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Case Report

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Mapping and successful ablation, from within the great cardiac vein, of premature ventricular contractions originating from the summit of the left ventricle

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ARTICLE INFORMATION

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Acronyms
AIV: anterior interventricular vein
GCV: great cardiac vein
LV: left ventricle
PVCs: premature ventricular contractions

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ABSTRACT

The case of a 43-year-old female patient is presented, with an apparent history of good health, up to several weeks prior to admission, when she began to present syncopes preceded by palpitations. An electrophysiological study was performed and prematurity in the distal portion of the coronary sinus recording electrode was demonstrated, which corresponds to the great cardiac vein (anterior interventricular vein) and summit of the left ventricle. Despite the excellent early registration, neighboring structures were studied, such as the left ventricular outflow tract in the left coronary cusp, here the pace mapping was not totally concordant. At the site of the precocity obtained within the cardiac venous system, a 100% concordant mapping was achieved, with an ablation catheter's precocity of -30 milliseconds. The ablation was decided with progressive increases in temperature and power with thermomapping and the success of the ablation was achieved without reproducibility of the arrhythmia and excellent subsequent evolution.
Keywords: Cardiac electrophysiologic techniques, Radiofrequency ablation, Premature ventricular contraction, Ventricular tachycardia

Mapeo y ablación exitosa, desde el interior de la vena cardíaca magna, de extrasístoles ventriculares originados en el techo (summit) del ventrículo izquierdo

RESUMEN

Se presenta el caso de una paciente de 43 años, con antecedentes de salud aparente, hasta varias semanas previas a su ingreso, cuando comenzó a presentar síncopes precedidos de palpitaciones. Se realizó estudio electrofisiológico y se demostró precocidad en la porción distal del electrodo de registro de seno coronario, que corresponde a la vena cardíaca magna (interventricular anterior) y techo (summit) del ventrículo izquierdo. A pesar del excelente registro precoz se estudiaron estructuras vecinas como el tracto de salida del ventrículo izquierdo en la cúspide coronaria izquierda, aquí el mapeo eléctrico (pace mapping) no fue concordante total. En el sitio de la precocidad obtenida dentro del sistema venoso cardíaco se realizó mapeo concordante 100%, con una precocidad del catéter de

ablación de -30 milisegundos. Se decidió ablación con incrementos progresivos de temperatura y potencia con corte de impedancia (termomapping) y se logró el éxito de la ablación sin reproducibilidad de la arritmia y excelente evolución posterior.

Palabras clave: Técnicas electrofisiológicas cardíacas, Ablación por radiofrecuencia, Extrasístoles ventriculares, Taquicardia ventricular

INTRODUCTION

Approximately between 12 and 14% of the idiopathic left ventricular arrhythmias have originated from the summit of the left ventricle (LV), which corresponds to an epicardial triangular region of the outflow tract. The vertex is formed by the bifurcation of the left main coronary artery in the anterior and circumflex descending, and its base is shaped by the imaginary arch that connects the first perforating septal branch (of the anterior descending) with the circumflex artery[1]. The left coronary vein or great cardiac vein (GCV) divides it laterally at the height of its junction with the segment that corresponds to the anterior interventricular vein (AIV), in an area accessible to the ablation in the lower part and another inaccessible at the top[1]. The ventricular arrhythmia, originated in the summit of the LV, usually shows, in the electrocardiogram, right bundle branch block morphology with lower axis and right deviation, with

