was negative, even at very high intensities, and surgery was ruled out for the same reasons as in the first patient.

An anomalous origin of the RCA with interarterial course is a known risk factor for sudden cardiac death in young patients. The most accepted theories for this association suggest that the particular anatomic structure of the artery can provoke an ischemic event that triggers ventricular arrhythmias.[3] The incidence of atherosclerosis in coronary artery anomalies is similar to or lower than that of anatomically normal arteries, and intravascular ultrasound studies have failed to identify atherosclerotic disease in the initial intramural segment of these vessels, which is generally the site of greatest stenosis.[4,5] Nonetheless, both cases demonstrate that plaque rupture or erosion with thrombus formation is one of the possible mechanisms of sudden cardiac death and cardiac events in this patient population.

An inability to visualize the RCA during coronary angiography should suggest the presence of this coronary anomaly. Systemic thrombolysis should be considered in these patients to locate the origin, as well as facilitated angioplasty (as in the second patient). If there are contraindications (such as recent traumatic resuscitation), catheterization of the contralateral sinus should be attempted, as well as atypical projections and aortography if necessary. Series detailing interventions for anomalous RCAs show that single stents can be implanted in these vessels, with promising clinical and angiographic results.[5] Nonetheless, these procedures involve prolonged and technically complex catheterizations requiring a high volume of contrast agent.

Clinical practice guidelines indicate surgical revascularization for patients with an anomalous RCA and interarterial course if there are symptoms or documented ischemia, but the treatment is controversial in other patients[6] and there is no widely accepted approach. Both in our patients and in the few previously described cases, the culprit lesions were outside the interarterial course. This situation adds another point of uncertainty regarding its further evaluation, suggesting the possible need for various surgical techniques to free the vessel course.

CONFLICTS OF INTEREST

Á. Sánchez-Recalde is an Associate Editor of *Revista Española de Cardiología*.

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Endoepicardial Ventricular Tachycardia Ablation With a New High-density Non-fluoroscopic Navigation System

Ablación endoepicárdica de taquicardia ventricular con un nuevo navegador no fluoroscópico de alta densidad

To the Editor,

Ablation of ventricular tachycardia (VT) is a procedure that is becoming increasingly more widespread in clinical practice.[1] It is estimated that 12% to 17% of cases of VT are of myocardial and subepicardial origin, which is a more common substrate in nonischemic heart disease.[2] Rhythmia (Boston Scientific; Marlborough, Massachusetts, United States) is a new nonfluoroscopic navigation system able to generate high-density maps combining a steerable 64-electrode catheter (IntellaMap Orion; Boston Scientific) with software able to automatically capture the recorded electrograms. Given the novelty of the system, experience with this catheter for epicardial mapping is very limited,[3] and no information has been published on the outcomes and complications of VT ablation guided by the Rhythmia system.

We present the case of a 56-year-old physician who was an endurance sports enthusiast. He started to experience frequent episodes of palpitations, generally triggered by exercise, and accompanied by nausea. On exercise testing, regular sustained broad QRS tachycardia was induced with right bundle branch block and left superior axis morphology. In the 24-hour Holter recording, 80 episodes of the same tachycardia were detected. The results of both echocardiography and coronary angiography were normal, and diagnosis of VT was confirmed in an electrophysiology study. On magnetic resonance imaging, a 30 × 7-mm area of gadolinium enhancement was observed between the myocardium and subepicardium of the inferior wall of the left ventricle.

The patient remained symptomatic despite treatment with beta-blockers and was therefore referred to our center for percutaneous ablation.

At rest, he had ventricular extrasystoles and episodes of VT. In view of the information from magnetic resonance imaging, it was decided to perform endocardial and epicardial mapping with the IntellaMap Orion catheter and the Rhythmia system.

