Even with a high level of suspicion, diagnosis may be difficult to confirm. Serologic tests are more sensitive than blood cultures, but they are not specific and are difficult to interpret in endemic areas. They may also be negative in early stages of the disease. The most common tests are Huddleston, Rose-Bengal, Wright, 2-mercaptoethanol, and complement fixation. As a result of the slow growth of the bacteria and the need for specific culture media, the negative blood culture rate is higher than for other types of bacterial endocarditis. (4) Due to the high valvular endocardial damage, treatment is rarely limited to the use of antibiotics alone and surgical procedures are also necessary. (5)

Indications for surgical intervention include refractory heart failure, sepsis resulting from a myocardial abscess, severe valvular dysfunction, and embolism. Valve replacement with aggressive debridement of infected tissue is the most important part of the treatment, and should be complemented with a course of antibiotics before and after surgery. (6)

Brucella infective endocarditis is a rare entity with a high morbidity rate, and also represents the most common cause of death in patients with brucellosis. A high index of suspicion for this disease is necessary to diagnose it in potentially exposed patients in endemic areas. In Argentina, it is a mandatory reportable disease.

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Epicardial Cryoablation of Ventricular Tachycardia in Chagas Disease: Emergency Hybrid Treatment

Ventricular tachycardias (VT) associated to nonischemic structural heart disease present larger scars in the epicardial area than in the endocardial area. At the same time, the density of slow conduction channels within the epicardial scar is higher than in the endocardium. (1) The combined (epicardial and endocardial) ablation of VT achieves high success rate and low recurrence; (2) however, it is a major challenge to avoid lesions in the coronary arteries during the procedure.

We describe the case of a patient with Chagas disease and electrical storm, where the left ventricular epicardial and endocardial voltage mapping was fused with a multidetector computed tomography angiography (MDCTA) to directly visualize the relationship between the myocardial scar and the coronary arteries. A hybrid treatment with radiofrequency and cryoenergy was used in order to minimize risks.

A 69-year-old male patient with dilated Chagas cardiomyopathy (ejection fraction 28%) was referred to our center due to electrical storm. He had been treated with implantable cardioverter defibrillator (ICD) 12 months before as primary prevention of sudden cardiac death.

He had incessant sustained monomorphic ventricular tachycardia (SMVT) without hemodynamic decompensation, with multiple ICD shocks, refractory to amiodarone treatment. Surface electrocardiogram (ECG) met epicardial VT criteria (3) (Figure 1).

The patient underwent an emergency catheter ablation procedure. The pericardial cavity was reached using Sosa's technique. (4) Voltage mapping determined a large anterolateral epicardial scar region in basal and medial segments. The VT breakout site was obtained with activation mapping in the basal anterolateral region. At this level, ventricular fractionated and mid-diastolic potentials were observed, and the slow conducting zone of the tachycardia circuit (isthmus) was localized with entrainment maneuvers. Previously, a MDCTA was performed and merged with the epicardial voltage mapping. As a result, it was possible to determine the exact relationship between the scar and the coronary arteries. The use of radiofrequency on that site interrupted the arrhythmia in a few seconds (3.4 sec.), as shown in Figure 2, top.

Then, the VT substrate was treated using the dechanneling technique with an 8 mm tip focal cryoablation catheter, to reduce the risk of coronary artery lesion (Figure 2, bottom) until the abnormal electrograms, described by Haissaguerre (5) (LAVAs), were eliminated.

A different VT morphology was induced, which did not present electrocardiographic criteria for epicardial VT. A transseptal puncture was performed to access the left ventricle and voltage mapping was created. A slow conduction zone (isthmus) was localized at the endocardial level, on a voltage channel that divided the scar into two. The use of radiofrequency interrupted the VT in 3.9 sec. (Figure 3).

Several consolidation lesions were targeted on this point to close the voltage channel. (5) No VT was induced by any protocol of programmed ventricular

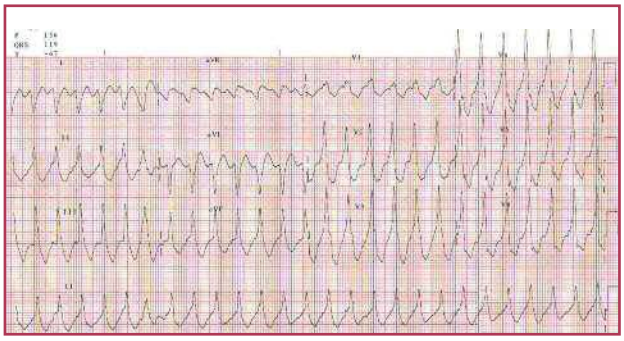

Fig. 1. Monomorphic ventricular tachycardia with epicardial origin: absence of Q-waves in inferior leads; pseudo-delta wave > 75 ms; MDI > 0.59.

