ISSN: 3049-5849

Journal of Vascular Medicine & Surgeries

SCIENTIFIC Research and Community

Case Report

Open Access

Identification of Circuits in Ventricular Tachycardia Ablation in Hypertrophic Cardiomyopathy: A Case Report

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ABSTRACT

Catheter ablation of ventricular tachycardia (VT) in structural heart disease is a useful strategy to reduce the discharges of implantable cardioverter-defibrillators (ICDs) and improve patient survival.

We present the case of a 30-year-old female, with hypertrophic cardiomyopathy, carrier of ICD as primary prevention, who presented to the emergency department with an electrical storm and multiple shocks (Figure 1), which is why she was taken to catheter ablation. In the procedure, two tachycardia circuits were identified, and radiofrequency was applied.

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Received: April 19, 2023; **Accepted:** April 25, 2023; **Published:** April 30, 2023

Keywords: Catheter Ablation, Ventricular Tachycardia, Hypertrophic Cardiomyopathy

Introduction

Ventricular tachycardia (VT) ablation in structural heart disease is a useful strategy to reduce the discharges of implantable cardioverter-defibrillators (ICDS) and reduce mortality and hospitalizations [1]. The identification of the substrate involved in VT, through various techniques in these patients, is of vital importance to carry out ablation [2].

Case

A 30-year-old female with a history of hypertrophic cardiomyopath and carrier of ICD as primary prevention, presented to the emergency department with an electrical storm and multiple shocks (Figure 1), for which she was taken to catheter ablation. Her family history was notable for Sudden cardiac death in both father and brother.

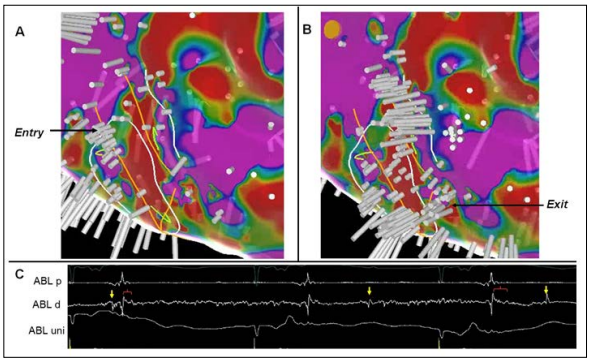

Figure 1: Clinical Tachycardia.
Electrocardiogram with presence of ventricular tachycardia with ventricular frequency of 160 bpm, wide QRS image, early transition in V1 and BIRDHH image. In frontal plane, with superior axis, rS in DIII and aVF suggesting location in the mediapetal region of the left ventricle.

Catheter ablation was performed with CARTO system (Bio sense - Webster, Diamond Bar, California) under general anesthesia and supported by intracardiac echocardiogram. A decapolar catheter was positioned in the coronary sinus and a quadripolar catheter in the apex of the right ventricle. By retro aortic approach and with a PENTARAY TM NAV catheter (Bio sense – Webster, Diamond Bar, California) we proceeded to perform electro anatomical reconstruction of the left ventricle (Figure 2). Using an irrigated ablation catheter, power-controlled radiofrequency (35 W) was applied.

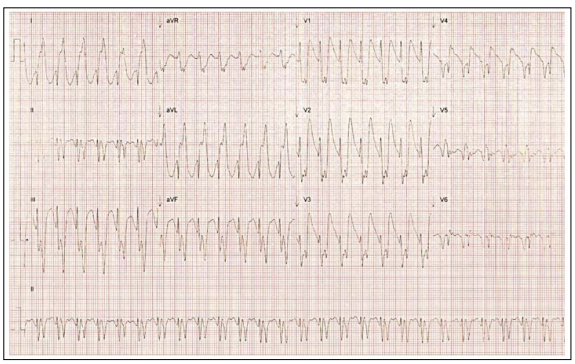

Figure 2: Antero Posterior Projection During the Electrophysiological Study.
It shows a decapolar catheter positioned in the coronary sinus (CS), a quadripolar catheter in the apex of the right ventricle (RVA) and

by retro aortic access the electro anatomical reconstruction of the left ventricle is being done with the PENTARAY TM NAV catheter (Bio sense – Webster, Diamond Bar, California) (red arrow).

The voltage map (0.5 mV - 1.5mV, in bipolar) allowed to identify extensive areas of fibrosis in the septal region and in the anterior wall of the left ventricle, in addition Ripple Mapping was used in sinus rhythm, which allowed to clearly define two zones of slow conduction, probable circuits involved in the VT (figure 3). One circuit was in the anterior basal portion of the left ventricle, which from now on we will call the superior circuit, and the other was in the septal-infero region of the left ventricle, which we will call the inferior circuit (figure 3). Likewise, it was possible to determine the input and output zones of both circuits (Figure 4, panel A and B, Figure 5, panel A and B).

In the output of the upper circuit, post-systolic potentials were observed, which disappeared during the application of the radiofrequency (Figure 4, panel C), as well as at the entrance of the circuit pre-systolic potentials were found which separated and / or dissociated from the ventricular electrogram (Figure 4, panel D). Subsequently, radio frequency was applied in the critical areas of the lower circuit, some areas of this circuit. (Figure 5, panel C) At follow-up, the patient has not had ventricular arrhythmias again.

