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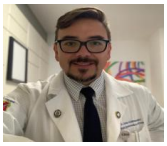
Epicardial Ablation of Intractable Ventricular Tachycardia Secondary to Myocarditis due to SARS-CoV-2 vs Coxsackie B in a Pediatric Patient with Mechanical Support (VA-ECMO)



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Abstract

Background: Refractory arrhythmias in the pediatric patient are successfully managed with antiarrhythmic therapy and/or in the electrophysiology lab, rarely these arrhythmias may be refractory to conventional therapies, inducing states of low cardiac output with the consequential development of cardiogenic shock. In this scenario, the proarrhythmogenic effects of catecholamines and antiarrhythmics drugs complicate resuscitation efforts, so mechanical support devices, including extracorporeal membrane oxygenation (ECMO), have been successfully used to provide cardiac support in pediatric patients with significant hemodynamic compromise. Once these patients have been placed on mechanical support, several treatment modalities can be offered to halt the arrhythmias while the myocardium and other organ functions recover.

This case highlights the course of a 14-year-old patient who presented intractable ventricular tachycardia (VT) secondary to myocarditis due to SARS-Cov-2 vs Coxsackie B, with hemodynamic compromise that require mechanical support with venoarterial ECMO (VA-ECMO), and ultimately epicardial ablation.

Case presentation: A 14-year-old male patient (124 cm in height, 33.8 kg in weight) with no relevant history, refers retrosternal pain, palpitations and dyspnea two days prior arrival to the emergency room. He was admitted for surveillance and following persistent discomfort a single-lead electrocardiogram (ECG) showed a non-sustained narrow QRS tachycardia (166 bpm) with a regular RR interval and atrioventricular dissociation. AZerwards, he presented another non-sustained tachycardia episode (340 bpm) with wide QRS complex. Several 12-lead ECG were obtained with morphology suggestive from posteromedial papillary muscle vs an epicardial location. Tachycardia event: 300 bpm, wide QRS complex, RBBB, regular RR intervals, capture and fusion beats were observed.An electrophysiological study was performed, the ectopic focus was located in the basal region of the leZ ventricle with a peak precocity of – 34 ms. Ablation points (TactiCath™, Abbott, Chicago, Illinois, USA) were accomplished without any events of extrasystoles or tachycardia (Figures 5 and 6). At the end of the procedure the patient presented a self-limited wide QRS complex tachycardia with no response to medical treatment (amiodarone 15 mcg/kg/min, esmolol 60 mcg/Kg/min and lidocaine 20 mcg/kg/min), for which myocarditis was suspected and gamma globulin with steroid boluses were initiated. With a multidisciplinary approach we decide to secure the airway and start temporary mechanical circulatory support.

The patient was placed on VA-ECMO with centrifugal pump (Rotaflow, Maquet®, Alemania), drainage catheter was inserted in the leZ femoral vein (25 Fr) and the return catheter was inserted in the right carotid artery (19 Fr). Extracorporeal circulation was initiated at blood flow of 3.5 L /min (100 mL/kg/min) and a sweep gas flow at 0.2 L/min with an FiO2 of 0.45.During mechanical support various events of ventricular extrasystoles in patterns of bigeminy and trigeminy and sustained ventricular tachycardia refractory to antiarrhythmic medications, were found. Echocardiography showed decreased global ventricular function (LVEF 33%; E/A ratio 1; FAC 10%; TAPSE 9 mm), with improvement aZer 24 hours (LVEF 58%; TAPSE 20 mm; FAC 30%, LV end-diastolic diameter Z-score +2.6). Despite complex antiarrhythmic treatment, events of nodal rhythm with ventricular rates of 45 bpm alternating with monomorphic VT with rates between 120 – 160 bpm, without hemodynamic instability, continued. Lab results report normal BNP 22 pg/mL and elevated cardiac troponin I 21 µg/L. Serology for SARS-CoV-2 was negative, but reverse-transcriptase PCR came positive, as well as the serology for Coxsackie B2, Coxsackie B4 and Coxsackie B5, indicating previous or recent infection.