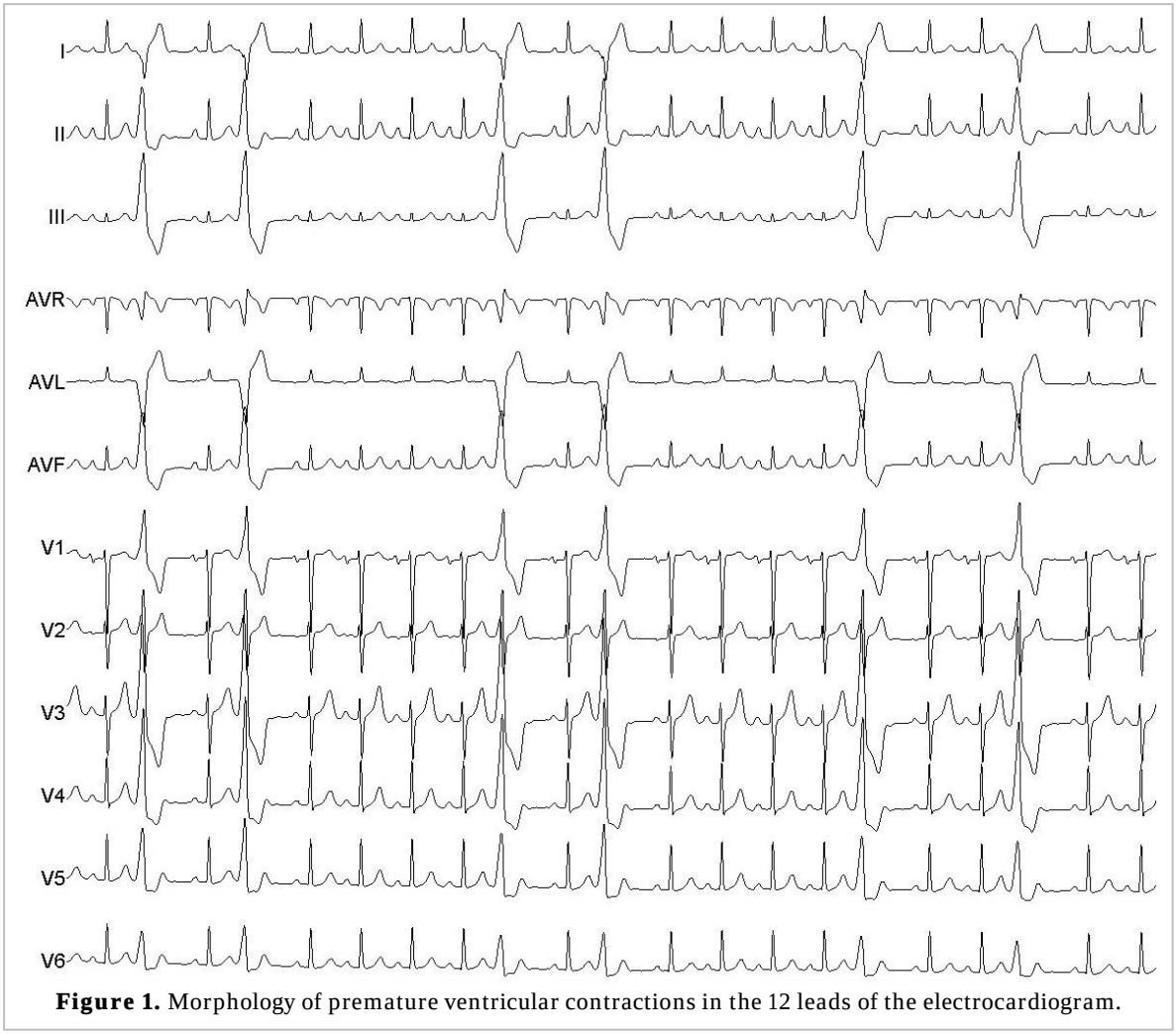

Figure 1. Morphology of premature ventricular contractions in the 12 leads of the electrocardiogram.

higher voltage of the R wave of D_{III}, compared to D_{II}; presence of QS in D_I in 30% of cases; abrupt loss of R in V_2, compared to V_1 and V_3, due to the anatomical opposition of the scanning electrode, and Q-aVL/Q-aVR ratio > 1.45; with the presence of a rapid deflection at the beginning of the QRS (pseudodelta) greater than 34 milliseconds (ms).

In recent years, the ablation of ventricular arrhythmias of the summit of the LV has been considered, with increasing attention, in the medical bibliography, given its frequency and the difficulties it poses with the technical aspects of the catheter ablation; however, the success of the ablation can be greater than 90%[1,2].

Figure 2. Precocity of -27 milliseconds (ms) in the register 1 and 2 of the coronary sinus during the premature ventricular contraction (PVC).

