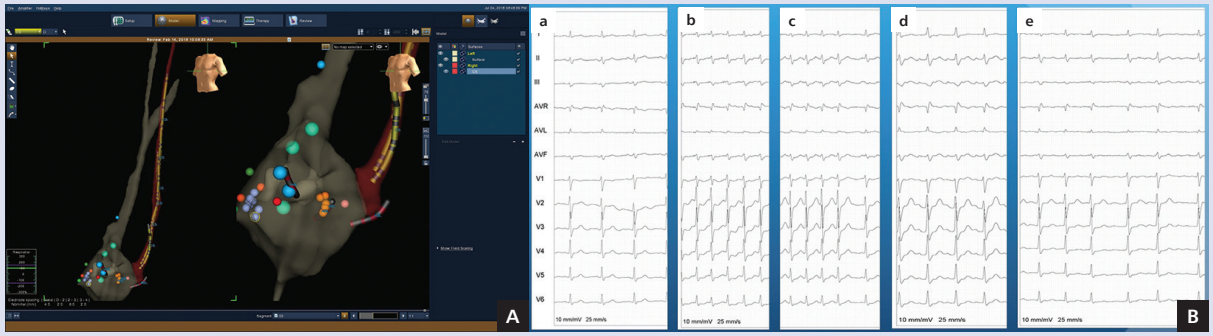

Figure 1. **A.** Simplified three-dimensional electroanatomical mapping, left anterior oblique 30° view. Right side: Blue dots represent right-sided His signal recordings; red and light purple dots represent effective ablation points in the triangle of Koch for slow-fast atrioventricular nodal re-entry tachycardia (AVNRT); green dots represent effective points within the coronary sinus (CS) ostium for slow-slow AVNRT; and purple dots represent effective points for lateral right-sided atrial tachycardia. The shadow (red) of the ablation catheter is located on the floor of the CS. The yellow shadow indicates the decapolar diagnostic catheter positioned within the CS. Left side: The same setting with a panoramic view of the decapolar catheter advanced through the proximal CS into the persistent left superior vena cava (PLSVC) with several yellow shadows. Reproducible mapping shows an atypical connection of the CS far from the heart and region of the left atrium; **B.** Atrial tachyarrhythmias in a patient with PLSVC: sinus rhythm (**a**), slow-fast AVNRT (**b**), slow-slow AVNRT with intermittent 2:1 conduction (**c**), low right-sided atrial tachycardia with 2:1 conduction (**d**), atrial fibrillation (**e**)

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