As tachycardia events persist, under mechanical support an electrophysiological study was performed. Electroanatomic mapping reveal a maximum precocity of - 30 ms in the anterolateral papillary muscle (Figure 6), an ablation attempt (TactiCath™, Abbott, Chicago, Illinois, USA) was performed with unsatisfactory results. An additional epicardial mapping detected a higher precocity of – 60 ms at the inferolateral region of the leZ ventricle with respect to the QRS complex, coinciding with the unipolar QS zone and 99% of pace mapping (Figure 7 – 152). Radiofrequency was delivered in at least 4 points with completely abolition of extrasystoles (TactiCath™, Abbott, Chicago, Illinois, USA). Even aZer endocardial/epicardial stimulation and atropine/ephedrine

boluses, VT wasn't triggered. Due to hemodynamic stability and complete arrhythmia control, we decided to withdraw the mechanical support.Three days aZer the procedure a scheduled extubation was performed, but due to respiratory failure, the patient required reintubation and complementary studies were requested. Atypical pneumonia with moderate pulmonary involvement and a subacute hemorrhagic infarction of the striatum and lenticular nucleus with involvement of the anterior arm of the right internal capsule were found on the pulmonary and head computed tomography. At the time of the extubation, isolated ventricular extrasystoles and non-sustained VT were presented and treated successfully with antiarrhythmic medication. Finally, extubation was achieved 7 days aZer withdrawing the mechanical support without any complications. Clinically the patient had leZ hemiparesis with significant improvement aZer physical rehabilitation.

Discussion: Radiofrequency catheter ablation has a recognized role in the treatment of drug refractory VT, allows a better identification of critical VT isthmuses and may lead to more accurate ablation (3), but patients requiring this procedure oZen have severe heart disease, hemodynamic compromise or several comorbidities that may increase the risk during the procedure.Recently, several reports refer that VT ablation can be safely performed with mechanical support, because allows rhythm stabilization, long and complex ablations procedures with a low incidence of hemodynamic decompensation or mortality (4,5). ECMO provides an effective cardiac output to tolerate any arrhythmia without impairing the possibility of multiple vascular accesses and permits extensive endo-epicardial mapping free from interferences leading to a successful VT ablation.Despite the elevated risk of presenting an arrhythmia that produces hemodynamic compromise during ablation of a VT, regardless of the techniques used, mechanical support may be needed only in a select group of patients, including those with severe decompensated heart failure, severe pulmonary hypertension and congenital or acquired heart disease who might not tolerate VT. Pondering, that the use of ECMO has significant disadvantages and possible risks: vascular access site complications, bleeding complications, lower extremity ischemia, compartment syndrome, clinical seizures, acute kidney injury, infections.In our experience, the mechanical support allowed the procedure to be carried out without complications, with full VT mapping and ablation, so in this case we consider it useful and safe to prevent hemodynamic collapse, despite the complications derived from its use.

Conclusion: In conclusion, we described a pediatric patient with cardiogenic shock due to an intractable arrythmia that required an electrophysiology study and transcatheter ablation during mechanical support with VA-ECMO. Although, the challenges and potential risks of epicardial ablation are accentuated in the setting of a pediatric patient on anticoagulation required for VA- ECMO, it is a safe and feasible intervention with a low incidence of heart decompensation and mortality.

Biography:

Dr.Carlos Alcántara, he earned his medical degree at Universidad Nacional Autonoma de México. He completed his first residency in Pediatrician (2006-2009), at Universidad del Estado de Mexico, Pediatric Surgery (2009-2013) at Universidad de Guadalajara and Pediatric Cardiovascular Surgery (2013-2016) at Universidad Nacional Autonoma de Mexico. He is an assistant professor of Cardiothoracic Surgery at the Universidad Nacional Autonoma de Mexico. His clinical practice includes all aspects of pediatric cardiac surgery. Dr. Alcantara sees patients at Hospital Infantil de México Federico Gomez of UNAM, in Mexico City. He has presented numerous abstracts at national meetings.

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