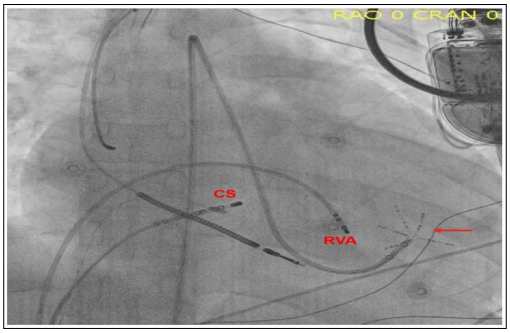

Figure 3: Electro Anatomical Reconstruction of the Left Ventricle and Identification of Circuits.
Different views of the voltage map of the left ventricle, extensive areas of fibrosis are observed in the anterior and septal wall. The two circuits involved in ventricular tachycardia have been delimited, which are marked with arrows.

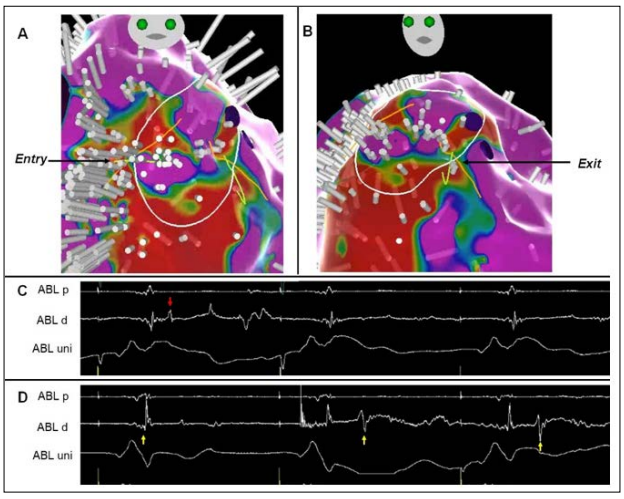

Figure 4: Radio Frequency Application in The Upper Circuit.
A) Input of the circuit. B) Output of the circuit. C) Application of radiofrequency at the output of the circuit, a post-systolic potential (red arrow) is observed that disappears with the application of the radiofrequency. D) Application of radiofrequency at the entrance of the circuit, a predominantly negative pre-systolic potential (yellow arrow) is observed that deforms the initial part of the ventricular electrogram and that separates from it after the radiofrequency has begun. ABL p: proximal ablation catheter dipole, ABL d, distal ablation catheter dipole, ABL uni, unipolar ablation catheter register.

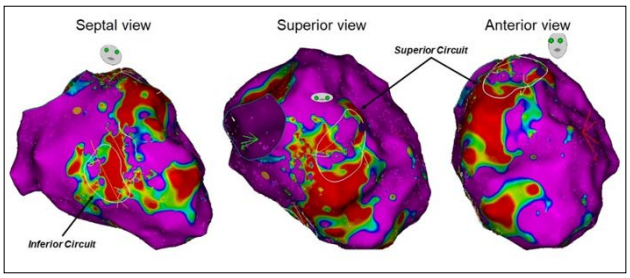

Figure 5: Ablation in The Lower Circuit.
A) Input of the circuit. B) Output of the circuit. C) Application of radiofrequency at a point where there is progressive separation of a post-systolic potential (red keys), which suggests that this point is involved in the exit of the circuit and dissociation of a pre-systolic potential (yellow arrow) is observed, suggesting that this point is also involved in the input. ABL p: proximal ablation catheter dipole, ABL d, distal ablation catheter dipole, ABL uni, unipolar ablation catheter register.

Discussion

The most frequent ventricular arrhythmias in hypertrophic cardiomyopathy are polymorphic VT and VF, with monomorphic VT being less frequent [1-3]. The substrate in these patients is very complex due to extensive fibrosis and disorganization of the myofibrils, which is why ablation in these patients is challenging [2-4]. Ablation is indicated when the patient has presented sustained episodes of VT or VF that have required ICD therapies, in our case the patient presented a thunderstorm [5].

As in most patients with structural heart disease, the main mechanism of VT in patients with hypertrophic cardiomyopathy is re-entry. However, because ventricular arrhythmias are often not hemodynamically tolerated, ablation must be performed in sinus rhythm, only with substrate-based mapping aimed at identifying fractionated or unfolded potentials [1]. Several patient series have demonstrated the effectiveness and safety of VT ablation in patients with hypertrophic cardiomyopathy [2-5]. The identification of potential LAVA (Local Abnormal Ventricular Activities) is essential to carry out ablation [4-6].

Officially the bipolar voltage map allowed to identify large areas of fibrosis involving the interventricular septum and the anterior wall of the left ventricle, and then together with the Ripple Mapping slow conduction zones in sinus rhythm were determined, which had a clearly circular path, with an identifiable input and exit, finding these circuits within the fibrosis zones.

Has been shown that conservative techniques such as the identification of circuits and the subsequent application of ablation lines in the critical parts of them, as well as decanalization are cost-effective and effective techniques [3-6]. In this conservative approach turned out to be effective to date has not presented recurrences.

Conclusion

The identification of input and output circuits during VT ablation

in structural heart disease is crucial. The technique described as "decanalization" through radio frequency in a rational way in critical areas of the same has proven to be very useful.

Disclosures: The authors have nothing to disclose.

Funding: The authors did not receive funding.

Ethical responsibilities: Protection of people and animals: The authors state that no experiments have been conducted on humans or animals for this research.

Confidentiality of data: The authors state that they have followed their workplace protocols on the publication of patient data.

Right to privacy and informed consent: The authors declare that no patient data appears in this article.

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