Using percutaneous access, the Orion catheter was introduced into the pericardium through an Agilis steerable sheath. Voltage and activation mapping of the spontaneous tachyarrhythmias was performed. The system automatically selected the appropriate beats for inclusion in the map and only included those with a QRS correlation > 90% during the expiratory phase of the respiratory cycle. Voltages > 0.5 mV were considered normal and those < 0.3 mV were considered low. A 9180-point map was generated in 26 minutes. The map only included extrasystoles and episodes of VT coinciding with clinical tachycardia (Figure 1 and Video 1 of the supplementary material). The site of earliest activation (32 ms before onset of QRS) was located on the inferior wall of the left

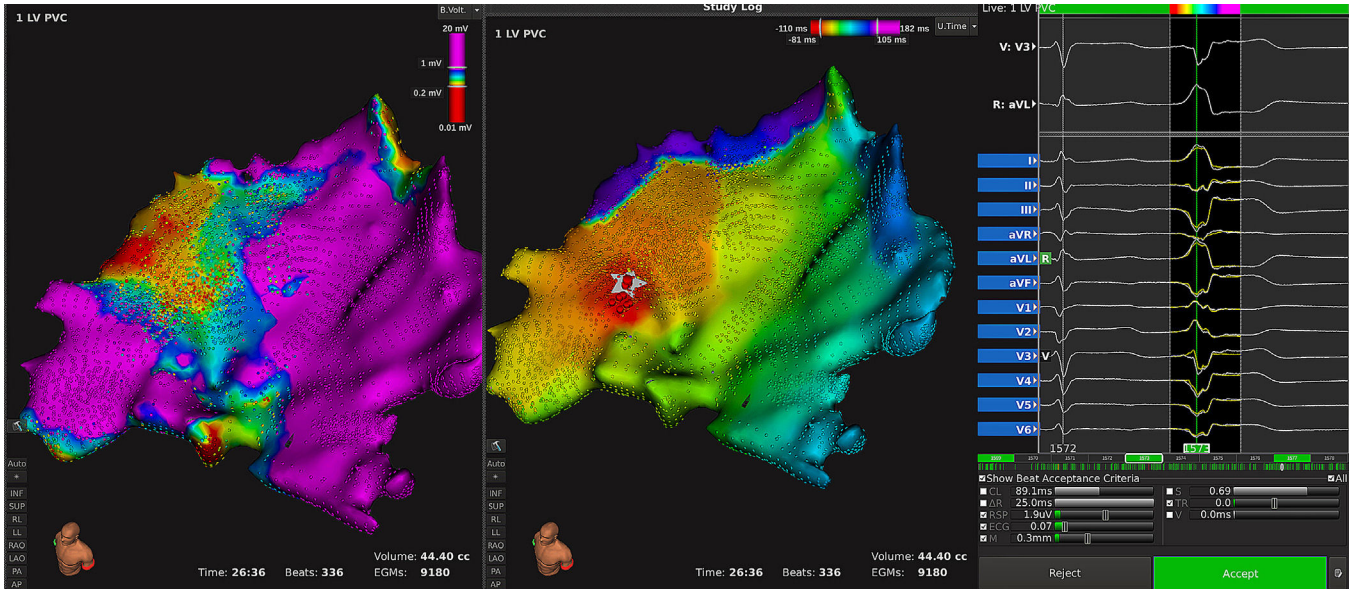

Figure 1. Epicardial voltage maps (left panel) and activation maps (right panel) of the inferior wall of the left ventricle from a left anterosuperior view. At an earlier time point, an area of low voltage and activation is observed in the inferior part of the left ventricle (star in the middle panel), corresponding to the origin of the ventricular tachycardias. The right panel illustrates how the automatic algorithm correctly samples a clinical extrasystole.

ventricle, close to the ventricular septum, and showed a local single-lead QS-type electrogram. Coronary angiography was performed, which ruled out the presence of major arteries in the vicinity (Figure 2). Radiofrequency pulses were applied with an irrigated-tip ablation catheter. The arrhythmias were temporarily suppressed but recurred after several minutes had elapsed. The ablation catheter was introduced via transeptal access to the endocardial point coinciding with the epicardial map. A single radiofrequency pulse applied at this site definitively suppressed the arrhythmia (Figure 1 of the supplementary material). After 30 minutes without spontaneous arrhythmias, isoproterenol was infused intravenously and the VT induction protocol was followed, without inducing any arrhythmias (Figure 2 of the supplementary material). The only complication was pericarditis without significant pericardial effusion, which resolved with anti-inflammatory treatment. After 9 months of follow-up, the patient was asymptomatic and free of arrhythmias.