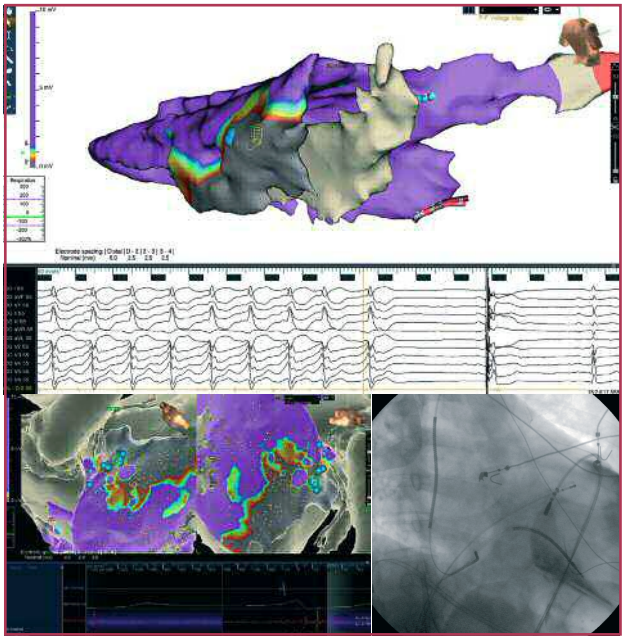

Fig. 2. *Top*: Epicardial voltage mapping delimiting the anterolateral region of the scar. The blue dots correspond to the effective ablation site (circuit isthmus). *Bottom*: Mid-diastolic potentials recorded by the ablation catheter placed in the circuit isthmus during sustained monomorphic ventricular tachycardia (yellow). Notice the prolongation of the ventricular tachycardia cycle before its interruption. *Bottom, left*: Fusion of multidetector computed tomography angiography and epicardial voltage mapping. The blue dots correspond to a slow conduction channel from the edge to the inside of the scar (double ventricular electrogram in red: ROV SC D2). Targeted focal cryoablation was performed to eliminate the conduction within the scar. *Bottom, right*: Right anterior oblique projection. Subxiphoid approach and fluoroscopic catheter position at the epicardial level, on the effective ablation site in the lateral left ventricular wall.

stimulation. The ICD was rescheduled, and the patient was discharged after 72 hours, without complications. During the 3-month follow-up, the patient did not present VT episodes or defibrillator discharges.

About 25% of the patients with ICD develop electrical storm during the course of 4-5 years, increasing mortality rate despite the ICD. Catheter ablation of VT should be performed as emergency procedure in patients with electrical storm, both with ischemic or non-ischemic cardiomyopathy. It can be performed electively in cases of SMVT even in episodes stored in the ICD. VT ablation is complementary to ICD implantation, and should be performed early to reduce the number of ventricular arrhythmia episodes and shocks.

There are different signs suggestive of epicardial VT. In our case, we used the criteria proposed by the Marchlinsky group: absence of Q-waves in inferior leads; pseudo-delta wave >75 ms; MDI > 0.59 (interval between the onset of QRS to its maximum amplitude/duration); Q wave in L1. Those criteria have 96% sensitivity and 93% specificity.

Coronary angiography is used to correlate the position of the ablation catheter and the coronary vessels; however, this method only provides two-dimensional information, which can lead to errors. We chose to perform a MDCTA and merge it with the pericardial voltage mapping, thus allowing three-dimensional visualization of the relationship between the scar, the coronary arteries and the position of the ablation catheter. (6)

In critical areas of the epicardial circuit (isthmus), radiofrequency was used as ablation procedure. To treat the substrate (epicardial scar) with the dechanneling technique, we used a focal cryoablation catheter, given its improved biophysical profile. Cryoenergy preserves endothelial indemnity, reduces the formation of superficial thrombus, generates homogeneous lesions without extending beyond the surface of the ablation electrode, and reduces the incidence of lesions to vascular structures due to the convection or "ther-