CASE REPORT

The case of a 43-year-old woman is presented, who was admitted to the Department of Cardiology for syncopes with repetitions several weeks before admission, always preceded of palpitations. In the dynamic electrocardiogram of 24 hours (Holter) was confirmed the presence of symptomatic premature ventricular contractions (PVCs), with a high density (more than 35% of the overall beats), which had the following electrocardiographic characteristics (**Figure 1**): QS in D_I, small loss of the R of V_2 compared to V_1 and V_3, Q-aVL/Q-aVR ratio > 1.45; and QRS duration of 160 milliseconds (ms) in D_{II}, where the presence of a pseudodelta > 40 ms is observed.

Therefore, it was decided to conduct an electrophysiological study, with the patient under deep sedation with propofol (1.5 mg/kg), blood pressure monitoring and pulse oximetry. The quadripolar and decapolar electrodes were placed in the bundle of His and in the coronary sinus, respectively, the latter was introduced to the more previous portion, in the region of the GCV/AIV. Immediately, there was identified a record of intracavitary ventricular electrogram in coronary sinus 1-2, with precocity of -27 ms at the beginning of the QRS of the PVCs (**Figure 2**). Due to the precocity from the coronary sinus 1-2, a pace mapping was carried out at this point, with 100% of match. An ablation catheter of 8 mm (*AlCath Red TC LT G FullCircle* de BIOTRONIK) was inserted, more distal to the region of the coronary sinus 1-2 (**Figure 3**). Sodium heparin was administered according to the patient's weight.

A mapping of the LV outflow tract was performed, at the level of left coronary cusp, due to the anatomic relation it has with this portion; but the records were not higher than the ones observed from the coronary sinus 1-2. The pace mapping to that level (**Figure 4, B y C**) showed concordance approximately in 8 leads out of 12 with the PVCs of the electrocardiogram performed to the patient; it showed rS in D_I and small s, well defined, from V4 to V6, which was not observed in the PVCs of the initial electrocardiogram. With the ablation catheter inside the GCV/AIV, a mapping was carried out, which evidenced a precocity of -30 ms (in the intracavitary record of white color) and one pace mapping with concordance in the 12 leads explored (**Figure 4D**).

This mapped segment had precocity and adequate pace mapping, thus, there was decided to perform applications within the GCV at low tempera-

