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Substrate-based catheter ablation in previously undiagnosed arrhythmogenic right ventricular dysplasia by means of an electroanatomic mapping system using cutaneous patches

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Magnetic navigation and mapping systems have been used for electroanatomic voltage mapping and substrate-based catheter ablation in arrhythmogenic right ventricular dysplasia/cardiomyopathy (ARVD/C) [1–3].

The case is presented of a 24-year-old male patient with recurrent drug-refractory sustained monomorphic ventricular tachycardia. The patient had no previous medical history. He reported that his grandmother had died suddenly at the age of 45 years. The 12-lead ECG in sinus rhythm showed only slight notching of the QRS in leads II, V2 and V3, with normal ending part and no T-wave abnormalities. The transthoracic echocardiogram was unremarkable. More than 21 000 ventricular premature beats with 2 different morphologies were recorded by 24-hour Holter monitoring. Catheter ablation was performed using the EnSite NavX electroanatomic mapping system (St. Jude Medical, Inc., St. Paul, MN, USA). During the procedure, only short bouts of the clinical arrhythmia were inducible in the right ventricular (RV) apex with programmed electrical stimulation with up to 3 extrastimuli. One sustained (but lasting less than 1 min) and several unsustained episodes of a second monomorphic ventricular tachycardia with left bundle branch block morphology were reproducibly induced in the RV outflow tract instead, with the same programmed stimulation pattern. At this point, a suspicion of the presence of undiagnosed ARVD/C was raised. It was not possible to perform activation mapping due to the unsustained nature of the arrhythmia. Consequently, a three-dimensional voltage map of the RV in sinus rhythm was created. Areas of reduced bipolar voltage (< 1.5 mV) were found, located in the so-called triangle of dysplasia (Fig. 1A, B). An ablation line was created between the low voltage areas in the RV outflow tract and the lateral wall. Following the procedure, a positive signal-averaged ECG was obtained. Biventricular angiography during stable sinus rhythm (Fig. 1C–F) showed severe diffuse RV enlargement and hypokinesis, with almost akinetic RV inferior wall. Partial apical left ventricular (LV) involvement was found as well, but with normal LV end-diastolic and end-systolic volume indices, and an LV ejection fraction of 61%. These 2 additional tests provided sufficient criteria for a definite diagnosis of ARVD/C. Repeat transthoracic echocardiography, performed after the ablation, again described normal cardiac structure and function, with normal LV volumes and ejection fraction of 66%. Fifteen months after the ablation the patient was free of arrhythmia recurrence, while being treated with previously ineffective antiarrhythmic drugs.

Although electroanatomic voltage mapping is not an acknowledged first-line tool for diagnosing ARVD/C, it can support this diagnosis or raise enough suspicion for this entity. There are several publications about the use of the CARTO electroanatomic mapping system in patients with ARVD/C [1–3]. However, we were able to find only one

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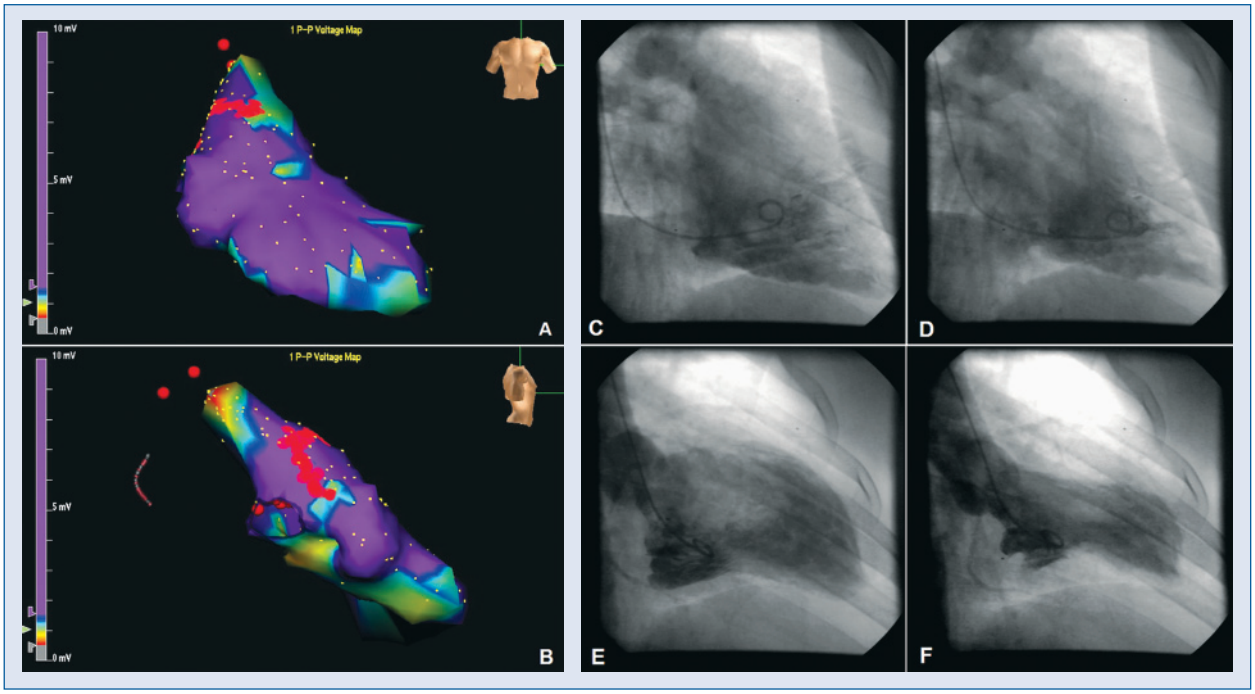

Figure 1. A. Electroanatomic voltage map of the right ventricle in anteroposterior projection; **B.** Electroanatomic voltage map of the right ventricle in right lateral projection; **C.** Right ventricular diastole; **D.** Right ventricular systole; **E.** Left ventricular diastole; **F.** Left ventricular systole. Panels C–F: Ventricular angiography, right anterior oblique projection, 45° (C, D) and 30° (E, F).

report about the use of the EnSite NavX mapping system in a patient with previously diagnosed ARVD/C, in whom the voltage map was used not for ablation, but only to check for a match between the low voltage area and the magnetic resonance image [4]. In our patient, there were not any ECG or echocardiographic hints about the presence of a structural heart disease. The possible presence of ARVD/C was suspected only during the electrophysiologic study. This suspicion was based initially on the reproducible induction of a ventricular tachycardia morphologically different from the clinical arrhythmia. Afterwards, it was reinforced by the voltage map. The diagnosis was confirmed by additional diagnostic tests, and was based on current criteria [5], namely the presence of late potentials on signal-averaged ECG, frequent ventricular extrasystoles on Holter monitoring, left bundle branch block — type ventricular tachycardia, and severe RV dilation with partial LV involvement. The EnSite NavX electroanatomic mapping system could be useful for substrate-based mapping and ablation in patients with ARVD/C.

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