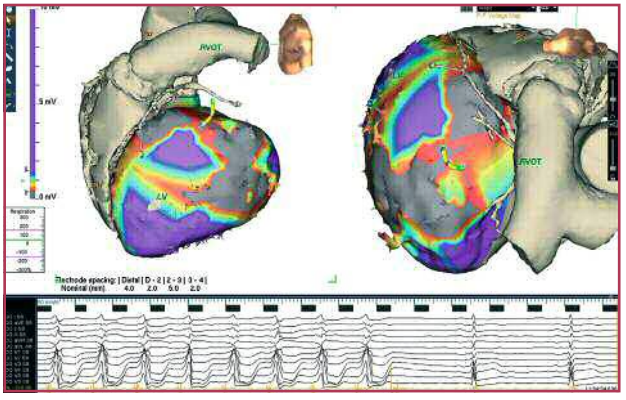

Fig. 3. *Top*: Endocardial voltage mapping. A large anterolateral region of the scar is delimited (gray) separated by an intermediar voltage channel (red), where the ablation catheter is placed. *Bottom*: Radiofrequency application in the voltage channel, and interruption of ventricular tachycardia. At this level, *entrainment* maneuvers were consistent with the circuit isthmus location. Notice the electrogram recorded by the ablation catheter, without conduction to the ventricular myocardium at the moment of interruption.

mal washing" effect produced by coronary blood flow. These characteristics turn it into an attractive technique for catheter ablation of epicardial arrhythmias with risk of coronary artery injury. While there are no prospective clinical trials to validate these results, the biophysical profile of cryoablation offers clear advantages on epicardial arrhythmogenic substrates. This is because the formation of lesions is limited by the convection warming effect produced by coronary blood flow. This method could also be applied to other techniques of substrate treatment, such as ablation of scar edges, scar transection, and scar homogenization.

Catheter ablation should always be considered as an emergency therapeutic method in case of electrical storm. The use of imaging methods, such as multidetector computed tomography angiography and cryoenergy, to complement conventional ablation techniques in complex arrhythmogenic substrates could reduce intraoperative risks. The effectiveness of these methods should be evaluated with prospective protocols.

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Aortic Hypoplasia, an Extremely Rare Cause of Hypertension

In the study of refractory hypertension (HT), the importance of imaging tests to identify its etiology is well established. We describe the case of a male patient who underwent a transthoracic echocardiography and a chest CT angiography, resulting in the definitive diagnosis of the extremely rare cause of his HT.

We describe the case of a 49-year-old male patient with a history of amaurosis fugax (normal brain CT scan). During the study of refractory HT, a transthoracic echocardiography was performed, showing the bicuspid aortic valve with raphe between the right and left coronary cusps. No significant transvalvular aortic gradient was detected, with mild eccentric aortic regurgitation. Valve annulus was 25 mm and the ascending aorta was dilated (44 mm).The aortic arch was 32.6 mm, narrowing just before the beginning of the descending thoracic aorta at the level of the supra-aortic trunks (diameter 15.6 mm), with end-systolic acceleration of flow at that level but no significant gradient (Figures 1A & B). There was evidence of normal left ventricular size and thickness, with preserved systolic function.

In view of these findings, a chest CT angiography was performed, showing aneurysmal dilation of the ascending thoracic aorta (anteroposterior diameter, 44 mm), and a caliber change in the region of the aortic arch with diameter of 18 mm, and descending aorta of 22 mm (Figure 2).

All the findings were consistent with hypoplasia of the thoracic aorta, causing the patient's refractory HT.

Coarctation of the aorta is defined as a significant narrowing of the aortic lumen that causes severe obstruction of blood flow. This process affects an isolated short segment of the aorta.

Coarctation is most often found at the junction of the ductus arteriosus and the thoracic aorta, representing a 98% of all aortic coarctations.

When the narrowing affects longer portions of the aorta, it is known as tubular hypoplasia of the aorta, an exceedingly rare anomaly (1) on which there are very few reports in the literature associating it with secondary HT. (2)

First described by Quain, (3), the etiology of this condition is not well known and congenital and acquired causes have been proposed, (4, 5) although most of the authors turn to a congenital origin.

In the case of our patient, the diagnosis of hypoplasia of the thoracic aorta was associated with the presence of bicuspid aortic valve.

Symptoms typically occur within the first three decades of life and include HT, lower extremity claudication, and mesenteric ischemia.

One of the most severe complications is the HT resulting from this condition. Hypertension is often severe and, if untreated, can lead to potentially life-threatening complications, such as stroke, heart failure or kidney failure. In our case, the patient had a history of amaurosis fugax, with no evidence of changes in the brain CT scan.

Diagnosis is made using imaging techniques, such as echocardiography or CT angiography.