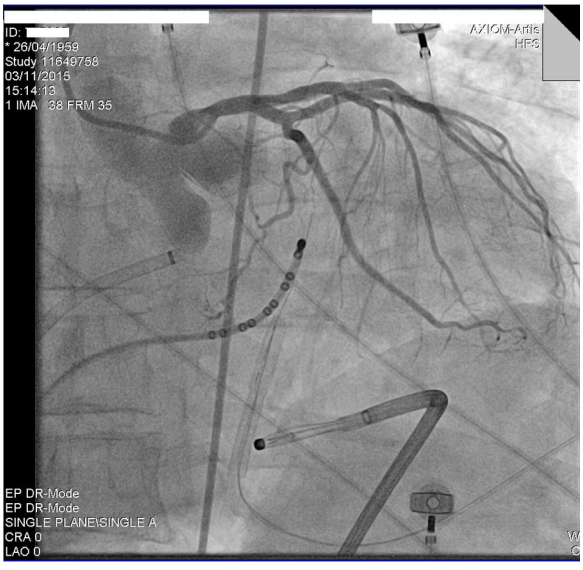

Figure 2. Left coronary angiography in the anteroposterior view with an Orion catheter in the pericardial sack.

This is a case of VT originating from a ventricular myocardial-epicardial scar. The tachycardia was treated effectively by focal ablation guided by epicardial mapping with an Orion catheter. In the case presented, the performance of the system was notable, reflecting the ease with which the multipolar catheter could be steered in the pericardial space and the precision of ventricular activation mapping. In this case, the algorithm for recognition of QRS of the target VT was very specific in, even during mechanical induction of multiple extrasystoles, which the system rejected systematically.

One of the specific characteristics of the system during epicardial mapping, in contrast to conventional catheters, is that the Orion catheter electrodes are electronically printed on the splines of the basket such that, instead of showing a 2-dimensional epicardial map, a virtual space is generated. Therefore, the epicardial map generated with the Orion catheter should always be visualized from inside the virtual cavity. If, as often occurs, the external face of the map is visualized, false areas of low voltage are observed, arising because only electrograms recorded with electrodes that probed the parietal pericardium are selected (Video 2 of the supplementary material).

In conclusion, in the opinion of the authors, epicardial mapping with this new system is possible and offers an electroanatomical map with a very high point density.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found in the online version available at: http://dx.doi.org/10.1016/j.rec.2016.12.001.

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Percutaneous Closure of Complex Fistulas Between the Left Main Coronary Artery and Right Atrium. Report of 3 Cases

Cierre percutáneo de fístulas complejas de tronco coronario izquierdo a aurícula derecha. Informe de 3 casos

To the Editor,

Coronary fistula is an uncommon condition (incidence, 0.002%)[1] that can originate in a coronary artery segment and drain into any chamber of the heart or great vessel of the thorax. The most common location is the right coronary artery, with drainage mainly into the right ventricle.[2,3] To date, there are no well established criteria to determine whether a fistula should be closed by a percutaneous procedure or by surgery.[4]

We present the cases of 3 patients aged 5 to 20 years with a diagnosis of a single coronary fistula originating in the left main coronary artery (LCA) and draining into the right atrium. Two patients had symptoms of palpitations and exertional dyspnea, associated with pallor. The third patient was asymptomatic, with the anomaly being detected after a clinical finding was observed in a preoperative evaluation. All 3 patients underwent chest radiography, electrocardiography, and echocardiography. The diagnosis was confirmed by computed tomography angiography (CTA), which better depicted the course of the fistula tract, and the size and number in each case (Table). Percutaneous closure was considered feasible and the procedure was carried out using