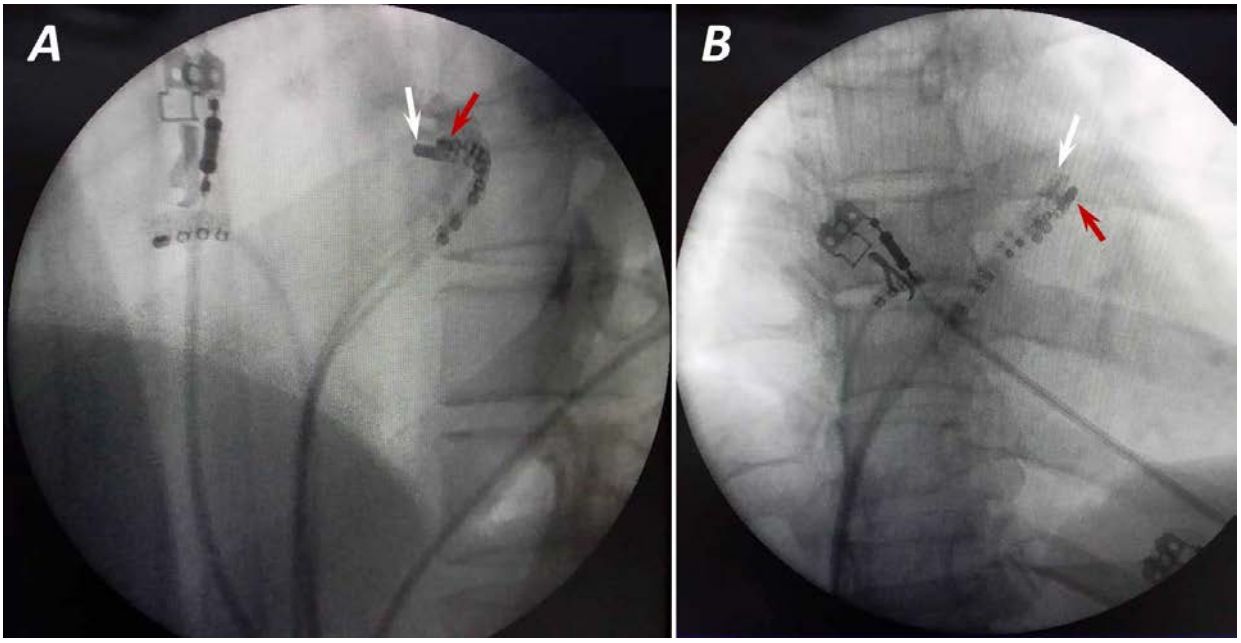

Figure 3. Fluoroscopy showing the location of the decapolar (red arrow) and ablation (white arrow) catheters at the precocity and ablation sites. **A.** Left anterior oblique view. **B.** Right anterior oblique view.

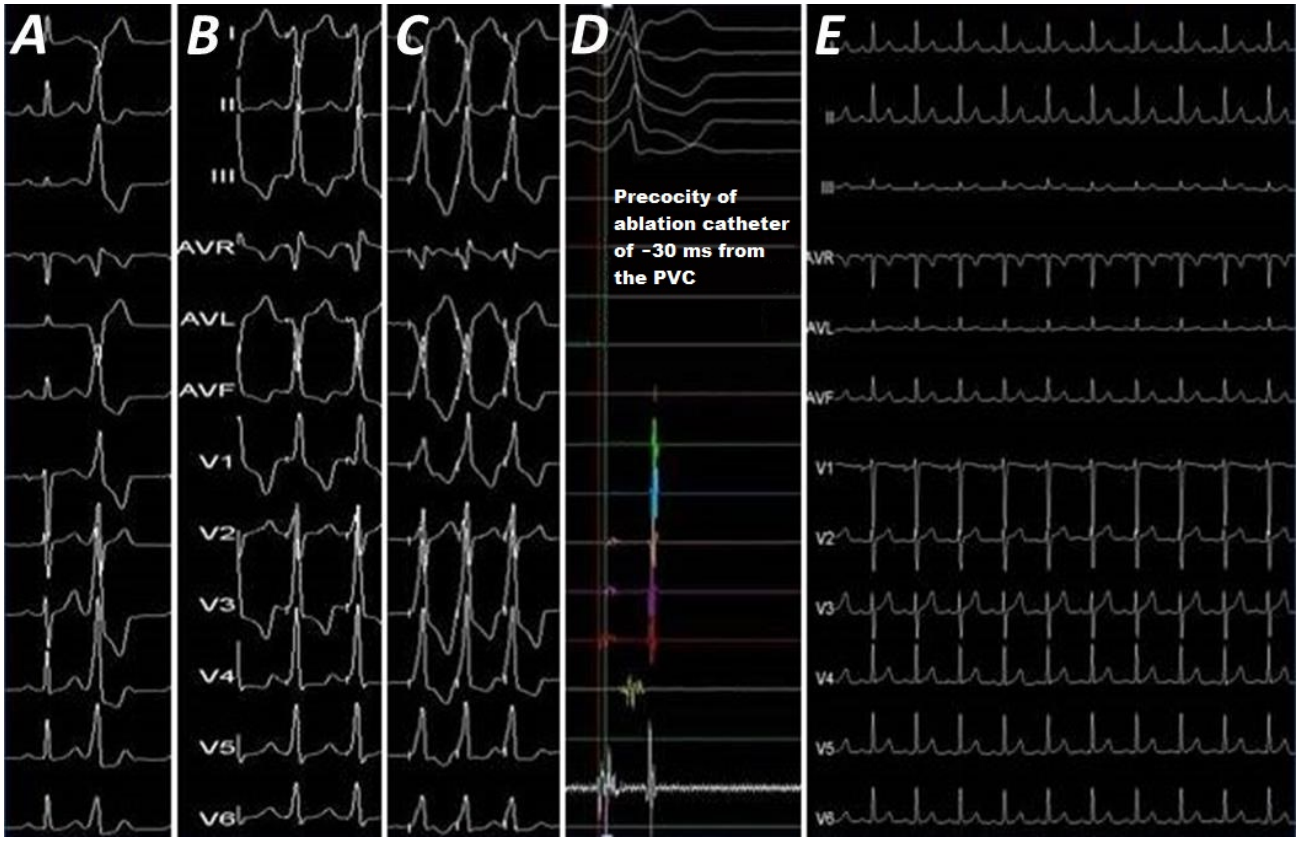

Figure 4. Different records during the electrophysiological study **A.** Morphology of the PVCs in the summit of the left ventricle. **B.** Pace mapping at the level of the left coronary cusp. **C.** *Idem* from the great cardiac vein. **D.** Precocity in the ablation. **E.** 12-lead electrocardiogram after ablation.