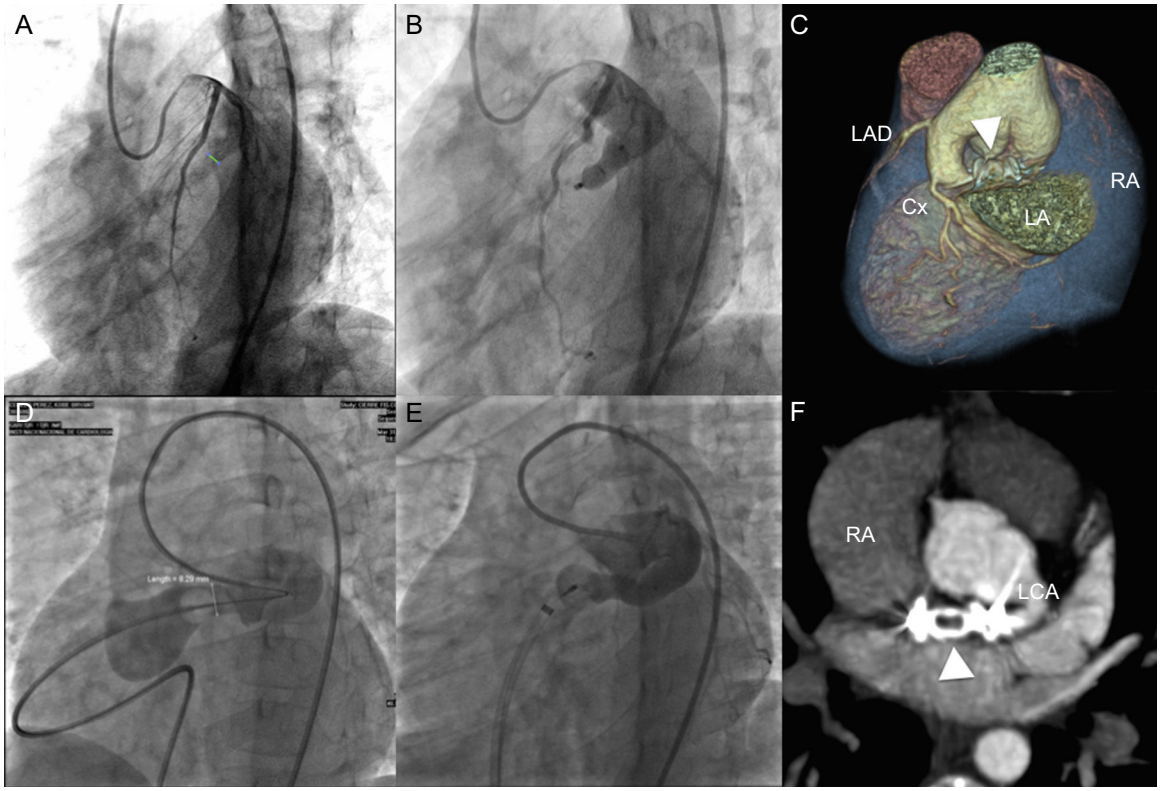

Figure. Patient 1: A) Coronary fistula with a maximum diameter of 6.5 mm; left anterior descending artery and circumflex artery show no abnormalities. B) 10-mm Vascular Plug IV in the fistula. C) Cardiac computed tomography angiography volumetric reconstruction with exclusion of the left atrium shows a properly positioned device and absence of flow through the fistula (arrowhead). Patient 2: D) Coronary fistula with a maximum diameter of 8.29 mm occluded by a pulmonary catheter, with preserved flow to the left main coronary artery. E) Deployment of the device through a retrograde approach. F) Computed tomography angiography maximum intensity projection in a paraxial view depicts absence of residual shunting and adequate placement of the device (arrowhead).
Cx: circumflex artery; LA, left atrium; LAD, left anterior descending artery; LCA, left main coronary artery; RA, right atrium.