ture (50 W power , 50 °C temperature and cut according to impedance), which evidenced the immediate disappearance during application and reappearance after completion (thermomapping). The temperature and power were increased at 55 °C and 65 W, respectively, with equal cutting parameters according to impedance, which allowed the disappearance of the PVCs immediately and sustained, after an application of 90 seconds (**Figure 4E**).

The hemodynamic remained stable and the pulse oximetry showed 100% of peripheral saturation. The PVCs or ventricular arrhythmias were not inducible with administration of isoprenaline at 4 mcg/min and stimulation protocol from the right ventricle, with cycle length of 300 ms and three extrastimuli, introduced decreasingly up to 200 ms.

During follow-up, with electrocardiogram at 24 and 72 hours, and at 30 days with Holter of 24 hours, no PVCs have been evidenced. Currently, the patient is asymptomatic.

COMMENTS

Since the summit of the LV is located in a proximal position with respect to several structures (right and left coronary cups, septal right ventricular output tract, mitro-aortic continuity, and junction of GCV and AIV), a successful catheter ablation is possible from any of these structures. When the origin of the ventricular arrhythmia is epicardial, at the level of the summit of the LV, and the ventricular activation times are earlier in the distal portion of the GCV than elsewhere, as the outflow tracts of the left and right ventricles, usually, the pace mapping is ideal and concordant in that area of precocity[2]. Yamada *et al*[3] have described the successful ablation of ventricular arrhythmias originating in the summit of the LV within the junction of GCV and AIV in 14 out of 25 patients with a local ventricular activation at that level earlier than in any other endocardial location; in their study, they used non-irrigated and irrigated catheters (as in the case presented here). Jauregui Abularach *et al*[4] have described the successful ablation from the left coronary cusp in 9 out of 16 patients with a ventricular arrhythmia originating from a place marginally nearer to the junction of the GCV and AIV, and they observed that a Q-aVL/Q-aVR wave ratio < 1.45 predicted the success of the ablation from that site.

The patient presented here had a ratio greater than 1.45, as it was described above, and it has been mentioned that with this ratio, there is a greater likelihood of demonstrating the focus with more precocity close to the junction of GCV and AIV. It has also been described that, when the ablation is not effective from the endocardium or the coronary venous system, the use of an approach from the epicardium can be contemplated percutaneously. In a study of 23 patients of this type, an epicardial ablation was attempted in 14 of them and only the success was obtained in 5 of the cases; while in the remaining 9 patients, the origin of ventricular arrhythmias was in an inaccessible area in close proximity to the main coronary vessels[5].

Enriquez *et al*[2] described several steps for a successful ablation of the PVCs or ventricular arrhythmias originating from the summit of the LV. Mapping from: a) coronary sinus, GCV and AIV, b) coronary cusps, c) endocardium of the LV below the left coronary cusp, d) septal portion of the right ventricular outflow tract, and e) ablation. This last step is advisable to be performed at the earliest activation. In the patient of this case report, the precocity was observed when inserting the catheter into the coronary sinus; despite this element, the mapping of the LV outflow tract, left coronary cusp and endocardium of LV was performed.

Also, Enriquez *et al*[2], when mentioning the limitations to access and achieve the ablation of the PVCs from the GCV/AIV, referred that the access by catheter can be difficult –difficulty that was not present in our case– and mentioned little success for not achieving adequate temperatures and power; the values achieved in our laboratory for this patient were sufficient to achieve initial success.

This is the first case of ablation of premature ventricular contractions from the summit of the LV referred in Cuba, as there is no previous publication about this topic.

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